Pest Management Strategic Plan
for
Non-Rangeland Forages (excluding Alfalfa) in the Western States

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Lead Authors: Tom Jahns, Ronda Hirnyck, Lisa Downey
Editor: Sally O'Neal Coates

Contact Person:
Ronda Hirnyck, Idaho Pesticide Program Coordinator
(208) 364-4046
rhirnyck@uidaho.edu

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WORK GROUP

Alaska
Tom Jahns, Extension Educator, University of Alaska Fairbanks, Soldotna, AK
Phil Kaspari, Extension Educator, University of Alaska Fairbanks, Delta Junction, AK

Colorado
Bruce Bosley, Extension Educator, Colorado State University, Sterling, CO

Hawaii
Glen Fukumoto, Extension Educator, University of Hawaii, Kealakekua, HI

Idaho
Chad Cheyney, Forage Specialist, University of Idaho, Carmen, ID
Gordon Edwards, Cassia County Weed Supervisor, Burley, ID
Neil Rimbey, Rangeland Economist, University of Idaho, Caldwell, ID
Mir M-Seydbagheri, Extension Educator, University of Idaho, Mountain Home, ID
Glenn Shewmaker, Extension Forage Specialist, University of Idaho, Twin Falls, ID
Ronda Hirnyck, Extension Pesticide Coordinator, University of Idaho, Boise, ID

Montana
Scott Mann, Forage Producer, Roberts, MT
Cecil Tharp, IPM Research Associate, Montana State University, Bozeman, MT

Nevada
Earl Creech, Extension Weed Specialist, University of Nevada, Reno, Fallon, NV
Jay Davison, Extension Forage Specialist, University of Nevada, Reno, Fallon, NV
Mark Moyle, Forage Producer, Fallon, NV
Marty Plaskett, Forage Producer, Eureka, NV

Oregon
Mylen Bohle, Extension Educator, Oregon State University, Prineville, OR
Glenn Fisher, Extension Entomologist, Oregon State University, Corvallis, OR
David Hannaway, Forage Program Director, Oregon State University, Corvallis, OR
Russ Ingham, Nematologist, Oregon State University, Corvallis, OR
David King, Forage Producer, Malin, OR
Cynthia Ocamb, Extension Plant Pathologist, Oregon State University, Corvallis, OR
Michael Slater, Vertebrate Specialist, USDA-APHIS, LaGrande, OR

Utah
David Drake, Extension Educator, Utah State University, Richfield, UT
Thomas Griggs, Agronomy Specialist, Utah State University, Logan, UT
Blaine Meek, Farm Manager, Elberta, UT

Washington
Dean Alverson, Forage Producer, Royal City, WA

John Fouts, Extension Educator, Washington State University, Walla Walla, WA
Tipton Hudson, Rangeland and Livestock Extension Educator, Washington State University, Ellensburg, WA
John Kugler, Forages Extension Educator, Washington State University, Ephrata, WA
Bob Parker, Extension Weed Scientist, Washington State University, Prosser, WA
George Vandemark, Research Geneticist, USDA-ARS, Prosser, WA
Doug Walsh, Entomologist/IPM Coordinator, Washington State University, Prosser, WA
Tim Woodward, Dean of Agriculture Education, Research and Development, Columbia Basin College, Pasco, WA

SUMMARY OF CRITICAL NEEDS IN FORAGE CROPS

Research Priorities

- Conduct research to support more pesticide registrations in grasses and forage mixtures.
- Analyze forage long-term yield and quality in variety trials.
- Research alternatives to chemical controls (e.g., biocontrols) in all pest groups.
- Organize and support a forage alliance to promote research, positions, and funding.
- Research vertebrate control options (including rodenticides).
- Establish pesticide treatment thresholds for mixed stands and grasses.

Regulatory Priorities

- Add forage crops to new and existing pesticide labels, and expedite new and pending registrations for forages (e.g., Buctril).
- Increase forage group involvement with IR-4 to bridge data from other commodities to forage crops and to utilize the crop grouping process to make new registrations available for forages.
- Register zinc phosphide for forages (both the USDA baits and the HACO pellets).
- Expand and increase rates on Roundup label to include pre-harvest application on all forages (grasses and mixed stands).
- Add forage acreages (mixed stands) to National Agricultural Statistics Services (NASS) survey information and the National Alfalfa and Forage Alliance PAC.

Education Priorities

- Provide adequate funding for university research, extension, and teaching personnel.
- Educate growers about monitoring, scouting, diagnosis, and identification of insects, diseases, weeds, nematodes, vertebrates, nutrients, and abiotic stresses affecting plant and animal health as part of an overall IPM strategy. This includes education about treatment thresholds as they are established and education about identification and conservation of beneficials and biocontrol agents.
- Educate growers, field personnel, researchers, and educators about using cultural practices to achieve good forage growth and productivity. This includes irrigation management, tillage, species/variety selection, seed selection, pest management, harvest techniques, planting date, crop rotation, and general agronomic management.
- Educate state and federal regulators and other interested groups (e.g., Oregon Tilth, Oregonians for Food and Shelter), on the specifics of forage production and pest management methods.
- Communicate forage pest management and production information to growers and industry personnel through the use of tools including a website, a list server, an IPM manual, and a crop/pest management technique matrix.
- Educate growers about stand removal, including evaluating stands for removal (i.e., monitoring yield decline and heeding economic thresholds for removal) and stand removal methods.

- Educate the general public about the food safety of forages (e.g., we are not using all the chemicals that are registered all the time).
- Maintain adequate funding for biocontrol of pests (e.g., cereal leaf beetle parasitoid rearing).

INTRODUCTION

The Environmental Protection Agency (EPA) has completed the risk assessments required under the Food Quality Protection Act (FQPA) of 1996 and is continuing its pesticide reregistration process. However, with the advent of the FQPA and subsequent risk assessments, several pesticides were voluntarily cancelled or now have reduced or more restrictive label uses.

The Endangered Species Act (ESA) may also impact the availability or restrict the use of certain pesticides. The ESA requires that any federal agency, including EPA, taking an action that may affect threatened or endangered species must consult with either the National Oceanic and Atmospheric Administration (NOAA-Fisheries) or the U.S. Fish and Wildlife Service, as appropriate. Lawsuits have been filed against EPA alleging the agency failed to complete this consultation process.

One lawsuit resulted in the establishment of buffers for applications of certain pesticides around salmon-supporting waters in Washington, Oregon, and California. Threatened and endangered species other than salmon are located throughout forage-growing regions, and there are likely to be further requirements for the protection of these species, whether the requirements are court-ordered or result from the consultation process.

Because buffers are not in general use, no one knows their impact on agro-ecosystems or the pest complex. Whether planted to crops, planted to vegetation that is habitat for beneficial insects, abandoned to weeds, or managed for other values, buffers have great potential to play either a positive or negative role in the pest complex. If pest management needs in buffer zones are not addressed or understood, growers may simply resort to cultivation to keep these areas free of weeds. Improper cultivation practices may lead to increased sediment loads in streams.

The total effects of FQPA and ESA are yet to be determined. Clearly, however, new pest management strategies will be required in the industry. Growers and commodity groups recognize the importance of developing long-term strategies to address pest management needs. These strategies may include identifying critical pesticide uses, retaining critical uses, researching pest management methods with emphasis on economically viable solutions, and understanding the impacts of pesticide cumulative risk.

In a proactive effort to identify pest management priorities and lay a foundation for future strategies, forage growers, commodity group representatives, pest control advisors, regulators, environmentalists, university specialists, and other technical experts from Alaska, Colorado, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming formed a work group and assembled the following document. The growing regions represented by this document are contiguous with areas in Arizona, New Mexico, Kansas, and Nebraska where forages are produced. Therefore, these states are included in the description of growing regions even though they were not represented in the work group. Members of the group met February 22 and 23, 2006, in Boise, Idaho, where they

discussed the FQPA and possible pesticide regulatory actions and drafted a document containing critical needs, general conclusions, activity timetables, and efficacy ratings of various management tools for specific pests in forage production. The resulting document was reviewed by the work group, including members who were not present at the meeting. The final result was this document, which is a comprehensive strategic plan addressing many pest-specific critical needs for the forage industry in the western United States.

The document begins with a region-by-region overview of forage production in the western states, followed by discussion of critical production aspects of this crop including the basics of integrated pest management (IPM), irrigation decisions, species groupings, pesticide registrations, species selection, resistant varieties, and toxic weeds. The remainder of the document is an analysis of pest pressures during the production of forages, organized by crop life stages. Key control measures and their alternatives (current and potential) are discussed. Differences among production regions represented are discussed where appropriate.

Each pest is mentioned in the crop stage (e.g., pre-plant, planting, vegetative growth) in which IPM, cultural controls (including resistant varieties), and/or chemical controls (including seed treatments and pre-plant pesticide treatments) are utilized, or when damage from that pest occurs. Descriptions of the biology and life cycle of each pest are detailed under the first crop stage in which they are present. Within each major pest grouping (nematodes, weeds, diseases, and insects), individual pests are presented in alphabetical order, not in order of importance.

NOTE: Trade names for certain pesticide products are used throughout this document as an aid for the reader in identifying these products. The use of trade names does not imply endorsement by the work group or any of the organizations represented.

Scope of Document

This document is a pest management strategic plan for non-rangeland forages in the western states. With the exception of pure alfalfa or pure corn stands, we propose to cover all types of domesticated forages that are harvested mechanically (i.e., cut for hay) or harvested by the grazing activity of animals (i.e., pastures). This includes forage production for retail sales as well as production to support an individual forage producer's animals. While this document does not address pure stands of alfalfa or corn, forage systems that include alfalfa or corn as part of a mixture are covered. This document does not include silage, nor does it include rangeland, defined by the Society for Range Management as "a type of land on which the natural vegetation is dominated by grasses, forbs, and shrubs and the land is managed as a natural ecosystem," nor does it include improved rangeland.

PRODUCTION REGIONS

Region 1: Alaska

Growing conditions in the subarctic environment of Alaska present a challenge. The frost-free growing period ranges from 100 to 118 days. Climatic characteristics include a long summer photo period (18–24 hours of daylight in June), relatively low spring precipitation (0.9–1.7 inches for April and May), cool summer temperatures (July averages range from 51–61°F for the different production regions), cool-damp autumns (average September temperatures of 44–47°F with 1.3–3.3 inches of precipitation), and cold winter temperatures (average January temperatures of –2 to 14°F). Average yields of perennial forages range from 0.9–1.3 tons/acre with the better-managed crops often exceeding 2 tons/acre/year. Alaska forage crop production has averaged over 25,000 tons/year for the previous 8 years. In 2004, Alaskan hay sold for $225–720 per ton compared to $87 per ton in other states. Annually, high quality hay is often in short supply, which drives the price up. Alaska ranked 47th in production value ($6.4 million) and in harvested acres (21,000).

Unlike other states represented in this document, Alaska is not comprised of counties, but rather of boroughs. The majority of forage crops are produced in the Tanana Valley and Delta Junction areas of Interior Alaska, and the Matanuska-Susitna Valley and the Kenai Peninsula of South Central Alaska. In 2004, the Tanana Valley had 44.7% of the acreage and 47.1% of the production in Alaska, the Matanuska-Susitna Valley had 43.3% of the acres and 43.2% of the production, and the Kenai Peninsula had 10.9% of the acres and 8.5% of the production. There is minor production of forages in Southwest and Southeastern Alaska, including Kodiak Island. The South Central area, which includes the Kenai Peninsula to the south, is near sea level and influenced by a maritime climate. The Interior region is 400–1300 feet in elevation with a continental climate regime. The maritime climate generates more precipitation, with a longer frost-free season, but has cooler and moister growing conditions than those of the Interior. High winds can scour insulating snow from the fields in parts of the Interior and South Central regions.

All-weather roads allow forage products to be marketed interchangeably among regions. The South Central region contains some beef, sheep, and goat producers, a few commercial dairies at Point MacKenzie (in the Mat-Su), and the majority of the state's recreational horses and other minor livestock (e.g., llama, alpaca). The forage market in the Interior is comprised of more commercial dairies, beef production units, and game ranches, with fewer recreational livestock. Alaska forage growers do not export their hay to other states or countries and regularly cannot produce enough high quality forage to meet demand.

There are a limited number of state and borough Agricultural Leases (native grass pastures), which for the most part are tied to long-term tenants in support of the livestock industry. Examples include Homer's Fox River Cattlemen's Association and the Kodiak Cattle Company leases. Most livestock producers without grazing leases rely on

domesticated perennial blue-grass based pastures to supply their animal's spring, summer, and fall feed requirements.

The smooth bromegrass (*Bromus inermis*) varieties 'Manchar' and 'Carlton' and the timothy (*Phleum pretense*) variety 'Engmo' are the predominant forage crops planted for hay in Alaska. Timothy is considered a single-cut crop, while two cuttings of smooth bromegrass are common. Timothy is more resistant to spoilage and retains a green color better when subjected to rain during the curing process than does bromegrass. Other forage grasses planted for hay in Alaska include: the Kentucky bluegrass (*Poa pratensis*) varieties 'Nugget,' 'Marian,' and 'Park;' creeping red fescue (*Festuca rubra*) varieties; common meadow foxtail (*Alopecurus pratensis*); creeping foxtail (*A. arundinaceus*); and reed canarygrass (*Phalaris arundinacea*).

In the Interior, a mix of bluegrass, creeping red fescue, Garrison creeping foxtail, and American slough grass is utilized for pasture forage. In South Central Alaska, a common pasture mix consists of perennial bluegrass, creeping red fescue, and perennial ryegrass (an option used interchangeably with oats as a companion crop). Much of the Interior's and some of South Central's perennial grass is planted with a companion crop of oats. The oats provide a number of benefits, including quick establishment, weed competition, soil stabilization, a harvestable hay crop the first year, and protection of the perennial forage crop during its most vulnerable establishment stage.

Longevity of intensively managed perennial forage crops is seven years or more. Some bromegrass and timothy stands have remained productive for over 20 years. Forage legumes have met with very limited success in Alaska, although their use and potential continue to be evaluated.

Interest in irrigation of forage crops is increasing, especially in the dry Interior region where nearly 10% of the crop receives some additional water during the growing season. The need for supplemental irrigation is less in the South Central region. A total of 5% of the forage acres in Alaska are irrigated. Sprinkler systems used include traveling guns (25%), center pivots (35%), and wheel and hand lines (40%). Irrigation scheduling is typically determined by factoring in grower experience, capacities of the system, and the use of tensiometers.

Region 2: Hawaii

There are approximately one million acres of pasture and grazing lands in production in Hawaii. Forage production is located in Hawaii, Maui, Oahu, and Kauai counties.

The Hawaiian Islands are located in the middle of the North Pacific Ocean. They are the world's most isolated land mass, separated by more than 2,400 miles of ocean from the next nearest continental land mass. Hawaii is located in the tropics, between 18º and 22º north latitude. The large ocean mass surrounding the islands acts as a climatic buffer and the prevailing northeasterly trade winds contribute to the mild and stable weather conditions. There are no extreme weather variations in the Hawaiian Islands that would typify the four-season annual cycle. Variation in temperature, humidity, solar radiation,

and rainfall are relatively stable over the ocean waters that surround the islands. However, variations of the landscape throughout the islands create diverse microclimates wherein temperature, rainfall, and soil types can vary dramatically within very short distances. Elevation, landscape features, and land orientation significantly affect the weather patterns and climate in Hawaii. In general, the windward or eastern sides of the islands receive higher rainfall as the warm and moisture-laden ocean air current precipitates over the coast and upland slopes. The leeward or western sides of the islands receive less of the moist air. The islands with taller, more massive mountains dissipate most of the moisture as the air moves westward, resulting in an arid leeward environment. Hawaii encompasses 11 of the world's 13 climatic zones, from tropical conditions in the lowland humid forests to sub-arctic extremes at the summit of Mauna Kea (13,796 feet above sea level). There are 551 separate watersheds delineated in the state and 144 different soil types.

Precipitation in forage-growing areas ranges from 10–15 inches per year in dry leeward areas to 150–180 inches per year in humid windward areas, with rainfall distribution patterns changing drastically from watershed to watershed in very short elevation gradients. Less than 0.1% of forages are irrigated in Hawaii. Of this small minority of acres, 90% is irrigated with fixed impact sprinkler head irrigation, and the other 10% use movable, big-gun irrigation.

The environmental diversity of Hawaii has a large impact on the growing period of plant and animal species. The relatively level and low alluvial plains near coastal perimeters of the islands are prime agricultural areas that enable virtually year-round production. Large-scale sugarcane and pineapple plantation operations in the dry leeward regions of the islands developed sophisticated irrigation infrastructure to expand their operations. Extensive pasture and rangeland operations were developed in the up-slope regions of the islands. No irrigation, other than the infrastructure necessary to keep livestock watered, was developed for these regions. The growing periods of these up-slope areas were short due to the higher elevation and poorer soil conditions. However, since the downsizing of both the sugar and pineapple industries within the past decade, these prime agricultural lands have become available for pasture.

Kikuyu (*Pennisetum clandestinum*) is the most important forage grass for the state. However, this grass is listed by the USDA as a noxious weed in the contiguous 48 states. A 2003 petition with the USDA to remove this grass from the Federal noxious weed list was not successful.

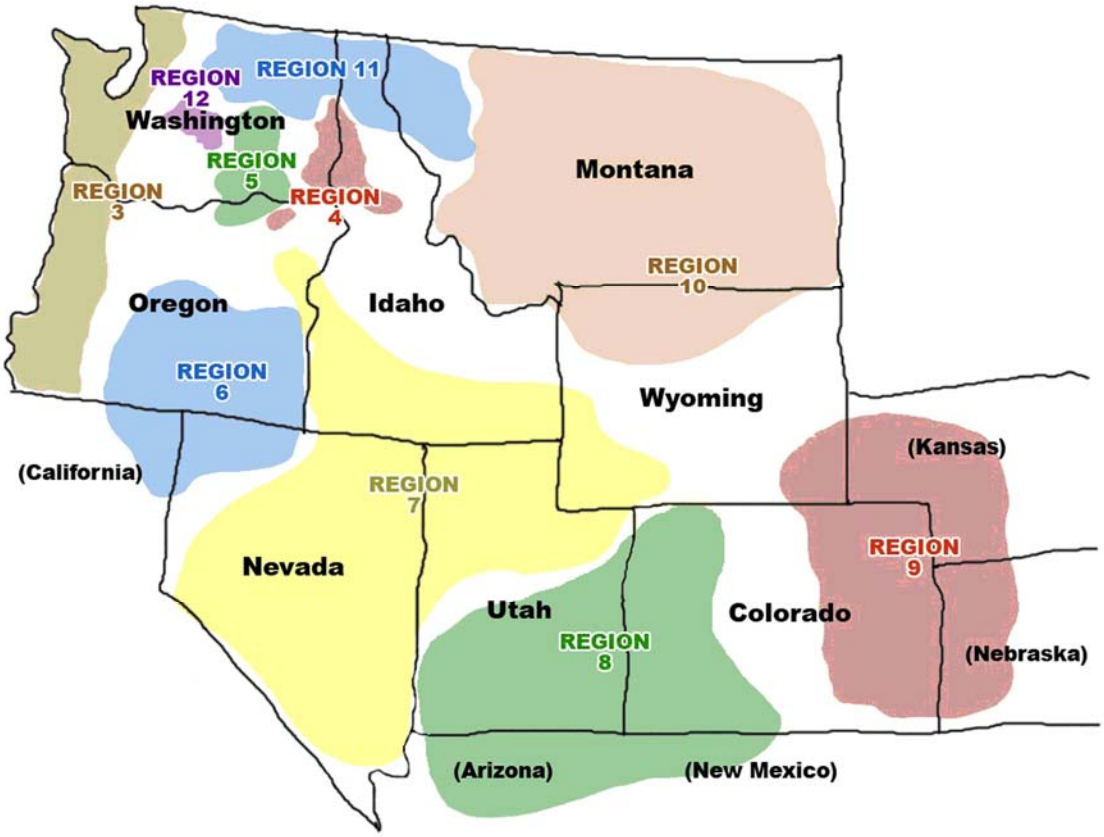
Other important grass forages include: pangola (*Digitaria decumbens*), Guinea (*Panicum maximum*), para (*Brachiaria mutica*), buffel (*Cenchrus ciliaris*), bahia (*Paspalum notatum*) and other *Paspalum* spp., Puerto Rican star (*Cynodon nlemfuensis*) and other *Cynodon* spp., and elephant (*Pennisetum purpureum*). Temperate grasses, such as ryegrass, were evaluated in the past with low success rate due to the highly aggressive nature and competitiveness of kikuyu grass.

Important legume forages include: white clover (*Trifolium* spp.), trefoils (*Lotus* spp.), desmodium (*Desmodium* spp), glycine (*Glycine wightii*), vetch (*Vicia sativa*), perennial peanut (*Arachis pintoi*), and *Leucaena leucocephala*. The later two legumes are under investigation and evaluation by the University of Hawaii, College of Tropical Agriculture and Human Resources.

Most of the pastures in Hawaii are mixed grasses and legumes. The most common mix is kikuyu grass and white clover in the moderate elevation zones and a Guinea grass and desmodium combination in the lower-elevation pastures.

Virtually no annual pasture or range planting is done by producers in Hawaii. Most of the grasses and legumes are tropical and subtropical perennials. On occasion a producer may overseed a pasture to develop a mix or bank of different forages. The University of Hawaii College of Tropical Agriculture and Human Resources is researching this technique. They have also recently purchased a no-till pasture seed drill to investigate and evaluate the benefits of pasture forage diversification and to encourage strategic no-till seeding practice by producers.

None of the forages grown in Hawaii are exported to other countries. Forages produced on the islands are primarily use in managed grazing systems for ruminant livestock. Currently, there are no major hay production operations in Hawaii; however, there are ongoing efforts by the beef cattle industry to develop forage resources by recovery and processing (baling) of crop residues generated by the sugarcane industry.



Region 1 (Alaska) and Region 2 (Hawaii) not shown

Region 3: West of the Cascades (Oregon and Washington)

Within this region, forages are produced in the following Oregon Counties: Clatsop, Columbia, Tillamook, Washington, Multnomah, Clackamas, Yamhill, Marion, Polk, Lincoln, Benton, Linn, Lane, Douglas, Coos, Curry, Josephine, and Jackson. Forages are produced in the following Washington Counties: Clallam, Clark, Cowlitz, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pacific, Pierce, San Juan, Skagit, Skamania, Snohomish, Thurston, Wahkiakum, and Whatcom.

Three forage-producing subregions are important to distinguish within the West of the Cascades region: (1) the coastal area, (2) the Willamette Valley and Puget lowlands, and (3) the southwestern interior.

Stretching along the Pacific Ocean border, the coastal subregion area is characterized by wet winters, relatively dry summers, and mild temperatures throughout the year. Coastal terrain features include a coastal plain (extending from less than a mile to a few tens of miles in width), coastal valleys, and the Coast Range, the peaks of which range from 2,000 to 5,500 feet above sea level. The abundant moisture supports lush pastures for dairy and animal production. Along the lower elevations of the immediate coast, normal

annual precipitation is between 65 and 90 inches. However, spots high on the western slopes of the range may get up to 200 inches.

The Willamette Valley of Oregon and the Puget lowlands of Washington are diverse agricultural areas and the home of the majority of the population. Livestock operations are common, including the dairy, beef, sheep, and poultry industries. Recreational horses are also abundant. Forages grown in this region support these industries. There is considerable variation in precipitation, ranging from annual totals below 40 inches in the western portions of these valleys to upwards of 80 inches in the foothills of the Cascades. Elevation is the single most important determinant of precipitation totals. Mean high temperatures range from the low 80s in the summer to about 40°F in the coldest months, while average lows are generally in the low 50s in summer and low 30s in winter. The mean growing season (days between spring and fall freezing temperatures) is 150–180 days in the lower elevation areas, and 110–130 days in the foothills (above about 800 feet).

Even in these cool, humid areas the climate is dry in the summer, and supplemental irrigation is required for high levels of forage production. Moisture is abundant during most of the long growing season, but supplementing irrigation in the summer is common. Seventy percent of the forage acres are irrigated. Irrigation systems are primarily the less expensive big gun (10%) and wheel-line systems (50%), with 40% of the acres irrigated by center pivot.

Soil conditions (including depth, texture, infiltration rate, drainage, and pH) influence land use and choice of species for forage production. Irrigated pastures generally are confined to heavy-textured, shallow soils with imperfect internal and external drainage. Cultivated forages (including alfalfa, oats, sudangrass, and silages) occupy the more productive cropland, all in competition with cash cropping systems. Rangeland-type pastures in the temperate oceanic summer areas of the coastal region have mild winters and support a complex mixture of resident winter annuals that germinate with fall rains and are grazed in the moist winter and spring seasons. In the semiarid regions, drought-resistant perennials and short-lived annuals provide spring and summer grazing. Many grass and legume species are required to provide grazing throughout this variable region.

Hay, pastures, and supplemental crops are the primary forage sources. Alfalfa is the principal hay crop west of the Cascades. The majority is grown as a pure stand, but alfalfa/grass mixtures account for approximately 20% of the alfalfa acreage. Cereal grain hay is produced throughout the region but is concentrated in dryland areas in central and northern coastal sections of Oregon and Washington. Oats grown with and without vetch, wheat, barley, cereal rye, triticale, and blends of forages are all grown. Of these, oats and forage blends are the most important. Cereal hays are in demand as dry stock dairy and horse feed, but cereal silage is more widely harvested in dairy-producing regions. Sudangrass and sorghum-sudangrass hays are an important source of nutrients for beef and dairy cattle. These species are highly productive under warm temperatures.

Grass-legume hay is used locally for maintenance of livestock during the winter. Some timothy hay is produced for horses and for export to Pacific Rim countries (Japan, Korea, Taiwan). Other forages exported to the Pacific Rim countries include alfalfa, orchardgrass, tall fescue, timothy, sorghum, sudangrass, and grain hay and grass seed straw from perennial ryegrass, annual ryegrass, tall fescue, orchardgrass, and bentgrass.

Region 4: The Palouse (Idaho, Oregon, and Washington)

The Palouse is a contiguous region encompassing north-central Idaho and the southeastern corner of Washington, along with a portion of northeastern Oregon. It runs continuously along the north and northwest foothills and base of the Blue Mountains into Oregon.

According to 2002 Census of Agriculture data, the Palouse includes a total of over 81,000 acres of harvested forage, of which less than 3% is irrigated. The harvested forage consists almost entirely of hay. About 22% of the hay is cereal grain hay, which is almost entirely non-irrigated. The remaining forages are either grasses (wheatgrasses, orchardgrasses, fescues, ryegrasses, and bluegrasses), or mixtures of these grasses with the following legumes: alfalfa, clovers, vetches, peas and sainfoin. The Palouse has about 1.24 million acres of pastured cropland.

The Palouse is characterized by very deep loess soils. Some of the soils are as deep as 200 or more feet to bedrock. The Palouse is an area with gently rolling to extremely steep hills like sand dunes that were created by glaciers and wind patterns in the Ice Age. It is now one of the most productive farming areas in the world.

Most farming is done on the contour due to the steepness of the hills. Erosion is a major problem on the steep slopes. Farming practices have changed in recent years to help alleviate wind and water erosion problems. Many grass waterways have been established to mitigate water erosion. Many of the waterways are harvested for forage. Most of the mechanically harvested forages are raised on the less steep slopes or in the bottoms between the hills.

In general, the Palouse has moderately cold, wet winters with hot, dry summers. Spring can be wet or dry and fall is usually relatively dry. Precipitation ranges from about 15 inches along the western edge of the Palouse to more than 30 inches along the eastern edge abutting the Bitterroot and Blue mountains. Snow depths range from minimal along the western edge of the Palouse and along the Blue Mountains to deep along the Bitterroot Mountains. Growing seasons usually begin in late March to early April, though it is not unusual to have frost into May. The growing seasons usually last until late September to early October, but it is not unusual to have frost in mid-September.

Region 5: Columbia Basin (Oregon and Washington)

The Columbia Basin refers to the area of the Columbia River's drainage in southeastern Washington and northeastern Oregon. For the purposes of this document, we further refine this definition to include the irrigated or sub-irrigated (land that has a shallow water table that normally supplies a crop's irrigation requirements) areas east of where

the Columbia River borders the eastern slopes of the Cascade Range to the dryland wheat country between Moses Lake and Ritzville, Washington. The north-south boundaries are indicated by the town of Stratford, Washington on the north to the towns of Pendleton, Umatilla, and Boardman, Oregon on the south. The region includes, in whole or in part, seven counties of Washington (Grant, Adams, Lincoln, Franklin, Benton, Yakima, and Walla Walla) and the northern portions of three counties of Oregon (Umatilla, Morrow, and Sherman). The region is classified as a shrub-steppe landscape with annual precipitation from 6 to 9 inches. Approximately 73% of the forages grown in this region are irrigated, primarily from water supplied by a series of dams and canals on the Columbia River and its tributaries, the Yakima, Snake, Umatilla, and John Day rivers. There are a limited number of deep wells providing irrigation water. 70% of the irrigation is by center pivots, 10% is wheel lines, and 20% is rill irrigation. The Columbia Basin Project alone provides irrigation water for over 530,000 acres of prime agriculture land.

Within the Columbia Basin, over 80,000 acres (excluding alfalfa) of machine-harvested forages and approximately two million acres of pasture forages are grown. Timothy hay production (approximately 25,000 acres) and orchardgrass hay production (approximately 25,000 acres) dominate the machine-harvested forage makeup. Most of the high quality timothy is exported. Lower quality timothy hay (with weeds, rain damage, excessive dirt, mold, etc.) is sold domestically as feeder hay. Approximately 40% of timothy hay is exported. The pastureland is primarily permanent swards containing cool-season grasses (fescue, brome, and orchardgrass) and clover mixes. Common forage mixtures in the Columbia Basin include tall fescue, orchardgrass, perennial ryegrass, and festulolium.

Critical needs specific to the Columbia Basin forages include annual and perennial grass weed control in pure timothy and orchardgrass stands, foliar and root disease resistance characterization of timothy and orchardgrass varieties, and more cost-effective options for insect and mite pest management.

Region 6: The Klamath Basin (Nevada and Oregon)

The Klamath Basin region consists of the southeast quarter of Oregon, the northwest corner of Nevada, and the northeast corner of California. This includes Oregon east of the Cascade Mountain range and south of Bend, i.e., the counties of Deschutes, Klamath, Lake, Harney, Malheur, and Crook. Nevada counties include Humboldt and Washoe, and California counties include Siskiyou and Modoc.

The dominant growing areas of the Klamath Basin are in southern Oregon where a Bureau of Reclamation project provides water from Klamath Lake to approximately 250,000 acres. Christmas Valley, halfway between Bend and Klamath Falls, has approximately 35,000 acres irrigated by pivot sprinklers from wells. Most of the other growing areas in Region 6 are small valleys with good soil and wells that can provide irrigation water.

This region is considered a high desert climate with 10 to 13 inches of rain annually. Elevations of farming areas vary from 2800 to 4500 feet. Ninety-five percent of the

forages are produced under irrigation. Irrigation breakdown is 75% sprinklers, 15% flood, 5% sub-irrigation, and 5% non-irrigated (dryland).

The predominant forages planted are alfalfa, grass, and various cereal grains for hay. Mixtures usually include alfalfa and grass or cereal grains as a nurse crop for perennials. Orchardgrass and timothy grass along with some annual varieties are the most common grass species.

The alfalfa hay produced is usually targeted for dairies. Hay with less protein and digestibility – and therefore not of high enough quality to support a high level of milk production – is exported to Pacific Rim countries or sold for horse or cattle feed. Grass and alfalfa/grass mixtures are typically baled in small, light bales for the retail horse trade. Hay that has been rained on or has other quality issues that do not fit the above markets is generally sold as stock hay for cow/calf producers.

Region 7: The Great Basin (Idaho, Nevada, Utah, and Wyoming)

For the purpose of this document, we define the Great Basin as northern Utah, most of Nevada, and southwest Wyoming. Also included is the Snake River Basin, which extends from eastern Oregon through the southern third of Idaho to the Wyoming border.

The region has three climatic regions: humid, semi-arid, and arid. The high mountains and plateaus are humid, and the lower basins, valleys, and flatlands are often arid. The transitional places in between are semi-arid. The arid region generally receives less than eight inches of precipitation annually, while the humid zone generally receives eighteen inches or more. While most of the moisture is associated with frontal systems from the Pacific Ocean, there is a period in mid- to late summer when convectional rainfall is very important. During this time, moist air masses flow from the Gulf of California or the Gulf of Mexico into the Great Basin. This moist air is unstable, and convectional processes frequently cause cloudbursts and flash flooding.

The Great Basin is effectively cut off from the westerly flow of Pacific moisture. As these air masses cross the Sierra and the Cascades, the resulting cooling precipitates much of the moisture out. The result is a dry steppe, cold climate for most of the Basin with no water surplus and mean annual temperatures under 64°F.

An elevation gradient occurs from the low-elevation, dry lake bottoms in the Great Basin to the humid areas on alluvial slopes. Two elevation gradients occur in the Snake River Plain: one from Oregon/Idaho to the mountain valleys in eastern Idaho, and the other from river level to the foothills. Interior basins are approximately 2,000 to 5,000 feet above sea level, and some mountain meadows are as high as 7,000 feet in elevation.

Much of the naturally best agricultural land occurs in flood plains and on alluvial soils. Livestock dominates Great Basin agriculture, because grazing is the best and sometimes the only reasonable agricultural use for huge areas due to the climate, the landform, or both. Livestock production relies on the availability of low-cost forage production.

Variation in yield from dry-land forage production is largely explained by spring precipitation. For example, Idaho alfalfa yield dropped from 4.2 tons/acre in 2000 to 3.9 tons/acre in the drought year of 2001. Approximately 80% of the forage acreage is under irrigation, and it produces 93% of the tonnage. An estimated 50% of the irrigated acreage is on center pivot, 25% on wheel lines and solid set, and 25% is irrigated by surface with furrows and flood.

Common forage species planted in the irrigated and humid pastures of the Great Basin include orchardgrass, smooth brome, meadow brome, tall fescue, perennial ryegrass, timothy, oats, triticale, hooded barley, and winter wheat. Common forages planted in arid and semi-arid areas include crested wheatgrass, Russian wildrye, and intermediate wheatgrass. Cool-season legumes planted in this region include white clover, red clover, sainfoin, and birdsfoot trefoil. Warm-season grasses include sorghum X sudan hybrids and grazing corn. *Brassica* spp. planted as forages include forage rape, turnips, and kale. Examples of common forage mixtures are: orchardgrass, meadow brome, and alfalfa; perennial ryegrass and white clover; and barley and turnips.

Timothy hay is exported to Pacific Rim countries and to the West Coast. Grass and mixed grass hays are sold to regional urban areas or exported to the East Coast and the southern United States. Hay that is rain-damaged is usually used for beef operations.

Trends in production that involve or impact forage acres include:

- Rapid growth in the dairy industry: Idaho was 5th in the nation for dairy cow production in 2004.
- Beef cattle are relying less on harvested hay and more on grazed forage because of economics.
- Horse populations are increasing, and demand for hay and pasture is growing. This demand is for grasses and grass mixes with alfalfa.
- Drought conditions.
- There is a lack of rain for dryland forage production.
- Lack of water or increased cost of power for irrigation.
- Shift from wheat grain production to cereal forage.
- Increased use of double-cropping with triticale that is fall planted, harvested in May, and followed by a corn silage crop.

The region faces increased urban pressure for plentiful, clean water. The recovery of various salmonid species and domestic water use will surely impact irrigation water use and availability in the future. Public and agency demands to decrease surface water Total Maximum Daily Loads (of contaminants) leaving the farm will necessitate greater irrigation and farm nutrient/management practice changes in the future.

Region 8: The Colorado Plateau (Colorado, Utah, Arizona, New Mexico)

This region covers southern and eastern Utah, western Colorado, northeastern Arizona, and northwestern New Mexico. This area is predominated by high elevation arid plateaus (3,500–13,000 feet above sea level). Cultivated lands are found in high and low elevation

valleys receiving an average annual precipitation of approximately 6–12 inches. High elevation cultivated lands (5,500–7,500 feet above sea level) are the focus of this description. However, dispersed in this region are lower elevation valleys (3,500–5,500 feet above sea level) that have forage production similar to Region 7 but that differs in that non-irrigated or partially irrigated land is less productive and that southern locations may experience earlier seasons, higher temperature extremes, and summer monsoonal precipitation. High elevation average winter temperature lows are in the teens; highs are in the 30's. Summer average daily temperatures include nighttime lows in the 50's and daytime highs into the 90's. Frost can occur throughout the year and limits the growing season. Forages are grown primarily for local livestock production.

High elevation forage production can be divided into cultivated lands and wet and semi-wet meadows. Cultivated lands are 75% sprinkler and 25% flood irrigated. Oats, triticale, barley, and corn are the forage crops grown between alfalfa rotations. Perennial crops for hay or pasture include: orchardgrass, smooth brome, timothy, tall fescue, and meadow brome, grown alone or in mixtures. Alfalfa, sanfoin, and clovers are used as legumes in grass mixes. Two hay or haylage crops are harvested per season. Warm season grasses and annuals are occasionally grown but are limited by frost, cooler temperatures, and the short growing season.

Wet and semi-wet meadows frequently produce a single cutting of grass hay and are managed as pastures during the rest of the season. Meadows are cultivated and seeded as needed with meadow brome, orchardgrass, meadow foxtail, Kentucky bluegrass, fescue, and timothy. Meadows are 95% flood irrigated and 5% sprinkler irrigated. Much of these meadows are naturally flood-irrigated by surface runoff or subirrigation.

Important weed pests in this region are primarily thistles, mustards, kochia, Russian thistle, and other noxious and invasive species including grasses, sedges, and rushes.

Insect pests in this region are typical to other western regions, but there are frequently large infestations of armyworms, grasshoppers, and Mormon crickets.

Ongoing and emerging forage production issues in this region include:

- Need for more forage production on private cultivated and pasture lands as the use of public rangelands becomes more restrictive.
- Increased competition for land and water for development and recreation.
- Drought, flooding, pest infestations, and extreme winter weather.
- Increased wildlife competition.
- Impact of threatened and endangered species on land use and management options.
- Need for development of better adapted and more productive crops (existing or alternative) and cropping practices.

Region 9: Western Great Plains (Colorado, Wyoming, Kansas, and Nebraska)

While forage production in Kansas and Nebraska is not covered in this document, parts of Kansas and Nebraska are contiguous with the Western Great Plains (as defined by this document) and can therefore be included in describing the region. The Western Great Plains lie east of the foothills of the Rocky Mountains, in eastern Colorado and southeastern Wyoming, including the area to the south of the North Platte River Basin. Elevation within this region ranges from 3,300 feet (Arikaree River at the Kansas/Colorado line) to approximately 6,000 feet above sea level. Annual average precipitation ranges from 6 inches to over 18 inches. Winter months (November through February) are usually fairly dry, with less than ½ inch of precipitation expected in any month. Spring and summer precipitation is generally more predictable and abundant, but seasonal droughts are very common. Summer precipitation frequently comes in just two or three major thunderstorms and can include violent micro-burst winds and driving hailstorms. This region supports primarily rain-fed forages.

Forage crops include alfalfa and alfalfa/grass mixtures; winter- and spring-seeded cereal crops (primarily winter wheat, winter triticale, oats, or barley) harvested as forage or grazed; summer annual feeds (millet hay and sorghum, or sorghum X sudangrass hybrids) also hayed, ensiled, or grazed; and perennial grass pasture for hay and grazing. The predominant species planted to perennial grass pastures include: smooth brome, meadow brome, orchardgrass, tall fescue, intermediate/pubescent wheatgrass, hybrid wheatgrass, western wheatgrass, tall wheatgrass, perennial ryegrass, and creeping foxtail for the wetter field areas. Occasionally, warm-season grasses such as switchgrass, big bluestem, and Indiangrass are planted for summer hay and grazing. Annual ryegrass is sometimes planted for grazed pastures. Few producers grow perennial legumes other than alfalfa in this region. Those who do grow perennial legumes grow birdsfoot trefoil, sainfoin, clovers, and hairy or crown vetch. Soybeans, peas, chicory, and brassicas can be seeded for hay or grazing. A few producers have planted bermudagrass, crabgrass, and prairiegrass brome, but success with these forages has been mixed or disappointing.

Forage producers in the Western Great Plains have ample market opportunities due to significant expansion in the past two decades of confined feeding dairies and horses housed in stables and in rural small acreage homesteads. Goats, llamas, alpacas, and other alternative livestock add to the market potential for forage producers. Cattle and sheep feeding operations as well as traditional livestock on range have held fairly constant through the recent growth and still demand significant hay inputs.

Region 10: Northern Great Plains (Montana and Wyoming)

The Northern Great Plains, as defined by this document, includes the contiguous area of the high plains of northeastern Wyoming and the state of Montana, with the exception of Montana's northwest corner. This corner of Montana, which has milder winters and more precipitation, is included in Region 11, the Columbia Basin Uplands.

The Northern Great Plains is semi-arid with cold winters. Almost all counties in the region have some type of forage production, though the more remote, high-elevation

areas produce less. Forages grown in the Northern Great Plains have a ready market within the region and are not commonly exported. In Montana, greater than 92% of harvested hay and 100% of pasture forages are fed to livestock.

Montana has more than 28,000 farms that utilize over 60,100,000 acres for various crops. It is consistently one of the largest producers of dryland grain crops. Wheat is the main crop grown, with over 5,470,000 acres planted in 2005. Wyoming has more than 9,000 farms and ranches that utilize over 34,000,000 acres for various crops. The average size of a farm in Montana is 2,146 acres. The average size of a farm in Wyoming is 3,700 acres, with hay (grass and alfalfa) being the main crop grown. Wyoming harvested 2 million tons of hay in 2004. Montana ranks 9th in the nation in alfalfa and alfalfa mixes, with over 2,590,090 acres grown in 2005. Wyoming ranks 24th in the nation in alfalfa and alfalfa mixes, with 1.26 million tons harvested in 2004.

The western portion of the Northern Great Plains is generally high elevation and mountainous. For this reason it is largely primitive and inaccessible to farming, with the exception of a few valleys. Most farming of mixed-forage commodities takes place in the lower elevations of central and eastern Montana and northeastern Wyoming. Montana's elevation ranges from a low of 1,800 feet above sea level to a high of 12,850 feet at Granite Peak.

With the region's overall dry environment and the lack of groundwater in remote areas, roughly half of Montana's mixed forage is in dryland production. In irrigated areas, wheel-line irrigation systems are the most common, followed by pivot systems, then flood irrigation.

Alfalfa/grain mixtures are the predominant forage mixtures grown in the region, making pests and pathogens of both alfalfa and grain of utmost importance when considering pest management. Alfalfa/grass mixtures are also important; therefore, grass-specific pests must be considered. Critical pest management needs specific to forage systems in this region include establishing multi-purpose economic thresholds and finding low-risk alternative approaches for the control of various insect pests, including alfalfa weevil. Economic thresholds need to (1) indicate when a pest is actually on the brink of being an economic problem, (2) be specific so that growers can avoid unnecessary costly chemical treatments, and (3) minimize chemicals in the ecological system that are harmful to beneficial insects. Presently, thresholds are in place for grains or alfalfa alone but not for mixed forage systems such as alfalfa/grain. Among insects that need to be evaluated for thresholds are alfalfa weevil, Russian wheat aphid, and cereal leaf beetle. As for finding low-risk alternatives, botanicals with high efficacy on weevils that could be labeled for use on organic systems would be a great asset for this region.

Region 11: Columbia Basin Uplands (Idaho, Montana, Washington)

The region we are calling the Columbia Basin Uplands includes the northeast part of Washington State, the north part of the Idaho panhandle, and the northwest corner of Montana. It includes the upper Columbia River drainage and is characterized by variable soils created by glaciers and the actions of the Ice Age floods of Lake Missoula. Data

from the 2002 Census of Agriculture indicate that the region comprises over 138,000 acres of mechanically harvested forage, of which about 21% is irrigated. The region has about 250,000 acres of pastured cropland.

Forage harvested in the Columbia Basin Uplands consists almost entirely of hay and is produced primarily in the intermountain valleys and uplands or highlands. About 22% of the hay is cereal grain hay, which is almost entirely non-irrigated. Other important forage species cultivated in the Columbia Basin Uplands include: wheatgrasses, wild ryes, fescues, rye grasses, orchardgrasses, brome grasses, and timothy. Timothy hay grown in Pend Oreille County, Washington is exported to Japan. Common forage mixtures planted in this region include alfalfa/grass, alfalfa/cereal grain, and pea/cereal grain.

Less than 10% of the pastured cropland acres (i.e., forage acres that are grazed rather than cut for hay) in this region is irrigated. Of those acres, at least 80% is sprinkler irrigated, and the rest is flood irrigated.

The climate is generally cold, with wet winters and hot, dry summers in Washington and cold, wet winters with warm summers in the intermountain regions of Idaho and Montana. Spring can be wet or dry, and fall is usually relatively dry. Precipitation ranges from as low as 10 inches in the western end of this region to 30 to 40+ inches in the intermountain valleys of the Bitterroot, Cabinet, and Northern Rocky mountains. Snow depths range from moderate to deep depending on elevation and proximity to the mountains. Growing seasons are short with late spring and early fall frosts.

Region 12: Kittitas Valley (Washington)

Washington State has a global reputation for the production of high quality timothy (*Phleum pratense* L.) hay, which has lead to the development of a Pacific Northwest export market for timothy hay to Japan for use as roughage in feed rations for dairy and beef animals as well as for the prized primary feed for race horses. The primary production area for this type of hay in Washington is the Kittitas Valley. This region encompasses area to the north and south of Interstate I-90 and extends approximately 50 miles east-to-west from Vantage to Cle Elum. This area of cultivation exceeds 55,000 acres and has an annual farmgate value of approximately $40 million.

The Kittitas Valley has an average high monthly temperature of 59.2^{o}F and an average low monthly temperature of 35.2^{o}F. The average annual precipitation is 9.1 inches. Timothy is the primary cash crop in this region, to the exclusion of most other agricultural crops.

All timothy acreage under cultivation in the Kittitas Valley receives supplemental irrigation through a wide range of delivery systems, including rills, linear moves, and wheel lines.

Diseases and pests of Timothy encountered in this region include soil-borne diseases such as *Rhizoctonia solani* and *Pythium* spp.; a malady of unknown etiology called “brown leaf;” mites; and invasive weeds. Recent surveys (2006) indicate that wheat curl mite

could be a new and important pest in the region. Growers see several areas of research that could benefit the industry, including the development of improved cultivars that are particularly suited for cultivation under irrigation systems and climatic conditions characteristic of the Kittitas Valley.

Production Statistics by State

	Acres used for pasture or grazing	Hay Harvested (in acres)	Hay Harvested (in tons)
		(figures exclude wild and alfalfa hay)	
Alaska	8,917	22,498	25,540
Arizona	213,681	46,224	155,777
Colorado	1,797,455	369,603	487,959
Hawaii	36,540	820	1,658
Idaho	745,835	184,101	371,041
Montana	1,726,012	786,539	1,042,079
Nevada	314,430	54,296	125,296
Oregon	997,717	419,398	913,628
Utah	602,341	86,457	185,577
Washington	499,226	246,957	660,308
Wyoming	906,831	240,792	265,951
Western Region Total	8,670,532	2,568,370	4,444,606
US Total	60,557,805	31,298,744	60,978,646

Source: 2002 Census of Agriculture

PRODUCTION ISSUES

Integrated Pest Management

Integrated Pest Management (IPM) can be described as a pest management program that uses a combination of preventive, cultural, biological, mechanical, and chemical practices. Employing IPM does not mean abandoning chemical control of weeds, diseases, insects, and nematodes, but rather relying on these controls less and using them judiciously in combination with other practices. IPM practitioners consider impacts on human health, nontarget species, the environment, and economic sustainability in selecting control measures.

Weeds

Weeds can be the most significant pests of forage crops. Practicing integrated management within the spectrum of weed control is often called Integrated Weed Management (IWM) or Integrated Vegetation Management (IVM).

IWM advocates the use of all available weed control options, such as: plant breeding, fertilization, crop rotation, tillage practices, planting pattern, cover crops, and mechanical, biological, and chemical control. No single weed control measure can be a stand-alone practice due to the number of weed species, their highly variable life cycles, and the species survival strategies. In addition, if only one or two strategies are used, weeds will adapt to those practices. Applying the principles of IWM can minimize the overall economic impact of weeds, reduce herbicide use, and provide optimum economic returns to the producers.

In essence, the development of an IWM program is based on a few general rules:

1. Use agronomic practices that limit the introduction and spread of weeds, forestalling weed problems before they start. This could include selecting clean fields free from perennial weeds, controlling weeds – particularly perennials – prior to planting, and using certified seed.
2. Help the forage compete with weeds by encouraging the establishment of a dense, healthy stand that can out-compete weeds.
3. Use practices that keep weeds off balance and do not allow weeds to adapt to the site. For example, if planting a perennial forage (e.g., grass-alfalfa or perennial grass), seeding in the fall will help prevent summer annuals from interfering with establishment. The weeds will not establish well in the fall, and the first frost will kill those that do (depending on location and climate). Seeding early in the spring will often allow the crop to get ahead of weeds that begin germination later in the spring. Rotation of annual crops will also prevent some weeds from becoming dominant. For example, rotating a spring planted annual forage with fall-seeded winter wheat will prevent winter annual weeds from becoming dominant and vice versa.
4. If chemical controls are used, rotate modes of action to help prevent resistance development.

Combining practices based on these rules allows producers to design an IWM program for forage production on any site. There is no single recipe for all conditions and years. The plan needs to be changed and adjusted to each site and condition. The goal is to manage weeds rather than attempt to eradicate them. In weed management, growers must control both the plant and the seed and vegetative propagules in the soil.

Diseases

Cultivated forages also suffer from diseases caused by pathogens and insect vectors. These diseases typically are the product of interactions between the plant host, the pathogen or pest, and the environment. Because forage production is most often characterized by reduced inputs and because the crops have relatively low gross value, agrochemicals are very rarely applied for controlling disease. The most effective method for controlling diseases in forages is to cultivate varieties that have genetic resistance to specific diseases. It is unnecessary to apply agrochemicals for disease control when crop varieties are cultivated that have resistance to specific disease profiles likely to be encountered in a given production region. Because of the continually evolving nature of plant pathogens and other pests, it is necessary to maintain and expand efforts to develop and evaluate disease-resistant forage varieties. It is critically important that growers have extensive knowledge of the pathogens and pests that are likely to be encountered in their growing regions if they are to make informed decisions with respect to choosing varieties that have appropriate disease resistance profiles.

Equally important to an integrated disease management program are rotation with crops that are non-hosts to forage disease pests; fertility management; appropriate timing and amount of irrigation water; and alteration of planting and harvest time (e.g., pushing back planting dates to avoid aphids and Hessian fly).

Growers that possess reliable information on diseases and pests endemic to their production areas are more likely to apply agrochemicals appropriately, decreasing impacts on nontarget organisms. The ability to provide growers with reliable information is dependent on research efforts focused on the characterization of diseases and pests of forages and the timely transfer of this information to growers.

Insects, Mites, and Related Pests

Except for the unusual situation of a single blister beetle in a bale of hay being fed to equines with sensitive mouths, insects and mites must reach critical population levels (thresholds) in a field before the damage they cause justifies the cost of controlling them, like applying an insecticide. Proper insect pest management requires being able to identify pests; having a way to quickly monitor their numbers (such as using a sweep net or counting aphids/leaf); knowing if these numbers are or will be economical; and hopefully having alternative methods to control them (to reduce their numbers to insignificant levels). These methods are not just different insecticides, although they often include them. Sometimes they include naturally occurring biological controls in the field (i.e., a very effective predator population) or an early harvest to avoid the brunt of economic damage. These alternate controls may be more practical, economical, and more stable through the growing season than a chemical control.

Insect pest management is defined here as the timely reduction of pest populations before they cause economic damage to the forage. It is understood that the cost of a control used is less than the value of the crop that would have been lost. The principles of insect pest management are (1) correct identification of pests and their predators/parasites, (2) understanding their life histories and how the species interact in the crop, (3) being able to quickly monitor their population levels, (4) knowing at what threshold population level crop damage occurs, and (5) having a selection of appropriate controls from which to choose (these may be insecticides, naturally occurring biological controls already in the field, or perhaps the ability to harvest a crop early, thereby avoiding damaging losses culturally).

Many species of insects occur in forage crops. Fortunately, only a few are pests requiring controls. Many are incidental and feed on decaying matter. Others are beneficial and may be predators or parasites of the pest insects. The particular forage, or combination of forages, grown as well as their geographic location, largely determine the pests that will be present. Climate, weather, soil type, and cultural practices such as irrigation, fertilization practices, and harvest schedules, may also affect pests and their densities in a particular forage. Some pests, such as the glassy cutworm and the armyworm, will infest only grasses. Others, like the alfalfa weevil, will attack only alfalfa. Most of the insect species encountered in forages are insignificant to the health of the crop, feeding on decaying organic matter or merely using the crop as temporary shelter.

Many other insects (as well as all spiders) are beneficial and worth knowing. These are the predator and parasitic insects that can significantly reduce populations of forage pests and reduce your spray bill by providing biological control of pest insects. Growers learn to recognize the important ones such as the predators of aphids, plant bugs, and leaf feeding caterpillars. They include: lady beetles, damsel bugs, green lacewings, syrphid flies, bigeyed bugs, and minute pirate bugs. Most all of the wasps seen in forages prey on or parasitize armyworms, looper, and cutworm pests of forages. Being able to identify them as well as know a little bit of their biology can sometimes pay off by letting them do the work of an insecticide. Obviously, protection and conservation of these naturally occurring predators and parasites can be critical to any forage IPM program that optimizes profit.

In addition to the above, there are many factors that may collectively determine the occurrence of pests and their population levels and subsequent damage in forage crops. It is important to know these and how they might affect populations of pests. Consider the:

- season, stage of growth, and vigor of the plants
- proximity to harvest or grazing time
- percentage of plants infested
- damage potential or rate of population increase of the pest
- effects of multiple pests
- potential consequences for any control action taken (certain insecticides may control a given pest but result in spider mite outbreaks requiring additional control expenses later in season)

Vertebrates
Growers consider a wide range of vertebrate management options. There is no "silver bullet" that deals with all vertebrate pests; therefore, growers must tailor their management strategies to the spectrum of pests present. Growers use a combination of physical and chemical controls. Examples of controls that are a part of an overall vertebrate IPM strategy include altering planting or cutting date, hazing to disorient or scare birds, tillage, and encouraging predators.

Vertebrate control is also imperative for good weed management. Vertebrate burrows disturb the soil and leave bare patches that encourage weed invasions.

Irrigation Decisions

Rain-fed, or non-irrigated, forage production is typically less intensively managed than irrigated forage production. Outputs are uncertain and dependent upon weather conditions. In contrast, irrigated production has more certain outputs, and producers apply inputs to optimize production. The inputs that growers are more cautious about in rain-fed production include: seeding rates, fertilizer, tillage and cultural practices, and pesticides applied. A dry-land or rain-fed system is much more risky, and therefore inputs must be maximized to help assure that, except for outside climate variability, the crop will survive. Seeding depth, seeding rate, and soil condition are carefully controlled, because growers know the environment will be severe. Therefore, there is still a high level of management, but possibly fewer inputs in dry land production. Operating costs are generally higher in irrigated operations. The impact on gross margin (return over operating costs) is variable and depends upon the levels of production and the operating costs. Whether or not a producer decides to irrigate may also have an impact on which species are selected for planting.

Species Groupings

For practical reasons, forage species in this document were grouped into the following categories. Some of the forages represented in this document were pure stands, whereas others were mixtures of species within and between the different categories.

- Cereal Grains. These forages are all annuals and include wheat, barley, oats, rye, and triticale, among others.
- Warm-Season Annual Grasses. Examples of these grasses include sudangrass, sorghum, and teff.
- Cool-Season Annual Grasses. The most common species is annual ryegrass.
- Warm-Season Perennial Grasses. Examples of common forages in this category include tufted hairgrass, kikuyu, and paragrass.
- Cool-Season Perennial Grasses. This category includes the bromegrasses, wildryes, timothy, orchardgrass, tall fescue, perennial ryegrasses, and wheatgrasses.
- Warm-Season Legumes. Included in this category are annual and perennial legumes, such as lespedeza and perennial peanut.
- Cool-Season Legumes. Includes clovers, trefoils, sainfoin, and vetches.

- Other Forbs. Examples are field turnips and *Brassica* spp.
- Specialty Mixes.

Pesticide Registrations

Many species of forages are represented by this document; therefore, discussing the availability of pesticide registrations is very difficult. Many existing registrations are for pure stands of one forage species (e.g., timothy, wheat, clover) but are not registered for species mixtures. Many of the pests found in forages have adequate controls in other crops, but those controls are simply not registered for forage species. Warm-season grasses and grass/legume mixtures are being added to new pesticide registrations, but existing registrations are not being modified to include such forages. To further complicate registrations, certain cereal grain products are specifically designed for cereals grown for grain, and forage cereals are not included in some of those registrations.

Species Selection

Growers select forage species depending upon their production goals and geographic adaptability. Potential goals could be: high yield (typically with ability to withstand expected grazing or harvesting intensity); high quality; palatability/animal acceptance (the highest yielding forages may not be the most palatable); earlier or longer grazing season; soil protection and control of erosion; competitive ability; management or avoidance of pest issues; stand longevity; distinctive growth habits; or wildlife cover and feed.

Growers must also consider soil, climatic, and economic factors. Soil characteristics to be considered include: pH (acidic vs. neutral vs. saline/alkaline), texture (sand, silt, clay) and erodability, water-holding capacity, fertility (nutrient excesses or deficiencies), drainage, organic matter, physical barriers (caliches layers or plow pans), slope (erosion control), and aspect (south, east, west, or north facing slopes).

Climatic considerations include total precipitation, seasonal precipitation, high and low monthly minimum and maximum temperature, temperature extremes, frosts, frequency of drought and/or flooding, and winter snow cover (snow cover vs. bare soil affects soil temperature and water quality and quantity). If irrigating, related factors include irrigation water source, depending upon snowpack, or other precipitation-related factors.

Economic factors growers consider include ease of marketing and market familiarity, export or domestic demand, on-farm/ranch use versus cash crop, nitrogen fertilizer input costs (legumes versus grass and/or mixed), production of honey (inclusion of legumes), and integration with other crops (adjacent or in rotation) and livestock.

Growers must also decide whether to plant a single species or a mixture. A single species may be easier to market, and certain cultural management techniques are easier to employ in a monocrop. Mixing species, however, can extend the grazing period, can create synergies in soil improvement or pest management, and may be more competitive with weeds. Where adaptable, including legumes in the mixture improves forage quality,

increases protein content and digestibility, adds nitrogen to the soil (thereby reducing fertilizer costs), increases yields over pure grass stands, and can decrease bloat in grazing livestock. Grasses have the advantage of fibrous root systems, which help to stabilize the soil, reduce water requirements, and control erosion. They are also less prone to rodent and ungulate pest damage, tolerate extended periods of flooding better than other forages, and can help extend the growing season.

Resistant Varieties

Proper variety selection is necessary to maximize the return on investment of other production inputs. No one variety has the best traits for all production areas. The first decision made is selection of species that are adapted to the environment. For instance, planting alfalfa in a soil with a high water table, such as a wet meadow, will never be successful long-term even if an alfalfa with high resistance to *Phytophthora* and other diseases is used. Selecting highly resistant cultivars will improve the temporary production, but fields will decline quite rapidly within several years. Selecting wet-meadow type grasses and possibly strawberry clover is the correct decision.

For forages other than alfalfa and cereals, the breeding selection for disease resistance is simply a matter of a better or worse rating (rankings) when one compares the selection of interest with a "check" variety. Within most widely grown forage species (grasses: orchardgrass, tall fescue, perennial ryegrass, cereals; legumes: clovers), there is variability in disease resistance to major pathogens, and plant breeding programs have selected for those traits. Thus, there should be one or more varieties or cultivars within a species that will have higher than average resistance to certain diseases. Where known disease pressures exist (e.g., high humidity environments), it is wise to select among the cultivars with better than average resistance. Selecting for pest and disease resistance is usually only utilized if the trait does not correspond to an unacceptable yield reduction. Unfortunately, a yield reduction often occurs with high resistance.

In the past, breeders relied on public agencies (USDA and land grant universities) to provide much of the pest resistance. With reduced funding, the public effort is now minimal and on limited crops.

Toxic Weeds

Most toxic or poisonous plants of concern in forages are forbs (broadleaf plants). Hundreds of toxic and potentially poisonous plants are present in the West. Toxicity may vary by location, time of year, and certain conditions. Livestock usually avoid these plants if adequate forage is available. Poisonous plant problems are more frequent in dry years when available pasture is reduced and animals graze plants they would not otherwise eat. Hay producers may also harvest fields or plants that are not usually harvested to have adequate feed for the winter. Additionally, toxic weeds can be harvested in hay or silage, and animals are often unable to separate these plants. If poisonous plants are present in a site to be sprayed with an herbicide, animals should be excluded from the site until the toxic plants are dead. Plants are often more palatable after they are treated with an herbicide.

All plants are toxic; however, the toxicity varies with the amount consumed (i.e., the dose makes the poison). Also, environmental conditions make some normally innocuous plants toxic. An example of this situation is nitrate poisoning. Nitrate poisoning is not specific to any one plant, but occurs when plants accumulate nitrates in their leaves and stems. This most often occurs when plants are grown in highly fertile environments, such as fertilized cropland or extended livestock concentration areas with accumulated manure. Moisture stress in plants accentuates nitrate accumulation tremendously, so this toxicity occurs most prominently during drought or in drought-prone areas. Freezing temperatures also increase nitrate accumulation.

The best way to protect livestock from toxic weeds is to develop and implement a comprehensive weed control program involving both mowing and herbicides. Mowing will reduce the likelihood of seed development and dispersal, and persistent spot spraying will eliminate particularly harmful weeds.

Animals sometimes experience negative consequences from the forages they consume. Animals do not naturally select the balanced diet they need and may not be able to avoid harmful plants, so forage-livestock managers must be aware of feeds and plants that can cause health problems. Naturally occurring toxins are common and can be deadly. In other cases, health problems arise because of an interaction between species and climate and management.

Partial List of Toxic and/or Injurious Plants

black henbane *(Hyocyamus niger)*
bracken fern *(Pteridium aquilinum)*
bull nettles *(Solanum* spp.*)*
buttercups *(Ranunculus* spp.*)*
cheatgrass *(Bromus tectorum)*
chokecherry *(Prunus virginiana)*
cocklebur *(Xanthium* spp.*)*
common groundsel *(Senecio vulgaris)*
death camas *(Zigadenus* spp.*)*
dogbane *(Apocynum* spp.*)*
fiddleneck (*Amsinckia* spp.*)*
foxglove *(Digitalis purpurea)*
foxtail barley *(Hordeum jubatum)*
halogeton *(Halogeton glomeratus)*
horsetail *(Equisetum* spp.*)*
jimsonweed *(Datura stramonium)*
johnsongrass *(Sorghum* spp.)
larkspur *(Delphinium* spp.)
locoweeds *(Astragalus* and *Oxytropis* spp.*)*
lupines *(Lupinus* spp.)
milkweeds *(Asclepias* spp.*)*
milkvetches *(Astragalus* spp.*)*
mustards *(Brassica* and *Descurainia* spp.)

nightshades *(Solanum* spp.)
oleander *(Nerium oleander)*
poison hemlock *(Conium maculatum)*
puncturevine *(Tribulus terrestris)*
St. Johnswort *(Hypericum perforatum)*
tansy ragwort *(Senecio jacobaea)*
waterhemlock *(Cicuta* spp.*)*
yellow star thistle *(Centaurea solstitialis)*

DISCUSSION OF PESTS AND CONTROLS BY CROP STAGES

The remainder of this document is a discussion of the common pests that can cause significant damage to forage crops, along with current and potential management practices for those pests. This discussion is organized by crop stage. The stages were defined by the work group in an attempt to arrange the complex matrix of forage crops and regions covered by this document into a meaningful organizational structure. Each crop stage is further divided into sections for the pests that are important to that stage. Within each pest group, the pests are described, followed by the current and potential management practices. Finally, research, regulatory, and educational needs are listed at the end of each section.

PRE-PLANT

Generally speaking, crop rotation and tillage are the most prevalent pre-plant techniques employed toward management of forage crop pests.

Crop rotation can play an important role in forages, particularly when forage crops follow high-value crops and can take advantage of the residual benefits of these crops' pest management practices, which are likely to be more intensive than those employed for forages. For example, potato fields are often fumigated to manage soil-borne pests including nematodes, insects, weed seeds, and diseases. While it is not profitable to fumigate forage fields to control the same pests, planting a forage crop in a field that was recently treated for economically damaging pests can confer obvious benefits.

Pre-plant tillage operations are also done at this time to help control certain diseases, insects, and weeds, and are discussed within the pertinent pests' sections.

Forage producers seldom if ever treat for nematodes. As the pre-plant stage is the only time when treatment might be considered, this is the only crop stage in which we discuss this pest.

Nematodes

Nematodes that are present in the soil and cause damage in alfalfa/grass mixtures are stem nematode, northern root-knot nematode, Columbia root-knot nematode, and root lesion nematode. Those that are present in forage systems containing cereal species are root-lesion nematodes and cereal cyst nematodes. While we know that nematodes have a deleterious affect on cool-season grasses, we do not know how much of an effect they have, nor do we know all the nematode species present. Nematodes can adversely affect the emergence and establishment of young seedlings and also permit other organisms to attack the plant. They cause direct damage to plant roots and stems. Nematodes are easily spread long distances by soil movement, irrigation water, seed, and seed debris.

Stem Nematode (*Ditylenchus dipsaci*)
Stem nematodes are one of the few groups of nematodes that feed mainly on above-ground plant parts and rarely on roots. They can be introduced into fields through uncleaned, infested seed, other infested plant tissue, or contaminated manure, irrigation water, or machinery. Stem nematodes hatch from eggs and go through four stages or "molts," any of which can infect the plant. They congregate under developing leaflets at or near the soil surface and penetrate the young succulent stem or bud tissue. Their feeding kills chloroplasts, which causes leaves to turn white. The bases of infected stems become swollen, discolored, and roughened. Nodes swell, internodes shorten, and plant crowns and lower stems are thickened. When the stem nematode feeds on roots, gall-like outgrowths occur that may girdle the root crown. Stem nematode damage primarily occurs in early spring and fall as the temperatures cool. They are more destructive in older fields and in irrigated regions, especially where wastewater or tailwater is used. Plant vigor and overall plant and stand survival are reduced in the presence of stem nematodes, and severely infected plants die. Patches of poor, stunted growth and bare patches where weeds can invade are indicative of alfalfa stem nematode damage.

Root-Knot Nematode (*Meloidogyne* spp.)
Northern root-knot nematodes (*M. hapla*) are present throughout the United States, whereas the Columbia root-knot nematode (*M. chitwoodi*) is only found in the Columbia Basin, Idaho, California, Colorado, Wyoming, Montana, and parts of Nevada. Root-knot nematodes thrive in moist, sandy loam soils. They live as parasites in the root tissue of alfalfa and a number of other hosts. Grain crops are poor hosts for the northern root-knot nematode. In contrast, grains (specifically, wheat and barley) are hosts for the Columbia root-knot nematode. Root-knot nematodes are infectious only when they are newly hatched, second-stage juveniles. As the seedlings develop, juveniles in the root become established and begin feeding. Small galls develop and excessive branching occurs on the roots at the feeding site. The galls may resemble nitrogen-fixing nodules on legumes, but can be distinguished, since healthy nodules are generally pink. The extent of the damage within the field depends on the initial nematode population, presence or absence of a resistant variety, and warm soils at planting. Root-knot nematodes encourage plant infection by bacterial wilt, Phytophthora root rot, and Fusarium wilt pathogens.

Root Lesion Nematode (*Pratylenchus* spp.)
Root lesion nematodes are found throughout the world in temperate and tropical regions. Like root-knot nematodes, lesion nematodes have a wide host range. They are most destructive to the roots of crop and weed plants in sandy or sandy loam soils. Many species of root lesion nematodes are associated with alfalfa. *Pratylenchus* species are migratory, endoparasitic (i.e., they live inside their host) nematodes that can invade plant roots at all stages of the life cycle outside the egg (similar to the stem nematode). Females deposit eggs in root tissue or soil, where the eggs overwinter. As with stem and root-knot nematodes, second-stage juveniles of root lesion nematodes emerge from eggs (nematodes typically undergo their first molt inside the egg). Lesion nematodes penetrate the entire root system, except root tips, by forcing their way between or through epidermal and cortical cells. They feed on cell contents as they migrate within roots, inflicting black or brown lesions on the root surface and reducing root growth. Lesions

may fuse to cause entire roots to appear brown. Secondary infections of roots by other bacterial and fungal pathogens commonly occur after root lesion nematode invasion. The most important method of dissemination of root lesion nematodes is probably contaminated irrigation water, machinery, or tare dirt, the soil that clings to the harvested crop. Plants infected with root lesion nematodes do not show above-ground symptoms that can positively aid in nematode identification. Above-ground symptoms are more general, and can include stunting and patchy stands.

Cereal Cyst Nematode *Heterodera avenae*
The distribution of this nematode is very spotty. Plants are typically affected in limited areas up to several acres, as this endoparasitic pest is not very mobile. In the field, affected plants appear stunted and chlorotic, leading to mistaking cereal cyst nematode presence for Barley Yellow Dwarf Virus. Upon closer examination, roots upon which feeding have occurred appear locally thickened and highly branched. The life stage impacting plants is the second-stage juvenile, which is typically only present at problematic levels in the spring, during egg hatch. For this reason, spring forage cultivars are more severely affected than fall cultivars. The characteristic brown to black "cysts" indicating the presence of this nematode are actually the dead bodies of the females, which hold the eggs. Before harvest, the females are white and can be seen attached to roots. Growers do not usually focus on managing this nematode.

Infestations of nematodes are a concern to forage growers throughout much of the western states (though cultivars are heartier in some areas, so damage is not as prevalent), but management options are limited. Generally speaking, forage growers do not treat for nematodes. No nematicides are registered, and fumigation is not considered cost effective for most forages, especially grasses. The one exception is timothy hay, which is a higher-value crop. Some timothy growers fumigate for nematodes once populations reach economically damaging levels. However, this fumigation, primarily with metam-sodium (Vapam), is not targeted at nematodes. Fumigants are used in an attempt to control billbugs, as well as annual grass and broadleaved weeds (e.g., annual ryegrass and Kentucky bluegrass), and any nematode control is a side benefit. Pre-plant soil sampling for nematodes is the only definitive way to determine nematode presence and the extent of any infestation. This is very seldom done in forage fields, as it is time consuming and treatment is unlikely. If fields are sampled, it is done in July, August, or September.

A few basic sanitation and cultural practices are employed toward minimizing nematode damage. Growers plant clean, nematode-free seed and may select certain forage species and rotational partners based in part upon the species' abilities to discourage a nematode population buildup. Rotation away from cereals, for example, helps suppress cereal cyst nematode, which favors oats, wheat, barley, rye, and ryegrass hosts. Sorghum/sudangrass mixtures can be effective at reducing nematode numbers. Timothy growers consider rotating with potatoes when populations of root-lesion nematodes reach economical levels, not because potatoes are a non-host, but because fumigation for nematodes in potatoes is generally cost effective. The timothy planted after fumigated potatoes will reap the benefits of lower nematode numbers. Rotations that include a crop in the

Brassicaceae family (e.g., canola, rapeseed) may provide some nematode protection the following year in the forage crop.

Critical Needs for Management of Nematodes in Forages at Pre-Plant

Research
- Research nematicidal seed treatment for forages.
- Research the effect that nematodes have on cool-season grasses.
- Research the effect fumigation has on mychorrizae (grass association).
- Research new grass forage species and crop rotation partners to eliminate or reduce nematode issues (some grasses have natural nematicides).
- Research the action threshold for stem, cyst, and root-knot nematodes.

Regulatory
- Maintain registration of fumigants for forages (including warm- and cool-season grasses) and rotation partners.
- Include cool- and warm-season grasses and grass/legume mixes on forage labels. This is being done for new registrations, but is not present on existing registrations.
- Expand the registration of chemicals that are effective on important pests and are currently available in some, but not all, forage crops.

Education
- Educate growers about the effects and management of nematodes in cropping systems.
- Communicate IPM information specific to forages via manual or website.
- Educate growers about the benefits of soil sampling for nutrient management.
- Educate growers about the benefits of species and varieties with or without resistance.

Diseases

Several soil-borne fungi are present in the soil at this crop stage. *Pythium*, *Phytophthora*, *Rhizoctonia*, and *Fusarium,* which persist on infected plant debris or as saprophytes on other plant species, cause early wilting and death of young cereal, grass, and legume seedlings pre- or post-emergence. *Sclerotinia trifoliorum* attacks legume stems and crowns in wet, cool springs. *Gaeumannomyces graminis* var. *tritici* is a fungus that lives in the soil or in diseased cereal and grass stubble and straw and causes the devastating disease known as take-all. Damage from take-all, which is favored by moisture, is most severe in irrigated areas and the forage-growing areas west of the Cascade Mountains in Oregon and Washington. Stems of plants infected with take-all become covered with a coal-black fungal growth, which is also present under leaf sheaths. Individual roots also turn black. Infected plants are stunted, mature early, and have white, empty heads or fail to head.

Growers use pre-plant tillage to bury previous crop residue and to reduce soil-borne inoculum of crown and root rot pathogens. The tilling action hastens decomposition of the stubble. Some growers burn crop residues (stubble) toward the same end. Although

pre-plant tillage can aid in disease prevention in the coming year, some growers are finding that use of no-till practices (directed seeding) results in less compaction, thereby reducing disease incidence in the long run.

Nutrient management also impacts disease suppression. Overfertilization, specifically with nitrogen, can increase problems with Sclerotinia diseases. Ammonia forms of nitrogen (ammonium nitrogen) and potassium chloride reduce damage to cereals caused by take-all.

Crop rotation, specifically rotating out of alfalfa for 3–4 years, can reduce problems caused by soil-borne diseases by reducing the concentration of inoculum in the soil. However, some forages stay in the field for 20 to 30 years, so rotation is not always practical. Planting wheat after wheat can increase the likelihood of take-all infection, so growers take care to avoid this particular rotation.

Application of metalaxyl can be made to target seed decay and damping-off diseases in legume and grass forages. Metalaxyl (Allegiance formulations) and mefenoxam (Apron formulations) seed treatments control Pythium and Phytophthora damping-off. Fludioxonil (Maxim) seed treatment controls seed decay and damping-off caused by *Fusarium* and *Rhizoctonia* spp.

Critical Needs for Management of Diseases in Forages at Pre-Plant

Research

- Research the positive and negative effects of tillage (long term no-till versus continual tillage).
- Research the effects of allelopathic chemicals released by rotational crops on diseases and following crops.
- Research viable crop rotations to help manage diseases.
- Research the effects of burning and burning alternatives (e.g., composting, baling) on disease management and economics.
- Research additional burning alternatives.
- Develop disease-resistant varieties of forages.
- Develop economic thresholds for disease control.
- Develop a method to bioassay soil to determine levels of *Phytophthora*, *Pythium*, *Fusarium,* and *Rhizoctonia* to get an idea of how much is in the soil.

Regulatory

- Maintain burning as an option for managing field stubble.
- Communicate between researchers and regulators about pre-plant application of manure. “Phosphate loading” presents a water quality issue, but is being used as a burning alternative.
- Expand the registration of chemicals that are effective on important pests, and are available in some crops, but not in all forage species.

Education
- Communicate IPM information specific to forages via manual or website.
- Educate growers about the benefits of soil sampling for nutrient management.

Insects

Soil-borne insects, including wireworms, cutworms, garden symphylans, slugs, crane flies, and white grubs can be found in forage fields at the pre-plant stage. While they may not cause damage at this crop stage, they are present, and management activities can take place at this time.

Wireworms and cutworms can cause losses in most forage-growing areas of the West, but chemical controls are not targeted at them at this time. Wireworms are generally not numerous enough to cause economic-level problems in forage crops. Grass forages, in particular, will support substantial wireworm populations with no yield reduction. Irrigating a field infested with cutworms will bring these pests to the surface where they can be treated with insecticides. While this technique is not currently practiced by forage growers in the western states, there is some interest in pursuing its feasibility. It is possible that this technique could exacerbate disease problems.

Garden symphylans and slugs can be problematic in western Oregon and Washington forages, while crane flies and white grubs are a concern in this area as well as in Colorado.

Rotation to non-host crops is the predominant control used for insects at this crop stage. Forage growers avoid rotations or forage mixtures with winter wheat on fields with a history of cutworms, since this crop is an early-spring host. White grubs can be controlled in part by deep plowing or perhaps chemically in a prior rotational crop for which a product was labeled. Rotating to other crops known to host problematic soil-borne pests (e.g., potatoes for wireworms, onions for white grubs) is avoided. Tillage is also used to help manage soil-borne insects, such as slugs and – in part – symphylans, as is summer plowing and fallowing until frost. However, the use of cultivation is decreasing in general in response to soil erosion concerns.

Chemical controls that may be used at this crop stage include metaldehyde and iron phosphate baits for slugs. Cyfluthrin (Baythroid) is labeled for grass and legume grass pastures for armyworm and does give semi-adequate crane fly control.

Critical Needs for Management of Insects in Forages at Pre-Plant

Research
- Develop monitoring techniques and control thresholds for soil-borne insects.
- Determine whether irrigation followed by insecticide treatment of cutworms could play a role in insect management in forages without increasing disease incidence.

Regulatory

- Expand the registration of chemicals that are effective on important pests and are currently available in some crops but not all forage species.

Education

- Present information from research in a simple, easy-to-understand format for growers.
- Communicate IPM information specific to forages via manual or website.
- Educate growers about the benefits of soil sampling for nutrient management.

Weeds

Effective weed management requires an understanding of weed biology and knowledge of the field history of weeds where forages are to be planted. Weeds can be annual, perennial, or biennial. Annual weeds can be broken down into summer annuals and winter annuals. It is important to know these delineations because they will determine how each weed is managed. Winter annual weeds germinate in the fall through early spring (October to March). They grow rapidly in the spring and are usually a problem only in the first cutting. Summer annual weeds germinate as temperatures rise in late spring (April to May) through summer. Most weed control measures employed at pre-plant are targeted at perennial weeds.

Several herbicides can be applied pre-plant and incorporated (usually mechanically) into the soil. Herbicide selection depends on the forage crop and the weed spectrum present. EPTC (Eptam) and benefin (Balan) are applied before planting legume forages, then incorporated to control annual and perennial grasses (EPTC) and annual grasses and broadleaves (benefin). All herbicides are used with caution due to potential phytotoxicity to rotational crops and mixtures. For example, EPTC (Eptam) cannot be applied if a grass or grain will be mixed with a legume. Grains cannot be planted in a field that has been treated with benefin (Balan) until at least 10 months after application. Triallate (Far-GO) can be applied pre-plant to wheat and barley, followed by incorporation into the soil. It cannot be used with crops underseeded with legumes. No pre-emergence products are registered for use on grass forages.

Nutrient management helps with weed control. Growers who apply recommended amounts of fertilizer prior to planting give their forage crops a competitive advantage. Conversely, over-applying fertilizer can harm the forage and sometimes gives weeds the advantage.

Crop rotation can be effective for reducing weed populations in forage species, because some weeds are more easily controlled in one crop than in another.

Some growers irrigate their field prior to planting the forage crop in order to germinate weed seeds present in the soil. Once the seeds have germinated, the weeds can be lightly tilled under or killed with a burndown herbicide such as glyphosate (Roundup) or paraquat (Gramoxone). Other cultural controls that growers use for weed control include flaming and intensive grazing prior to planting. Intensive grazing helps with control of annual weeds, including downy brome.

Critical Needs for Management of Weeds in Forages at Pre-Plant

Research
- Research pre-plant herbicides for grasses.
- Identify species/microorganisms that are good candidates for weed biocontrol.
- Investigate the effect of Roundup-ready crops on weed management, weed spectrum, and herbicide resistance.
- Discover pre-plant herbicides that will not harm planted grass seeds.

Regulatory
- Once pre-plant herbicides are identified, expedite their registration on forages.
- Include forages on the labels of new pre-plant herbicides.
- Expand the registration of chemicals that are effective on important weeds and are currently available in some crops but not all forage species.

Education
- Present information from research in a simple, easy-to-understand format for growers.
- Emphasize weed prevention versus weed eradication.
- Emphasize sanitation of equipment.
- Communicate IPM information specific to forages via manual or website.
- Educate growers about the benefits of soil sampling for nutrient management.

Vertebrates

All vertebrate issues are discussed at this stage, though vertebrates are present at all crop stages.

Vertebrate pests vary by region, but generally include: ground squirrels, voles, pocket gophers, rabbits, marmots, prairie dogs, badgers, birds, and ungulates. Vertebrate pests cause direct damage by feeding on crops and indirect damage through their activities, such as burrowing. Burrowing and other vertebrate activities disturb the soil, which can encourage weed invasions and create hazards for field workers, livestock, and equipment.

Ungulates can include livestock, deer, elk, pronghorn antelope, feral hogs and, in Alaska, free-ranging bison and moose. Although livestock are not usually considered pests when they are grazing on the forages as intended, they can become problematic when they feed on the wrong things (e.g., haystacks, immature plants) or when they contaminate a field by introducing pests such as weed seeds.

Birds cause various problems in forage fields. Damage and management options depend on the crop, growing season, bird species, and dynamics of the local bird populations, among other things. There is no one control method that will work for every field. Some examples of the damage caused by birds include eating seedlings, weed seed introduction, and direct consumption of the crop. With alfalfa mixtures, some growers find that planting alfalfa in the fall, as opposed to the spring, allows them to avoid bird

damage to seedlings, because birds are attracted to grain fields in the spring and may incidentally prey on seedling alfalfa as well. However, in some cases, fall planting might increase problems with Canada geese where these are problematic. Fall plantings are very vulnerable, because plants are much more likely to be ripped from the ground when they are seedlings. As migratory geese return in the fall, they can feed voraciously on fresh fall seedlings, and this causes the most extreme goose damage.

Because blackbirds strip heads off cereal grain forages once the grain heads reach the milk stage, growers generally harvest cereal grain forages upon first sighting of blackbirds in a field.

Growers consider a wide range of vertebrate management options. There is no "silver bullet" that deals with all vertebrate pests; therefore, growers must tailor their management strategies to the spectrum of pests present.

Mechanical/physical controls for vertebrate pests include tillage (pre-plant), close mowing or grazing of field borders and ditchbanks for voles, fencing to keep out ungulates and rabbits, suction for prairie dogs (in Colorado), and trapping for a range of pests (though body gripping traps are not a legal option in Washington). For bird control, some growers employ devices that scare or disorient birds. Sometimes, killing deer or other vertebrates may be necessary. In some cases, hazing or depredation permits are required, and growers check with their state wildlife agency before using these tactics. In Oregon, permits for taking game mammals such as deer, elk, or antelope must be garnered from the Oregon Department of Fish and Wildlife. USDA-APHIS Wildlife Services may play a role in implementing the control action, but it is not the permitting agency. USDA-APHIS Wildlife Services damage documentation forms may be required to accompany the forage grower's permit in order for the permit to be issued. This may require a grower to contact the agency, and this is often followed by a site visit by a specialist. In some states, the USDA-APHIS Wildlife Services office maintains depredation permits for migratory birds or has Memoranda of Understanding and Agreements for controlling mammals. Therefore, calling USDA-APHIS Wildlife Services can be good, because in each state a District Supervisor will know if a landowner needs a permit, when it would be needed, and where it would need to come from.

Encouraging predators is another way to manage vertebrates. For example, some growers encourage raptors to nest in their fields by providing perch poles. Raptors eat gophers, squirrels, and other pestiferous rodents. Visual barriers, such as hay bales and cloth fences, provide "blinds" for coyotes and other predatory animals to hide behind.

Some chemical controls are available for vertebrate pests, though regulations vary from state to state. Even chemicals cannot control vertebrates completely. Chemical controls include:

- Propane + oxygen ignited can be applied to burrows.
- Zinc phosphide has been used by growers under a Section 18 emergency exemption to control rodents for the past several years. EPA issued a tolerance on

alfalfa, barley, wheat, and timothy grass in October, 2003 and subsequently approved the registration of a zinc phosphide pellet product called Prozap. USDA-APHIS has developed a zinc-phosphide-impregnated wheat-seed product for use as bait against rodents, which is registered on pastures, alfalfa, and wheat. Zinc phosphide cannot be applied within a 5-mile radius of wildlife preserves, and growers have to bring livestock in from the fields when using a poison bait like zinc phosphide.

- Anti-coagulants such as warfarin (Adios, Moletox, Rodex, Kaput) in the form of baits and blocks weaken the health of target vertebrates.
- Methyl anthranilate (MA), a substance extracted from Concord grapes and marketed under the brand name Rejex-it, acts as a bird detractant. This has not been used extensively in agricultural operations because of the cost (about $100/acre) and the need to re-apply when there has been significant moisture or significant crop growth. However, it is a potential tool in protecting small areas, high value crops, and as part of an integrated bird control plan. There is a new system available that aerosolizes MA into a fog that can be distributed into areas where birds may be in crops. In this use, MA is breathed in by the birds, causing the deterrent effect. This may make MA more cost effective because it does not require as much active ingredient, but it also does not stick to the crop.
- Phosphine or aluminum phosphide gas tablets are efficacious against rodents and other vertebrates.
- Arsenic is employed by some growers.
- Strychnine (WILCO Gopher Getter Ag Bait, 0.5% strychnine alkaloid) is commonly used as a pocket gopher bait for alfalfa and grasses. It must be used below-ground only. This can be done through the use of hand baiting down burrows or through the use of mechanical burrow builders.
- There are a number of other methods used for wildlife damage control in forage crops. USDA-APHIS Wildlife Services works with growers who call them. They can evaluate a particular damage situation and recommend the appropriate methods.

Critical Needs for Management of Vertebrates in Forages (all crop stages)

Research

- Research control methods for rodent pests. More controls are always needed, since no single method works very well.
- Determine whether chewing gum is an effective vertebrate control measure.
- Determine how long zinc phosphide remains active and whether it can harm non-target species.
- Research use of cost-effective iron phosphide/phosphate for voles.
- Quantify economic damage caused by vertebrates.
- Research methods to predict jackrabbit and vole population explosions (because populations are cyclical).
- Research cost-effective exclusion methods or repellents (e.g., wolf excrement) for ungulates.

- Determine whether Concord grape extract is effective for vertebrates in forages, and determine cost effectiveness.

Regulatory

- Allow body-gripping traps for vertebrates in Washington.
- Include vertebrate damage under crop insurance coverage.
- Expand the zinc phosphide label to include grass pastures and other forage crops not already on the label.
- Register higher rate of strychnine.
- Expand the registration of chemicals that are effective on vertebrates and registered for use in some, but not all, forage crops to include all forage species.

Education

- Educate users of poisons about restrictions on re-entry and worker safety.
- Educate growers that there may be a provision for crop insurance in their state for damage caused by wildlife.
- Communicate IPM information specific to forages via manual or website.

PLANTING: LATE SUMMER TO FALL-SEEDED

Whether a field is planted to forages in the fall or in the spring depends upon the species selected and climatic factors such as moisture availability and temperature of the chosen field. Warm-season forage species such as sorghum or lespedeza are planted in the late spring, whereas cool-season forage species such as clover and timothy can be planted in either the fall or the spring. Further, certain species, such as wheat, are planted in the fall, because they need to vernalize, or experience a cold period, in order to mature.

If a field is to be planted in the fall, moisture availability determines whether planting takes place earlier or later in the season. In irrigated areas with a long growing season, forage crops can be seeded in the late summer to fall (usually mid-August), which allows the seedlings to become well established before fall freezes and results in minimum winterkill. When moisture is limited or excessive, early fall plantings are not practical. In some cases, such as with field turnips, planting in the early fall allows for fall pasturing.

Where fall precipitation allows seedbed preparation, later fall seeding, also known as dormant seeding, is typically practiced. Under these moisture-limited conditions, seeds can be planted from the time soil temperature is low enough so that the seed will not germinate until soil moisture conditions will not allow planting. This “fall dormant” seeding can begin as late as mid-November and continue into winter as long as the soil conditions allow. The soil is basically storing the dormant seeds until spring, when the soil warms and signals the seed to germinate. This type of seeding is also advantageous in areas susceptible to spring flooding or peaty areas that remain wet during the summer. This process will allow the seedlings to utilize moisture from winter snow.

Prior to planting, legumes are inoculated with the proper strain of nitrogen-fixing bacteria. There are different strains for alfalfa, sweetclover, cicer milkvetch, true clovers, sainfoin, and trefoil.

Conventional seeding utilizes pre-plant tillage to control weeds and other pests and to provide a smooth, firm seedbed. It also allows the incorporation of lime and fertilizers. Planting is generally accomplished with a drill, which distributes seed uniformly and ensures proper soil coverage. Low-till and no-till planting methods use little or no pre-plant tillage. Forages can be seeded directly into crop debris using specialized planters that displace existing crop residue and cut a furrow in the soil into which the seed is placed. This method is more successful in situations where water is not a limiting factor, i.e., in irrigated areas in the case of fall plantings. Low-till and no-till systems are sometimes chosen for areas that are prone to erosion. These methods usually depend on herbicides to limit the growth of existing vegetation during establishment.

Diseases

Disease management during planting is primarily comprised of cultural controls and seed treatments. Growers start with clean, certified seed, and they keep in mind the field’s history of disease when choosing species and cultivars. Resistant varieties are effective at

managing some diseases, including: leaf blotch, powdery mildew, and root and crown rots. If a field has a history of certain diseases, a grower may choose to plant a forage species that is a non-host to a particularly damaging disease.

In cereal forages, growers delay planting if there is a risk of viral diseases, including wheat streak mosaic, barley yellow dwarf, or high plains disease. Delayed planting reduces the exposure period to insect vectors. Growers may use insecticides on field edges directed at the virus vectors and/or plant a cultivar at the field edges that is resistant to that particular vector.

Several soil-borne fungi cause early wilting and death of young seedlings pre- or post-emergence. These symptoms are most commonly referred to as damping-off, and can be caused by different species of fungi: *Pythium*, *Phytophthora*, *Rhizoctonia*, and *Fusarium* spp. These fungi are most problematic under wet, cool conditions, such as in soils where drainage is poor or during periods of heavy rain or over-irrigation. Damping-off typically occurs during cool, wet conditions in the spring and occurs less often in the fall. The fungi can persist in the soil or on infected plant debris or as saprophytes on other plant species. Control measures include planting at a rate that will compensate for thinning due to seedling diseases and planting at a time of the year when growing conditions favor rapid seedling development. Seed treatments are also commonly used.

Growers planting orchardgrass, perennial ryegrass, and tall fescue take care to plant either endophyte-free varieties or varieties that are infected with non-toxic endophytes. An entophyte is an internal plant fungus (endo = inside + phyte = plant). Most older varieties are infected with endophytes, which makes plants more resistant to environmental stresses and insect feeding, but these plants are detrimental to foraging animals due to the production of alkaloids toxic to cattle, sheep, and other livestock. Newer varieties of tall fescue are available without the endophyte and are safe for animals. Endophytes do not affect the growth or appearance of the grass, and laboratory analysis is required to detect their presence. Additionally, endophytes are exclusively transmitted by seed; thus, once a non-infected stand is established, it can be expected to remain that way. There is also a new endophyte that is not detrimental to livestock.

Proper irrigation management at planting can help reduce damping-off and seedling blights (Pythium, Rhizoctonia, Phytophthora, and Fusarium). Overwatering and conditions that hinder drainage will increase the likelihood of seed diseases.

Nutrient management is also an important disease management strategy (e.g., application of potassium chloride to reduce take-all).

Some fungicide seed treatments are available for forage crops. Fludioxonil (Maxim), mefenoxam (Apron XL) and metalaxyl (Allegiance) are registered for grass and legume forages but are not used extensively because of the expense. If there is not a restriction on the label (like Maxim, whose label requires waiting 30 days after planting), these seed treatments can be used on grass and legume forage for both hay and pasture (grazing). Fludioxonil (Maxim) is a legume and grass forages seed treatment that targets seedling

diseases caused by *Rhizoctonia* and *Fusarium* spp. Mefenoxam (Apron XL) is registered for legumes, cereals, and grass hay. It protects against seedling diseases caused by *Pythium* and *Phytophthora* spp. Metalaxyl (Allegiance) is used in legumes and grass forages to combat seedling diseases caused by *Pythium* and *Phytophthora* spp. Carboxin (Vitavax) is a cereal seed treatment that protects against smuts.

Critical Needs for Management of Diseases in Forages at Planting (Late Summer- to Fall-Seeded)

Research

- Research cost-effective seed treatments for grasses (including efficacy and residue trials).
- Identify and develop resistant varieties.
- Research cost-effective biological controls for disease management.
- Discover a method to bioassay soil to determine levels of *Phytophthora*, *Pythium*, *Fusarium* and *Rhizoctonia* in the soil.
- Determine proper planting time for disease avoidance.
- Develop disease forecasting that is linked to a weather network.

Regulatory

- Expedite registration of new seed treatments for forages.
- Expand the registration of chemicals that are effective on disease, but are not currently available for use on all forage species.

Education

- Develop a user-friendly database on species and variety characteristics.
- Educate growers about irrigation management (i.e., by not overwatering, growers can avoid Pythium; merits of pre-irrigation).
- Communicate IPM information specific to forages via manual or website.

Insects

Insect pests managed at this crop stage in legumes include aphids, mites, wireworms, gray garden slugs, cutworms, grasshoppers, and crane flies. Insect pests managed in cereals include aphids, mites, thrips, wireworms, gray garden slugs, cutworms, cereal leaf beetles, grasshoppers, wheat stem sawflies, and Hessian flies. Insect pests managed in grass forages include mites, wireworms, cutworms, grasshoppers, and crane flies.

Aphids

Clover aphid (*Nearctaphis bakeri*), pea aphid (*Acyrthosiphon pisum*), alfalfa aphid (*Macrosiphum creelii*), blue alfalfa aphid (*A. kondoi*), cowpea aphid (*Aphis craccivora*), and spotted alfalfa aphid (*Therioaphis maculata*) are commonly found on legume plants. Clover aphids are the most serious on red clover. During the vegetative growth stage of the crop, spotted aphids are generally found on the undersides of leaves on the lower portions of the plant, where they feed on mature leaves. Pea aphids concentrate at the newer growing tips in the top portion of the plant. All aphids feed by piercing leaf tissue

and sucking the plant juices. Spotted and cowpea aphids, in particular, secrete large quantities of honeydew from their hindguts, which encourages the growth of black sooty mold on foliage. Blue alfalfa aphids are also copious honeydew producers, but their excretions do not seem to correlate as directly with sooty mold formation.

A complex of aphids infests cereal grain forages: Russian wheat aphid (*Diuraphis noxia*), bird cherry-oat aphid (*Rhopalosiphum padi)*, corn leaf aphid (*R. maidis*), and rose-grass aphid (*Metopolophium dirhodum*). The first two are the most serious, while the latter two seldom reach economic densities by themselves. Russian wheat aphid causes feeding injury by injecting plants with salivary toxins. This injury causes a dramatic striping pattern on the leaves and can be severe enough to eliminate seedling stands. With the exception of the Russian wheat aphid, grain aphids also cause indirect injury to small grains by transmitting disease-causing viruses, especially barley yellow dwarf virus (BYDV). Attempts to reduce incidence of BYDV by controlling established populations of aphids have not been very successful. Thiamethoxam (Cruiser) and imidacloprid (Gaucho) seed treatments are used in wheat and barley to protect against aphids. These treatments also have activity on Hessian fly and wireworms. Aphid control using thiamethoxam and imidacloprid is excellent, but only for the first 30–60 days. Wireworm control is evident with thiamethoxam. Gaucho has indicated some effectiveness, but clothianidin (Poncho 600SC) is a superior product for protection against wireworms, with similar levels of protection as thiamethoxam.

Cultural controls for aphids at the planting stage include planting border strips of resistant varieties (this mainly pertains to cereal grains) and delayed planting to avoid aphid flights. A healthy stand is the best defense against aphid damage.

Cereal Leaf Beetle

Cereal leaf beetles (CLB, *Oulema melanopus)* are the most prevalent and economically damaging insects in small grains. Both adult and larval CLB are pests on small grains, but larval feeding causes more severe damage. Larvae feed on the upper leaves, staying between the veins, which creates a frosted appearance on the leaves. After feeding for 10 to 14 days, the mature larvae crawl down the plant into the soil to pupate. Eggs are laid on the upper leaf surface near the midrib, hatching in 4 to 23 days, depending on temperature. First egg lay by CLB is typically mid-April to early May. Environmental conditions can cause egg mortality and reduction in egg hatch to below economic levels. Growers delay treating for CLB until after egg hatch and population assessment to avoid unnecessary insecticide applications.

Crane Flies

Two species of crane fly, *Tipula paludosa* and *T. oleracea* can be pests of legumes and grasses. Adults fly in late summer and lay eggs that hatch in response to rain or irrigation. In October and November the larvae (grubs) feed underground by day on roots and seedlings and, at times, above ground at night. Grubs feed through winter and mature in April (*T. oleracea*) or May (*T. paludosa*). The main damage caused by this pest is seedling stand loss. Reseeding is currently the only option, since no control measures are registered for crane flies in forages.

Cutworms and Armyworms
Cutworms and armyworms are the larval stage of several species of noctuid moths. Pests of legumes include variegated cutworm *(Peridroma saucia)*, redbacked cutworm (*Euxoa ochrogaster*), army cutworm *(Chorizagrotis auxiliaris)*, and clover cutworm (*Scotogramma trifolii*). Pests of cereals include army cutworm, variegated cutworm, pale western cutworm (*Agrotis orthogonia)*, and various *Euxoa* species. Pests of grasses include black cutworm (*Agrotis ipsilon*) and the army cutworm. Larvae are the damaging stage, with the climbing (army) cutworms feeding above ground at night and other species spending their complete larval cycle below ground. Pale western cutworms clip stems at or below ground level, while army cutworms strip foliage during the growing season. Damage often occurs to young plants in early spring. Army cutworms overwinter as larvae and are known to damage winter wheat and alfalfa in the fall and early spring. Pale western cutworms overwinter in the egg stage and feed later than army cutworms on spring seedling grain crops. Black cutworm is mainly a problem in western Oregon and Washington.

Chlorpyrifos (Lorsban) can be applied at planting to manage cutworms in wheat. It is effective, but it is not labeled for other types of forages. It also has activity on aphids, brown wheat mite, cereal leaf beetle, and grasshoppers.

Grasshoppers
Grasshoppers have been a major concern to farmers and ranchers since the High Plains were first settled. Grasshopper populations are cyclic. High populations may be present for two to four years, followed by several years where populations are low to moderate. Damage occurs most frequently in areas with less than 25 to 30 inches of annual rainfall. In most years, Montana, Idaho, Utah, and eastern Oregon and Washington fall into the high-risk rainfall category.

While over 100 grasshopper species occur in the High Plains, only four grasshopper species—the migratory *(Melanoplus sanguinipes),* differential *(M. differentialis),* two-striped *(M. bivittatus),* and redlegged *(M. femurrubrum)*—cause nearly all the damage to cultivated crops. These grasshopper species prefer habitats with a variety of host plants including both grasses and broadleaf weeds. As a result, they prefer cropland settings where there are undisturbed areas such as roadside ditches, crop borders, abandoned cropland, and overgrazed pastures or rangeland.

Although infestations occur in legumes and grasses, grasshoppers are primarily an economic problem in cereals. Both adults and nymphs damage crops, primarily through defoliation. They feed on foliage, on heads, or on stems just beneath the heads, causing them to drop. Late fall-seeded cereal grains are more vulnerable to injury than later plantings, because the plants emerge while the adult grasshoppers are still actively feeding. The newly emerged grain forage may be so severely damaged by grasshopper feeding that it will not establish or survive the winter. Another time period that may result in increased grasshopper pressure is when a light fall frost kills the foliage on broadleaf weeds, like sunflowers, in areas adjacent to grain forages. Grasshoppers losing this forage

source may move quickly into grain crops, increasing the extent of damage. However, a heavy frost may reduce the numbers of grasshoppers present.

Hessian Fly

The Hessian fly *(Mayetiola destructor)* adult is a delicate, mosquito-like fly with a reddish-brown to dusky black body. Insects overwinter in puparial "flaxseed" stage in stubble, volunteer wheat, and fields seeded before mid-October. Larval feeding at or near the crown stunts plants and reduces yield. The greatest damage is usually to wheat, but barley can also be attacked. Maggots feed by rasping plant tissue and sucking plant juices that ooze from the irritated surface of the stems of wheat and barley. Plant tissues near feeding sites are stunted and abnormal. Leaves may appear thickened, erect, and bluish-green in color. The central stem is often missing. Infested stems usually break over when heads form.

Hessian fly cultural control is entirely preventive: growers depend on host plant resistance in combination with cultural tactics to prevent larval establishment. There are no mechanisms to kill larvae once they have established on plants. Several wheat varieties with resistance to Hessian fly are grown in the Pacific Northwest, but their long-term effectiveness is questionable since all cultivars currently available to wheat producers use the same resistant gene.

Cultural practices include rotation to non-hosts, destruction of green bridge volunteer wheat plants, and delayed seeding to avoid flights of egg-laying adults. Growers seeding crops after mid-October tend to avoid problems with this pest. Fall tillage practices that bury overwintering puparia to a depth of 3 to 4 inches are highly effective in preventing adult emergence the next year, but such intensive tillage is impractical in the dryland production regions where low-till production methods are employed for soil and water conservation. Field stubble burning is less effective than tillage and contributes to increased soil erosion and air quality concerns.

Mites

The brown wheat mite *(Petrobia latens)* spends the summer in the soil as a white egg resistant to hot, dry conditions. In the fall, as temperature and moisture conditions improve, these eggs start to develop and hatch after 10 days of incubation. Females mature in about two weeks. These females lay round, red eggs that give rise to fall (one or two) and spring (two or three) generations. As summer conditions return, a generation of females is produced that lay only the white oversummering egg. Both egg types are placed on soil particles near the base of the wheat plant. Brown wheat mite feeds during the day and spends the night in the soil. Its activity peaks at mid-afternoon on warm, calm days, which is the best time to scout. This mite is not affected by cold temperatures, but populations are quickly reduced by driving rains of ⅓ inch or more. Brown wheat mite is a problem in dryland wheat. Wheat curl mite (*Eriophyes tulipae*) is a tiny, eriophyid mite that feeds on cereal grain forages. It causes the proliferation of florets and distortion of wheat heads. It is a vector of wheat streak mosaic virus. Early-planted fall grains are particularly susceptible. No chemical controls are used for this pest.

Clover mites (*Bryobia praetiosa*) and winter grain mites (*Penthaleus major*) are cool-season mites that are pests of grass pastures. Clover mites are also a pest of clover. They have caused serious damage to pastures of central Oregon. Populations build in October, with most damage to grass pastures observed from late February through May. Affected grass pastures do not green up in the spring. Insecticides with the potential to control these mites are not yet registered on pasture grasses. Hosts include grasses (heavy feeding gives a silvered appearance), clover, dandelion, shepherd's purse, strawberry, and iris.

The only cultural control mechanism employed at planting is to plant border strips of mite-resistant varieties (this mainly pertains to cereal grains) to help manage these pests.

Slugs
Gray garden slugs are problematic on all forage types. In legumes and grasses, they attack the seedling, whereas in cereals they attack the seed (due to the lack of a seed coat) and the seedlings. Slugs can kill new stands, allowing weeds to invade. Metaldehyde or iron phosphate baits are used at planting. Usage of these baits has become more common with the decrease in tillage. Slugs are the number one pest for growers trying to establish grasses, cereals, and legumes in no-till plantings.

Thrips
Barley thrips *(Limothrips denticornis)* are small (1/16-inch long) black, yellowish, or reddish winged or wingless insects. They feed within the upper leaf sheaths of both wheat and barley but damage only barley. Western flower thrips (*Frankliniella occidentalis*) are pests of timothy. Thrips use rasping-sucking mouthparts to break plant tissue and suck plant juices. Feeding in leaf sheaths by nymphs and adults causes white to silvery streaks in the leaf tissue. No specific control measures are employed at planting.

Wheat Stem Sawfly
The wheat stem sawfly *(Cephus cinctus)* is a pest of grain forages. Sawfly larvae feed within the stem after hatching and gradually move down the stem, feeding as they move, for about 30 days. The larvae are cream colored, are ½- to ¾-inch long, and have a broad head. When mature, the larvae move to the area in the stem near the soil line and cut a V-shaped notch around the stem, weakening it at that point. This often causes lodging. The wheat stem sawfly is not a strong flier, usually flying only until it finds the nearest wheat field. Hence, more serious problems tend to occur at the field margins closest to the adult emergence site, which is typically wherever wheat was grown the previous year.

Tillage can be used to reduce wheat stem sawfly larval survival through the winter and spring. The objective of summer and fall tillage is to bring the stubs containing the larvae to the surface so they will be exposed to dry conditions in the late summer and cold through the winter. There are wheat varieties used in Washington, Oregon, and Montana that are resistant to wheat stem sawfly.

Wireworms
Wireworms (*Limonius* spp.) are the larval stage of click beetles whose eggs are laid in the soil during the spring. Most wireworms have a 3- to 4-year life cycle. Wireworms emerge

from the eggs and begin feeding on seeds and underground plant parts after the plants have sprouted. They are early-season, sporadic pests that are difficult to predict. Wireworms destroy seeds and kill seedlings by feeding on the crown and rootlets. They attack all major forage species, though they tend not to be problematic in alfalfa mixtures that are kept free of weedy grasses. While they are present in most forage fields, they generally are not numerous enough to cause economic damage. Grasses, in particular, will support substantial wireworm populations with no yield reduction. Seeding at appropriate rates and depths helps with wireworm management. Planting too deeply will cause the forage seedling to emerge slowly, making it more susceptible to disease and wireworm damage. In Nevada, Montana, and western Oregon, growers increase seeding rates in grasses and cereals to compensate for wireworm damage.

Bifenthrin (Capture) is targeted to have a regional (ID, OR, WA) registration by 2008 for insects in grass forages. It has shown control on armyworms, winter grain mite, and most of the insects with piercing, sucking mouthparts.

Many seed treatment materials are available for on-farm use. These are known as hopper-box or planter-box treatments. Most hopper-box treatments are dry treatments formulated with talc or graphite that adheres the treatment chemical to the seed. Liquid hopper-box treatments are available as a fast-drying formulation. Good seed coverage is required for maximum benefit from any seed treatment formulations.

Critical Needs for Management of Insects in Forages at Planting (Late Summer- to Fall-Seeded)

Research

- Evaluate efficacy of seed treatments used for cereals on grass and legume forages against pests including wireworm, garden symphylan, and aphids.
- Research the use of a “drill grain box” or “pour on hopper-box treatment” (with seed) for the management of wireworm and cutworm.
- Identify in-furrow insecticides for forages with efficacy against wireworm, cutworm, and garden symphylan.
- Identify cereal varieties resistant to Hessian fly, Russian wheat aphid, and wheat curl mite.
- Research the impacts of different planting dates/windows/temperatures on insect population and damage. Planting date research for Hessian fly has occurred for southern states.
- Track resistant biotypes of Hessian fly.
- Research broadcast insecticide for clovers and grasses with efficacy against cutworms and crane flies.
- Research biology and control measures for all mites on grasses.

Regulatory

- Expedite registrations of alternative chemicals for forages.
- Expand the registration of chemicals that are effective on important pests and that are currently available in some but not all forage species.

Education

- Educate growers about planting dates and depths for insect and disease management.
- Communicate IPM information specific to forages via manual or website.

Weeds

Planting certified seed is one of the best ways to prevent weed problems in a field. Even the best-quality seed can contain a very low percentage of weed seeds, so other controls are also used. Certification standards for weed seeds in crops (especially timothy for export) are being strengthened.

A well-prepared seedbed is important for maximizing crop emergence, which in turn makes the crop more competitive against weeds. Light tillage can stimulate the germination of weed seeds and destroy sprouting weed seeds located near the soil surface. Minimum tillage generally results in fewer weeds than conventional tillage. Cultivation kills weeds but also turns up and breaks the dormancy of weed seeds.

Agronomic practices that promote a dense vigorous stand, such as appropriate planting date, fertilization, irrigation, and appropriate harvest time, are a primary component of a successful weed control program.

Annual weeds can be broken down into summer annuals and winter annuals (although this division is not true for weeds in Alaska). It is important to know these delineations, because they will determine when each weed becomes problematic and how each weed is managed. Winter annual weeds germinate in the fall through early spring (October to March). They grow rapidly in the spring and are usually a problem only in the first cutting. Summer annual weeds germinate as temperatures rise in late spring (April to May) through summer.

Growers plant forages when weed populations are low and growing conditions are optimal for the particular forage species. Low temperatures favor the growth of winter annual weeds over warm-season forages. High temperatures favor the growth of summer annual weeds. An intermediate seeding date gives time for additional spring cultivations for weed control and permits the forage crop to become established before the summer annual weeds emerge. In early fall (August and early September), just prior to frosts, numerous summer annual weeds are present; however, most of them will be killed by a frost and are not as difficult to manage. Growers who plant later in the fall will have more problems with winter annual weeds. Therefore, it is important to know the field's history of weed issues before deciding planting dates.

In long-season, irrigated areas, legumes will survive weed competition better when seeded in late summer than when seeded in spring. Winter cereals can be planted until February in some places.

Herbicides used for pre-emergence control of weeds and for burndown of existing weeds in minimum-till situations are discussed in the preceding Pre-Plant section. Imazapic (Plateau) is an herbicide that may be used at planting. A spray boom is mounted to the front of the planting apparatus, and the herbicide is sprayed from the front while seeds are planted from the back. This herbicide can be used in grasses or in legume/grass mixtures, but may cause grass injury. Per a self-imposed restriction by BASF, Plateau cannot be sold directly to growers, pesticide applicators, or agricultural chemical dealers. It is only sold to government agencies and to cooperative weed management areas (CWMA). It is possible for growers to have access to Plateau through agreements with their CWMA, either buying it through the CWMA or having the CWMA apply Plateau for them. Procedures differ by CWMA.

Critical Needs for Management of Weeds in Forages at Planting (Late Summer- to Fall-Seeded)

Research

- Find cost-effective, selective, and efficacious pre-emergence herbicides for forage grasses.
- Find cost-effective herbicides with short residual activity for use against perennial weeds.

Regulatory

- Register cost-effective, selective, and efficacious pre-emergence herbicides for forage grasses.
- Expand the registration of chemicals that are effective on important weeds and are currently available in some, but not all, forage species.

Education

- Educate growers about the appropriate timing of planting. Plant early enough for stand to survive winter, but late enough to avoid weeds.
- Emphasize use of clean seed.
- Communicate IPM information specific to forages via manual or website.

PLANTING: SPRING-SEEDED

Whether a field is planted to forages in the fall or in the spring depends upon the particular forage species being planted and on climatic factors such as moisture availability and temperature. In the West, spring seeding ranges from as early as February to as late as May, depending on geographic location. Timing is determined by the presence of adequate rainfall and temperatures that ensure good germination and successful stand establishment. Very early spring seeding (as soon as the site can be accessed) is practiced in sites where soils are excessively heavy (e.g., clay to clay loam soils), as it helps to reduce soil crusting common in heavier soils. There are some risks associated with planting in early spring, however. Cold soil temperatures may delay seedling emergence, and late frosts can damage young seedlings.

Due to cool temperatures, nutrient uptake by spring-seeded forage plants is slow, which makes the young plants more susceptible to seedling diseases and to competition from weeds.

Unlike fall seeding, spring-seeded forage crops are often seeded with a companion crop, also called a "nurse crop." These crops are generally peas or a cereal crop such as oats, barley, or triticale. The nurse crop establishes quickly, providing ground cover that reduces erosion and weed competition. Although the companion crop competes with forage seedlings for light, moisture, and nutrients, the companion crop can be harvested and provides income during the year the forage crop is establishing. Companion crops are not utilized in areas where a moisture shortage is likely to develop early in the season. An example of effective nurse cropping is the oat and grass mixtures planted in interior Alaska (as well as in other states). The oats provide a number of benefits to the grass forage crop. They help the grass seed flow through the implement-metering device, plus they aid germination of the grass by reducing wind velocities at the soil surface, thereby reducing evaporation and soil erosion. Oats grow rapidly and serve to reduce weed growth. The oat stubble remaining after the season traps snow, which insulates the new grass from the cold winter temperatures and provides soil moisture the following spring. The oats also provide a forage crop in the planting season and thereby generate a return to the producer.

In clear seeding systems, the forage crops are planted without a companion crop, allowing for better establishment and higher yields of the desired forage species. This method is not used in areas with significant slopes since it can increase erosion potential.

Prior to planting, legumes are inoculated with the proper strain of nitrogen-fixing bacteria. There are different strains for alfalfa, sweetclover, cicer milkvetch, true clovers, sainfoin, and trefoil.

Diseases

Many disease issues are the same in spring-seeded crops as in fall-seeded crops. However, there is even more disease pressure in spring due to the colder, wetter soils. These conditions favor some disease pathogens and also contribute to slower forage crop growth, thus increasing the plants' susceptibility to diseases.

As with fall planting, cultural controls in the spring may include use of clean, certified seed; selection of resistant cultivars (where available); selection of species based on a field's disease history; and alteration of planting date for viral disease avoidance.

Because the number of forage species that are planted in the spring is greater than the number of species planted in the fall, there is a greater diversity of disease issues. The seedling diseases caused by *Pythium*, *Fusarium, Rhizoctonia* and *Phytophthora* that are present in fall are also present in spring. As mentioned in the Fall-Seeded Planting section, damping-off is more prevalent in the spring than in the fall. Due to the cold, wet soils in the spring, nutrient deficiencies are more prevalent. These deficiencies, as well as the general environment, predispose forages to greater disease problems with spring seeding. In general, the cultural and chemical controls employed for disease control are the same.

Critical Needs for Management of Diseases in Forages at Planting (Spring-Seeded)

Research

- Same as fall-seeded planting.
- Study impacts of planting date/time based on soil conditions and weather forecast.
- Research fall dormant planting in regions that don't commonly use it, including which species would be best.

Regulatory

- Same as fall-seeded planting.

Education

- Same as fall-seeded planting.
- Extend knowledge about planting date/time.
- Increase grower awareness of dormant seeding and its advantages.

Insects

Many insect issues in spring-seeded forages are similar to those in fall-seeded forages, with a few pest-specific and/or region-specific differences worthy of mention.

Aphids

Management of aphids in spring-seeded forages is similar to fall-seeded forages except that perimeter insecticide sprays are not employed in spring-seeded crops.

Grasshoppers
Grasshoppers impact spring-planted forages somewhat less than fall plantings. Spring wheat and other small grains are most likely to be attacked later in the growing season when other food sources have been depleted and grasshoppers have reached more mobile adult stage. Grasshoppers may seriously damage headed small grains as they clip the heads while feeding. This pest tends not to be a problem in spring except in western Oregon and, on occasion, in southwestern Idaho.

Hessian Fly
In western Oregon and Washington, growers alter planting date of cereal forages to avoid Hessian fly. Early seeding can avoid flight periods of egg-laying adults. Spring wheat seeded behind fall-seeded wheat is especially prone to attack from this pest.

Mites
Management of mites in spring-seeded forages is similar to fall-seeded forages except that perimeter insecticide sprays are not employed in spring-seeded crops. Late-planted spring grains, like early-planted fall grains, are most susceptible to wheat curl mite.

Wheat Stem Sawfly
Growers in Montana, Oregon, and Washington plant cereal varieties with known resistance to wheat stem sawfly when planting in spring.

Wireworms
Wireworms are more of a problem in spring-seeded forages than in fall-seeded forages. The same seed treatments used in fall-seeded cereal grains are used here.

Critical Needs for Management of Insects in Forages at Planting (Spring-Seeded)

Research, Regulatory, Education
- Same as fall-seeded planting section.

Weeds
The weed spectrum is different between spring and fall plantings as well as between early and late spring plantings. Some winter annuals, such as downy brome, kochia, and Russian thistle, are still a problem for forages planted early in the spring. However, planting early allows growers time for one additional tillage operation to control these winter annual weeds. Plantings later in the spring are more likely to be troubled by summer annual weeds.

Cultural practices to manage weeds are the same as in fall-planted forages, with the addition of nurse cropping, a technique far more likely to be used in the spring than in the fall. Nurse cropping is described in greater detail in the introduction to this section. Planting at the correct time is even more critical in spring plantings. Planting too early when the soils are very cool will cause the crop to grow more slowly, allowing weeds to take over.

The stale seedbed technique is used more in spring plantings than in fall ones. A stale seedbed can be created by tilling the soil early, which encourages the weeds to germinate. In most springs, this means tilling the soil by late April, with a good weed flush by mid-May. After the weed cover is established, the emerged weeds are killed without disturbing the soil. This is accomplished by using herbicides like glyphosate (Roundup) or paraquat (Gramoxone). The key is not to disturb the soil, so that fresh weed seeds remain buried.

Direct-seeded systems rely on the use of selective herbicides, since there is no companion crop to help out-compete weeds. Herbicides used for pre-emergence control of weeds and for burndown of existing weeds in minimum-till situations are discussed in the Pre-Plant section.

Critical Needs for Management of Weeds in Forages at Planting (Spring-Seeded)

Research

- Develop selective (i.e., for use on grasses), pre-emergence at-planting herbicide.
- Develop temperature-sensitive seed coatings for dormant planting (when soil heats up, seed would germinate).
- Develop a method to "prime" seed so that it will germinate evenly.
- Research the use of a fertilizer seed coat to "jump-start" germination.

Regulatory

- Expand the registration of chemicals that are effective on important weeds and are currently available in some, but not all, forage species.

Education

- Extend information about soil temperature/planting date and seed germination.
- Emphasize use of clean seed.
- Communicate IPM information specific to forages via manual or website.

VEGETATIVE GROWTH TO ESTABLISHMENT (NEW STANDS)

This section refers to the first-year vegetative growth period, when a new stand is being established. As pest management practices differ in subsequent years, the vegetative growth period in established perennial forage stands is discussed in the following section. Note that Hawaii is unique in that all stands are essentially "established" stands, so many first-year restrictions do not apply.

Diseases

Diseases of forages are caused by a wide array of organisms, including fungi, fungal-like (Chromista) bacteria, nematodes, phytoplasmas, viruses, chytrids, and parasitic plants. Diseases can affect all plant parts, including roots, stems, leaves, and reproductive tissues.

Legume, grass, and cereal forages, including clovers, timothy, orchardgrass, and small grains, suffer from a wide range of root diseases. The predominant diseases are root rots caused by fungi including *Gaeumannomyces* spp., *Rhizoctonia* spp., *Fusarium* spp., and *Sclerotinia* spp. Members of the kingdom Chromista (brown algae group), such as *Pythium* spp., *Phytophthora* spp., and *Aphanomyces* spp., are also responsible for root rot diseases of forages.

Stem diseases of forages reduce yield directly through their effect on the plant and also by promoting lodging of the plant, in which the plant collapses at the stem and is rendered un-harvestable. Stem diseases of forages include stem rots cause by *Sclerotinia* spp., foot rots caused by *Pseudocercosporella* spp. and *Rhizoctonia* spp., and stem canker disease caused by *Septoria* spp.

Fungi and viruses are predominantly responsible for causing diseases of leaves and reproductive tissues in forages. Rust diseases, caused by *Puccinia* spp. and *Uromyces* spp., are prevalent in both forage grasses and legumes. Several different fungi, including *Septoria* spp., *Gloeosporium* spp., and *Helminthosporium* spp., cause leaf spot diseases in a wide range of forage grasses. A diverse range of viruses is known to be responsible for foliar diseases of forages, including alfalfa mosaic virus, clover yellow vein virus, and various other mosaic viruses. Diseases of reproductive tissues in forages can be of particular concern because of acute animal toxicity of mycotoxins produced by certain fungal pathogens. These diseases include ergot caused by *Claviceps* spp., head mold caused by *Fusarium* spp., and smut caused by *Ustilago* spp.

Because forages have a relatively low gross value on an acre-per-year basis, the most effective and popular method for controlling diseases is to cultivate disease-resistant varieties, a decision made in the previous crop stages, Pre-Plant and Planting. During the Vegetative Growth to Establishment crop stage, forage diseases are addressed through irrigation management. Viruses are dealt with by treating for the vectors.

Critical Needs for Management of Diseases in Forages at Vegetative Growth to Establishment Stage in New Stands

Research
- Identify and characterize forage varieties that are disease resistant.
- Characterize pathogen populations.
- Investigate effects of seeding rates on disease development.
- Research the effect of nutrient deficiencies/excesses on disease expression.
- Continue to investigate efficacious and economical fungicides.

Regulatory
- Expand the registration of chemicals that are effective on diseases and are currently available on small grains, but not on other forages.
- Expand the registration of chemicals that are effective on diseases and are currently available in some, but not all, forage species.
- Add grasses to the labels for rust control (some chemicals are registered on wheat, not for orchardgrass).

Education
- Educate growers about diagnosing disease problems as they appear in the field.
- As diseases appear, educate growers about varieties/species they might have chosen to avoid the particular disease.
- Communicate IPM information specific to forages via manual or website.

Insects

During establishment of new stands, growers minimize plant stress, particularly water stress if the stand is under irrigation, and they ensure proper fertility management to encourage a healthy stand.

Insect pests causing damage to legumes at this crop stage include: alfalfa caterpillars, cutworms, armyworms, alfalfa weevils, clover leaf weevils, pea leaf weevils, western flower thrips, and aphids. Thrips and aphids can be managed using carbaryl (Sevin). Currently, the only registered efficacious control for armyworms and cutworms is spinosad (Entrust, Success). Carbaryl does not control armyworm and does not perform according to label statements on medium- to large-sized cutworm larvae. Bifenthrin (Capture), which is not yet registered for forages, has shown efficacy on cutworms in other crops and is suspected to be efficacious in controlling cutworms in forages.

Cereal grain forage pests causing damage at this stage include: aphids, wheat stem sawfly, cereal leaf beetles, caterpillars, mites, and black grass bugs. It is not known whether insecticides are cost effective in mixed forage systems. No thresholds, or very few, are in place; however, insecticides are a cost-effective option for control of cereal leaf beetle, Russian wheat aphids, and cutworms. Russian wheat aphid is managed in cereals with zeta-cypermethrin (Mustang Max), lambda-cyhalothrin (Warrior), lorsban

and the synthetic pyrethroids. Cereal leaf beetle may be managed with various labeled insecticides or biological control agents (predatory wasps). Chemicals used to control cereal leaf beetle include malathion (Malathion), spinosad (Entrust, Success), and, for wheat only, carbaryl (Sevin) and zeta cypermethrin (Mustang). Lambda-cyhalothrin (Warrior) has been used under a Section 18 exemption in Idaho and Montana in recent years to control cereal leaf beetles in barley. USDA-APHIS introduced a biological control program for cereal leaf beetle in which an egg parasite *(Anaphes flavipes)* and several larval parasites (including *Tetrastichus julis)* were introduced into the host environment.

- Adults decreased in number and had a shorter season compared with previous years, making collecting and redistribution more difficult.
- The shortened adult period resulted in a shortened egg period. *Anaphes flavipes* parasitism rates were very low at 5%, a decrease from 2004 and 2005.
- *Tetrastichus julis* achieved high parasitism rates in most places sampled in Oregon. *T. julis* redistribution focused in central Oregon.

Caterpillars may be managed with insecticides if the infestation is sufficiently large and the plants are young. Mites and/or bugs may be chemically managed. Many of the insect pests on cereals may be controlled with the same chemical formulations.

Grass forage pests causing damage at this stage include: aphids, armyworms, cutworms, mites, black grass bugs, billbugs, slugs, crane flies, winter grain mite, clover mite (isolated to central Oregon and parts of Idaho), spider mites, and grass scale. Although some of the same pests are problematic in cereal grain forages, different controls are registered for grasses and cereals. Grass forage insecticide registrations are more limited. Carbaryl (Sevin), malathion, and methyl parathion are labeled, but carbaryl and malathion have limited efficacy, and methyl parathion has worker exposure issues.

Idaho, Nevada, and Washington have a Special Local Needs label (SLN/24[c]) for the use of methidathion (Supracide) in timothy and timothy/alfalfa stands to control grass scale, spider mites, and thrips. However, the results have not been positive. Anecdotal evidence suggests dormant oils may work well against mites in grass forages. University entomologists are currently doing research to test the efficacy. Bifenazate (Acramite) has been available via Section 18 in Nevada and is being pursued in Washington for mite control in timothy. Oregon had a crisis exemption in 2005 for zeta-cypermethrin (Mustang) for winter grain mite control in grass pastures and another for spinosad to control armyworms in grass pastures.

Grasshoppers and Mormon crickets can cause damage to all forage types at this crop stage. Current controls include carbaryl (Sevin) bait for wheat, alfalfa, and grasses; diflubenzuron (Dimilin), which has been used under Section 18 provisions for alfalfa, barley, and wheat; malathion for cereal grains, alfalfa, clover, and grasses; methyl parathion for cereal grains, alfalfa, and grasses; and *Nosema locustae* (grasshopper only). *Nosema locustae* spores (Nolo-Bait, Semaspore) are available in bait form. These are spores of a microsporidian protozoa that infects grasshoppers. Once ingested, the spores germinate in the grasshopper's midgut and the protozoa infect the fat tissue. However,

the use of conventional pesticides in addition to *Nosema* is usually required to control grasshopper outbreaks.

Lambda-cyhalothrin (Warrior) and zeta-cypermethrin (Mustang) are expected to be registered on grass forages in the near future. Mustang is registered on alfalfa, legumes, sorghum, triticale, and wheat. Warrior is registered for alfalfa, sorghum, triticale and wheat. Both are registered for control of Russian wheat aphid, barley thrips, brown wheat mite, cereal leaf beetle, cutworms and armyworms, grasshoppers, and wheat stem sawfly (Mustang only).

The clover root curculio (CRC) *(Sitona hispidula)* is an important weevil affecting alfalfa and clover root systems in the Pacific Northwest, primarily on forage alfalfa and primarily in Idaho. Adult clover root curculio weevils resemble alfalfa weevils. Larvae are white grubs and are normally found in the soil close to alfalfa root systems. Adults become active in the spring and deposit eggs on the soil surface or on the undersides of leaves of host plants. By May or early June, newly hatched larvae move into the soil where they begin to feed on roots.

Damage by this pest is not widespread, but in some areas of severe infestation, significant losses of quality, stand, and yield may occur. Adults feed on foliage, leaving semicircular holes around the leaf margins. This damage can be insignificant on established stands but very injurious to new seedlings. Larval feeding on plant crowns and roots is the most important damage caused by this pest. Larvae feed externally on the roots, causing scoring or girdling. This damage allows the entry of disease pathogens, specifically Phytophthora root rot.

The primary control for CRC is crop rotation to nonsusceptible species. Susceptible species include legumes such as soybeans and lespedeza, and some grasses such as Kentucky bluegrass. A rotation including potatoes or sugarbeets will help eliminate the pest. Adequate fertilizer and soil moisture monitoring are important defenses against this insect. No insecticides are registered for non-alfalfa forage legumes.

Critical Needs for Management of Insects in Forages at Vegetative Growth to Establishment Stage in New Stands

Research

- Develop effective and affordable alternatives to currently available broad-spectrum controls.
- Develop forage varieties that are resistant to emerging pests (e.g., alfalfa weevil).
- Develop lower-risk pesticide alternatives for control of insects on forages.
- Develop thresholds applicable in both pure and mixed forage stands.
- Develop forecasting/modeling using weather stations to aid in prediction and management of pests including weevils and aphids.
- Research effective alfalfa weevil control methods.

Regulatory

- Expedite registration of those controls already identified as efficacious, especially in grasses and grass mixes. (bifenazate and bifenthrin already in pipeline.)
- Expedite cross-registration for legume/grass, legume/cereal mixes.
- On a state-by-state basis, pursue 24(c)s for combined grass/legume labels on products with separate labels for grasses and legumes.
- Approach registrants for combined grass/legume labels at the federal level.
- Expand the registration of chemicals that are effective on important pests and are currently available in some, but not all, forage species.

Education

- Educate growers that clover root curculio can be controlled by rotating grasses into a legume rotation.
- Educate growers about scouting so they can identify insects and insect damage in the field.
- Communicate IPM information specific to forages via manual or website.

Weeds

A forage crop is most vulnerable to weed competition when it is in the seedling stage. Seedlings, especially legumes, grow slowly and do not compete well with weeds.

A well-established, adequately fertilized forage crop is one of the best defenses against encroachment by both annual and perennial weeds. Mowing greatly reduces seed production of annual weeds. Since many annual weeds grow more erect and go to seed much sooner than perennial forages, the forages are less damaged by mowing than are the annual weeds. For best results, growers wait to mow until weeds have produced flower stalks, usually 8 to 10 weeks after seeding. Earlier mowing may damage forage seedlings and may make an additional mowing necessary to prevent seed production by the annual weeds. Grazing is another good way to reduce the weed population in the field, but overgrazing can lead to bare patches in the field, allowing more weeds to germinate.

Sometimes growers prefer to wait and apply post-emergence herbicides rather than pre-plant herbicides, because the post-emergence application allows the grower to evaluate weed pressure, identify weed species, and select the most appropriate herbicide(s). Proper timing is important, because weeds are much easier to control when they are small.

Few chemical controls are available for legumes at this crop stage. Growers check the pesticide label to make sure legume hay is at an appropriate stage or height before applying herbicides and to make sure the weeds present in their fields will be controlled by the herbicide they apply. The herbicides used at this time include:

- 2,4DB (Butyrac, Butoxone). Only controls broadleaved weeds. Certain annual weeds have shown resistance, especially west of the Cascades.

- bromoxynil (Buctril). Only controls broadleaved weeds. Crop damage can occur, especially in high temperatures. Weeds cannot be more than 3 inches tall when application is made.
- imazamox (Raptor). Used when most weeds are between 1 and 3 inches tall or wide. Efficacy is reduced when used on stressed weeds.
- imazethapyr (Pursuit). Less crop injury is expected with imazethapyr than many other herbicides. It is soil active, so will continue to control weeds after application. Controls most broadleaves and suppresses grass weeds. Since cereals are also suppressed, cannot be used when a companion crop is involved. Since it is so persistent, there are rotational crop restrictions. For example, sugarbeets cannot be planted for 40 months after treatment.
- sethoxydim (Poast). Controls actively growing annual or perennial grasses. Works best when grasses are small but before legume canopy covers grass seedlings. Will not control annual bluegrass or any of the fine fescues and is weak on downy brome and quackgrass.
- clethodim (Select). Controls actively growing annual and perennial grasses.

There are post-emergence herbicides that are effective in managing broadleaved weeds in grasses and cereals. However, controlling grass weeds in grass forages is particularly challenging. Timothy is particularly sensitive to broadleaf herbicides. Weeds that are not being controlled well include mallow. Grasses are susceptible to herbicide injury in the seedling stage, so most herbicide labels indicate that the grasses have to have a certain amount of growth before herbicide application. Since these herbicides target broadleaved plants, legumes can be injured or killed by their application. Therefore, these herbicides are not appropriate for grass/legume mixtures.

- 2,4-D amine. Cannot be used on grass forages until they are well established due to injury. Has activity on annual, perennial, and biennial broadleaved weeds. Most effective on weeds when they are small and actively growing. Works best before biennials have put up a stalk. Can also spray perennials in bud stage.
- 2,4-D ester. Cannot be used on grass forages until they are well established due to injury. Has activity on annual, perennial, and biennial broadleaved weeds. Most effective on weeds when they are small and actively growing. Works best before biennials have put up a stalk. Can also spray perennials in bud stage.
- aminopyralid (Milestone). Has activity on broadleaved weeds.
- dicamba (Banvel, Clarity). Cannot be used on grass forages until they are well established due to injury. Controls annual, biennial, and perennial broadleaves. Most effective when weeds are still small and before biennials have put up a stalk. Perennials can also be sprayed in the bud stage.
- dicamba + 2,4-D (Weedmaster, Pasturemaster). Cannot be used on grass forages until they are well established due to injury. Has activity on annual, perennial, and biennial broadleaved weeds. Most effective on weeds when small and actively growing. Works best before biennials have put up a stalk. Can also spray perennials in bud stage.
- clopyralid (Stinger, Transline). Cannot be used on grass forages until they are well established due to injury. Has activity on annual, perennial, and biennial broadleaved weeds. Most effective on weeds when small and actively growing.

Works best before biennials have put up a stalk. Can also spray perennials in bud stage. Rotational restrictions exist for alfalfa and other crops.

- MCPA (Clean Crop). Cannot be used on grass forages until they are well established due to injury. Has activity on annual and perennial broadleaved weeds. Most effective on annuals when they are small and actively growing. Most effective on perennials in early bud to full bloom. Can be reapplied to perennials during regrowth in the fall.
- triasulfuron (Amber). Likely to injure orchardgrass, red fescue, and ryegrasses. Has the potential for resistance development. Has activity on some broadleaves and grasses, but a tank mix is recommended.
- triasulfuron + dicamba (Rave). Likely to injure orchardgrass, red fescue, and ryegrasses. Has the potential for resistance development.
- triclopyr + 2,4-D (Crossbow). Cannot be used on grass forages until they are well established due to injury. Has activity on annual, perennial, and biennial broadleaved weeds. Most effective on weeds when small and actively growing. Works best before biennials have put up a stalk. Can also spray perennials in bud stage. Cannot be applied to forages that are to be cut or sold for commercial purposes.
- triclopyr + clopyralid (Redeem). Cannot be used on grass forages until they are well established due to injury. Has activity on annual, perennial, and biennial broadleaved weeds. Most effective on weeds when small and actively growing. Works best before biennials have put up a stalk. Can also spray perennials in bud stage. Can injure or kill legumes, so is not appropriate for mixtures.
- Clopyralid + 2,4-D (Curtail). Registered on cereals. Cannot be used on grass forages until they are well established due to injury. Has activity on annual, perennial, and biennial broadleaved weeds. Most effective on weeds when small and actively growing. Works best before biennials have put up a stalk (bolted). Can also spray perennials in bud stage. Controls broadleaf weeds. The clopyralid portion has some long rotational restrictions.
- Metsulfuron (Cimarron). Registered on cereals and grasses as a foliar treatment. Can cause some yellowing or stunting on timothy and fescue, especially when applied while these crops are less than 6 inches high.
- Picloram (Tordon). Registered on cereals and grasses. Do not plant wheat, barley, oats, grasses, or field corn within 30 days of application. Has a long soil persistence, and rotational restrictions exist for many crops, including sugarbeets, beans, lentils, peas, potatoes, and broadleaved seed crops. This treatment is likely to harm the subsequent grain crop yield in treated areas for one or more years.

Critical Needs for Management of Weeds in Forages at Vegetative Growth to Establishment Stage in New Stands

Research

- Develop control measures for forage mixtures, especially grass/legume.
- Develop control measures for annual and perennial grass weeds in both annual and perennial grass forages.
- Investigate herbicide-resistant forage crops.

Regulatory

- Expand bromoxynil (Buctril) label to include forage grasses (currently available on turfgrass).
- Register imazapic (Plateau) for more forages.
- Expand the registration of chemicals that are effective on important weeds and are currently available in some, but not all, forage species.

Education

- Educate growers about the importance of herbicide application timing.
- Educate growers about the proper timing of mowing and/or grazing—earlier can be better.
- Communicate IPM information specific to forages via manual or website.

VEGETATIVE GROWTH (ESTABLISHED STANDS)

Generally speaking, most first-year control techniques can also be employed in established stands. However, there are more chemical control options for established stands, and higher rates of existing chemical controls are available once the forage crop is well established. More intensive grazing, as well as other mechanical harvesting and tillage operations, become an option after the first year. As with first-year stands, mowing/grazing/harvesting an established crop stand too early (when it is too short) can compromise stand vigor.

In addition to the disease, insect, and weed problems described in the following sections as being more prevalent in established stands, rodents become a greater problem in stands that are established.

Growers sometimes seed grasses into established legumes and vice versa. Growers have the ability to manage in favor of the preferred (most valuable) species in a forage mixture.

Note, once again, that Hawaii is unique in that all stands are essentially "established" stands.

Diseases

The majority of forages are cultivated as perennial crops, and over the course of several years, plants can suffer disease complexes resulting from infection by multiple pathogens. These disease complexes significantly reduce yield, profitability, and persistence of forage stands.

Crown rots are more prevalent in established stands. Barley yellow dwarf virus (vectored by bird cherry-oat aphid, green bug aphid, corn leaf aphid, and English grain aphid) is more prevalent in established stands but causes the greatest economic damage when infection occurs at the seedling stage of grasses. Some regions report increased disease incidence in established crops that appears to be linked to micronutrient deficiencies, but this is actually not increased disease incidence but rather greater symptom expression. To ameliorate symptoms of Barley Yellow Dwarf, balanced fertility is provided for forage grasses and drought stress is avoided. This reduces stress on affected grass plants.

Critical Needs for Management of Diseases in Forages at Vegetative Growth Stage in Established Stands

Research

- Develop decision-making criteria for longevity of stands—when does it make economic sense to remove an established stand?
- Characterize pathogen populations.
- Research the effect of nutrient deficiencies/excesses on disease expression.
- Continue to investigate efficacious and economical fungicides.

Regulatory
- Expand the registration of chemicals that are effective on important disease pests and are currently available on small grains, but not other forages.
- Expand the registration of chemicals that are effective on important pests and are currently available in some, but not all, forage species.
- Add additional grasses to the labels for rust control in grasses (some chemicals are registered for wheat but not for orchardgrass).

Education
- Educate growers about the importance of monitoring/diagnosing diseases.
- Communicate decision-making criteria on how to determine when to remove an established stand.
- Educate growers about accurate disease diagnosis and diagnosing disease problems as they appear in the field.
- As diseases appear, educate growers about varieties/species they might have chosen to avoid the particular disease.

Insects

Various ants become a greater issue in established stands. Grazing during this crop stage can aid in management of yellow sugar cane aphid, black grass bug, and alfalfa weevil. Light surface tillage in spring can aid in alfalfa weevil management. Burning has impacts on insect and mite populations.

Critical Needs for Management of Insects in Forages at Vegetative Growth Stage in Established Stands

Research
- Identify beneficial insects and potential biocontrol agents. Demonstrate effective conservation biocontrol.
- Determine impacts of burning on pest insect complex.
- Research effective alfalfa weevil control methods and compare efficacy of those control measures.
- Research efficacy of various controls on various mites.
- Evaluate cultivars for insect resistance.
- Find alternative(s) for dimethoate and disulfoton (Di-Syston).
- Develop effective and affordable alternatives to currently available broad-spectrum controls.
- Develop forage varieties that are resistant to emerging pests (e.g., alfalfa weevil).
- Develop lower-risk pesticide alternatives for control of insects on forages.
- Develop thresholds applicable in both pure and mixed forage stands.
- Develop forecasting/modeling using weather stations to aid in prediction and management of pests including weevils and aphids.

Regulatory

- Shorten allowable interval between insecticide application and grazing/harvest.
- Once alternative(s) for dimethoate and disulfoton (Di-Syston) are found and proven, expedite registration.
- Expand the registration of chemicals that are effective on important insect pests and are currently available in some, but not all, forage species.
- Expedite registration of those controls already identified as efficacious, especially in grasses and grass mixes. (bifenazate and bifenthrin already in pipeline.)
- Expedite cross-registration for legume/grass, legume/cereal mixes.
- On a state-by-state basis, pursue 24(c)s for combined grass/legume labels on products with separate labels for grasses and legumes.
- Approach registrants for combined grass/legume labels at the federal level.

Education

- Help growers understand importance of conserving beneficials for biocontrol and of knowing which beneficials are predators/parasites to which pests.
- Continue education on scouting, life cycle, and identification of various pest and beneficial insects and mites.
- Communicate IPM information specific to forages via manual or website.
- Remind regulators of the importance of parasitoids for cereal leaf beetles and of maintaining funding for rearing them.
- Educate growers that clover root curculio can be controlled by rotating grasses into a legume rotation.

Weeds

Cultural weed control measures at this stage include activities that disturb the weeds, such as selective grazing, cultivation, mowing, or burning. Growers may turn livestock onto specific areas of the field during the vegetative growth period to graze and/or rotate them between areas to prevent overgrazing. Fields can be lightly cultivated in spring to aid in weed suppression, but if legumes are present this must be done delicately to avoid crown injury and subsequent introduction of diseases. Mowing can forestall weed seed production and level out the crop, which can enhance vigor of the stand. Burning can help control weeds, especially woody species.

Biological control of tansy ragwort has been relatively successful in the Pacific Northwest using three biological agents. The insects introduced are the cinnabar moth (*Tyria jacobaeae*), ragwort flea beetle (*Longitarsus jacobaeae*), and ragwort seed-head fly (*Botanophila seneciella*). The level of tansy ragwort suppression has been highest when biological control agents were complemented with competitive vegetation. The cinnabar moth larvae defoliate the bolting plant, often preventing flowering. Cinnabar moths work best in large, dense stands at lower elevations. Ragwort flea beetles probably are the most important agent in reducing stand density. Both the larvae and the adults attack the plant. The larvae feed on the roots and the adults chew on the leaves. However, the flea beetle works best in coastal areas. The ragwort seed-head fly females lay eggs on

the developing tansy ragwort flower buds, and the larvae hatch and bore into the involucre (bracts around the flower), feeding on the developing seeds and receptacle tissues. By itself, the seed-head fly is not an effective agent, as it generally attacks only the buds produced early in the season. This insect appears to be better adapted to inland sites where the cinnabar moth and flea beetle are unable to establish.

In their second and subsequent years, perennial forage grasses can be treated with herbicides at higher rates—rates sufficient to suppress noxious weeds, if they are present. The bromes, fescues, and wheatgrasses are more tolerant of many of these treatments than bluegrasses or orchardgrasses. Herbicide use at this crop stage can include the following:

- metribuzin (Sencor). A soil-active herbicide that is registered for use on some legumes and some grasses. Can also be used in perennial grass forages mixed with alfalfa or sainfoin, but some injury to the forage grass can be expected. It has activity on annual weeds (grasses and broadleaves).
- triasulfuron (Amber). Can be applied to grass hay. Likely to injure orchardgrass, red fescue, and ryegrasses. Has the potential for resistance development. Has activity on some broadleaves and grasses, but a tank mix is recommended.
- triasulfuron + dicamba (Rave). Can be applied to grass hay. Likely to injure orchardgrass, red fescue, and ryegrasses. Has the potential for resistance development.
- Dicamba (Banvel, Clarity). Cannot be used on grass forages until they are well established due to injury. Controls annual, biennial, and perennial broadleaves. Most effective when weeds are still small and before biennials have put up a stalk. Perennials can also be sprayed in the bud stage.

Critical Needs for Management of Weeds in Forages at Vegetative Growth Stage in Established Stands

Research
- Further investigate selective grazing to manage specific weeds.
- Develop control measures for forage mixtures, especially grass/legume.
- Develop control measures for annual and perennial grass weeds in both annual and perennial grass forages.
- Investigate herbicide-resistant forage crops.

Regulatory
- Expand the registration of chemicals that are effective on important weed pests and are currently available in some, but not all, forage species.
- Expand bromoxynil (Buctril) label to include forage grasses (currently available on turfgrass).
- Register imazapic (Plateau) for more forages.

Education

- Educate growers about impacts of soil compaction from machinery, livestock, and recreational equipment.
- Educate growers about the importance of herbicide resistance management, particularly as more herbicide-tolerant varieties become available.
- Emphasize stand health with respect to fertility and when using grazing management.
- Emphasize continued weed management and economic impacts of weeds in the stand.
- Communicate IPM information specific to forages via manual or website.
- Educate growers about the importance of herbicide application timing.
- Educate growers about the proper timing of mowing and/or grazing—earlier can be better.

HARVEST/MARKETING

Harvest in a forage system can either mean cutting the vegetative growth and baling it for hay or it can mean grazing by animals. Generally, the first crop of a newly established pasture is harvested for hay rather than grazed. This allows the plants to become well established before they are trampled and pulled by livestock. Spring-seeded pastures under irrigation may be grazed in late summer or early fall if the stand is vigorous and dense. Dry, non-irrigated pasture is not usually grazed in the seeding year. It may take 2–3 years for root systems to develop adequately to anchor the plant.

Grazing management is very important to the longevity of the stand. Overgrazing will lead to many pest issues due to bare spots in the field and other impacts resulting from overused stands. Vigorous stands are more resistant to insect and disease infestations. Growers favor rotational grazing over continuous grazing. This involves subdividing pastures and allowing animals to graze a relatively small area uniformly, then moving them to another part of the pasture. Since rotational grazing limits the amount of time animals are in a particular area of the pasture, it increases the productivity of most forage species, provides high-quality plants for grazing, and allows forage species susceptible to overgrazing to remain in the pasture stand.

Plant maturity is the single most important factor affecting forage yield and quality. Quality decreases as plants mature. Harvesting for high quality hay, therefore, requires frequent cutting in a multi-cut species, or cutting prior to seed fill in a single-cut species.

Growers avoid mowing or grazing forages too short, which causes the plants to be more stressed and thus more susceptible to diseases and insects.

Management of all pests at harvest is aided by the following cultural practices:

- avoid cutting forages too short
- harvest youngest field first
- remove windrows and bales quickly
- irrigate quickly after harvest
- time final harvest to allow crop to replace or preserve plant energy
- avoid transporting pests into, out of, and around the field
- sanitize equipment

There are several factors that will affect a grower's decision to cut a forage stand for hay, including desired hay quality, anticipated length of the growing season, and the hay market. The purpose of producing high-quality hay is to take greatest advantage of the plant's nutrient potential as a livestock feed. Therefore, hay intended for use as a maintenance feed for beef cows or for "hobby" horses can be of much lower quality than that sold to dairies. Therefore, the growth stage at which hay is cut reflects the intended use for the hay and the price being offered for that intended use.

Diseases

When possible, growers harvest when the field is dry to minimize compaction and crown damage. Ergot, caused by the fungus, *Claviceps purpurea*, attacks barley, oats, rye, triticale, wheat, and numerous grasses. About 400 species of grass are hosts to ergot, including perennial ryegrass and tall fescue. Sclerotia formed on the heads drop to the ground or are mixed with seed used for planting. Infections frequently spread from wild grasses into cultivated cereals or grasses. Losses can be severe if livestock eat sclerotia in grain. Ergot is favored by wet, cool weather.

Smuts can be a problem in oats at this stage if a seed treatment was not used at planting.

Rusts on forage grasses can also be problematic. It affects the marketability of the hay, because it can cause the hay to be "dusty."

Insects

Timing of mechanical harvest may be informed in part by insect pest pressure. Crop damage from alfalfa weevil, aphids, cereal leaf beetle, and wheat curl mite may prompt a grower to harvest earlier, before damage devalues the crop, while high populations of Mormon cricket may delay harvest because these insects contaminate the crop.

Growers may also select the height at which they cut the crop in part because of pest presence. Leaving a longer stubble height when harvesting can provide a habitat for carryover of alfalfa weevil after first cutting in alfalfa/grass mixed stands.

Some "post cutter bar" insecticide applications are made for alfalfa weevil control. This involves the attachment of a spray bar mounted on the mower/swather, behind and under the cutter bar, so that an insecticide can be sprayed on the stubble underneath the cut windrow. The same insecticides and rates are used as in pre-harvest applications. Any insect that is controlled with these insecticides will also be controlled at this time if susceptible at this stage of maturity.

Blister beetles (*Epicauta* spp.) can cause problems at this crop stage. They are large, gray to black, elongate beetles that feed on foliage in late spring to summer. Actual feeding by these beetles causes little to no injury to the crop. The beetles have cantharidin in their bodies, which causes cantharidiasis, or blister beetle poisoning, when livestock eat hay that contain the beetles. These beetles are tough to manage.

Weeds

When harvesting fields that have weed patches, growers may mow around the patches to avoid contaminating harvest with weeds. Grazing animals are isolated (usually by fencing off) from weed patches to avoid weed seed movement. Equipment and livestock sanitation is important to avoid spreading weed seeds.

Critical Needs for Management of Diseases, Insects, and Weeds in Forages at Harvest/Marketing

Research

- Develop treatment thresholds based on quality.
- Research optimum cutting height and timing for mechanical harvest with respect to health of future stand.

Regulatory

- Support harmonization of international standards so that export markets are more accessible.
- Remove quarantine on shipping grass hay to Canada.

Education

- Impart better understanding of various standards systems.
- Understand how timing and height of cutting impact quality of subsequent stand.
- Educate growers who plan to export about regulations (e.g., quarantines, tolerances) in export markets. "Know Your Buyer."
- Educate growers about identity preservation in harvested forages.
- Establish and participate in voluntary noxious-weed-seed-free certification program.
- Communicate IPM information specific to forages via manual or website.

DORMANCY

There is a period of winter dormancy initiated by cooler temperatures and shorter days after the crop has been harvested for the last time of the season. Note that Hawaii is an exception in that this state does not have dormancy. There is a slow period, but it is not totally dormant.

Fertilization with phosphorous and potassium takes place in the fall as indicated by soil analysis. This is not done in Alaska. If free lime (i.e., calcium carbonate) levels are high, growers add sulfur and phosphorous. The above practices are not universal. Economics plays a role in the decision to fertilize in late winter/early spring versus in the fall. Some growers chose to wait until late winter/early spring to fertilize to put off the expense.

Growers evaluate stand health to determine if stand needs to be taken out.

Diseases

Grazing is delayed until after frost to prevent crown rot.

Insects

In some areas of Washington and Oregon, growers spray for aphid control on the regrowth after the last cut. This pertains to all types of forages, including mixes.

At the time of publication, growers were hoping that Mustang Max would be labeled in time to spray for mites. They were currently using cyfluthrin (Baythroid), a chemistry newly registered for alfalfa, sorghum, and wheat. Previously, forage growers had nothing to spray for mites this time of the year.

Cultural techniques employed toward the end of the dormancy period may include grazing or burning. Early spring grazing before dormancy breaks may reduce damage by weevils. Early spring burning just before dormancy breaks is an effective tool for managing winter grain mite in grass pastures.

Weeds

Herbicide applications are made during dormancy for perennial and biennial weed control. Annual weeds are not targeted, because they can be killed by frost. Perennial weeds can be treated with metribuzin (Sencor) in alfalfa/grass or sainfoin/grass mixtures. Some growers target biennial weeds in grass forages with a fall dormancy application of 2,4-D or dicamba. Glyphosate (Roundup) can also be used during dormancy, either as a spot or broadcast spray. This is done after a light frost, but when the weeds still have some growth on them.

In some areas, growers also have the option of burning weeds in the field before dormancy breaks.

Critical Needs for Management of Diseases, Insects, and Weeds in Forages at Dormancy

Research

- Research alternatives to burning for control of insects, diseases, and weeds.
- Research alternatives to chemicals for control of insects, diseases, and weeds.
- Develop new chemistries for dormant control of weeds in grasses.
- Provide research documenting advantages and disadvantages (both economically and biologically) to burning in legume and grass pastures.
- Conduct research on cereal forage yields. Most variety trials with yield information have been conducted on cereals planted for grain.
- Continue development of winter hardiness and dormancy ratings of forage cultivars.

Regulatory

- Expedite the registration of zeta-cypermethrin (Mustang Max) for control of mites at dormancy.
- Evaluate the status of GMO forages.

Education

- Educate the public about the advantages and disadvantages of burning for disease, weed, and insect control.
- Educate growers about the legal and responsible use of pesticides (read and follow the EPA label).
- Educate growers about the benefits of soil sampling for nutrient management.

TAKE-OUT/STAND REMOVAL

Nematode, insect, disease, and rodent damage are among the driving forces for removing a forage stand. The bottom line is that if yields decline sufficiently, if market prices do not provide worthwhile returns, or if crop quality is damaged from pests or other forces, a grower will decide to remove a stand.

Stand removal may be influenced by the pest or pests infesting the crop. That in turn may determine rotational crops (because of chemical use and rotational restrictions). Stand removal can be accomplished by cultivation, herbicides, herbicides and tillage, pre-harvest herbicide application, or post-harvest herbicide application. Glyphosate (Roundup) is not available for pre-harvest (perennial grass) applications and would not work on Roundup-ready alfalfa/grass mixes (old stands).

Crop stubble height and density is determined by subsequent crop.

Critical Needs for Management of Nematodes, Diseases, Insects, and Weeds in Forages at Take-Out/Stand Removal

Research

- Conduct research that will help growers evaluate stands and make stand removal decisions. For example, provide economic threshold levels for pest damage and stand health for stand removal.
- Research the use of glyphosate (Roundup) pre-harvest for perennial grass stand removal.
- Continue to investigate non-chemical stand removal options.

Regulatory

- Expand and increase rates on glyphosate (Roundup) label to include pre-harvest application on all forages (i.e., not just alfalfa).
- Check local and state regulations for burning permits.
- Expand the registration of chemicals that are effective on important pests and are currently available in some but not all forage species.

Education

- Continue education of growers to help them determine the general health of their field (see research need about stand removal decisions).
- Bring research to the growers.

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Activity Table for Forages in Alaska

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting					XXX	XXX	XXX	XXX				
Fertilizer application					XXX		XXX					
Cultivation					XXX	XXX	XXX	XXX				
Irrigation					XXX	XXX	XXX	XXX				
Harvest/Cutting						XXX	XXX	XXX	XXX			
Grazing					XXX	XXX	XXX	XXX	XXX			
Take-out/Stand removal					XXX	XXX	XXX	XXX				

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.												
Herbicide app.					XXX	XXX	XXX	XXX	XXX			
Fungicide app.												
Vertebrate controls								XXX	XXX	XXX		
Soil and water analysis					XXX	XXX	XXX		XXX			
Soil sampling for nematodes					XXX				XXX			
Weed surveys					XXX	XXX	XXX	XXX	XXX			
Monitor for wireworms												
Keep weather records					XXX	XXX	XXX	XXX	XXX			
Petiole nutrient analysis						XXX						
Keep water budget					XXX	XXX	XXX	XXX	XXX			
Monitor soil moisture					XXX	XXX	XXX	XXX	XXX			
Monitor soil temperature					XXX	XXX	XXX	XXX	XXX			
Monitor weed emergence					XXX	XXX	XXX	XXX				
Monitor canopy moisture, temperature, and humidity					XXX	XXX	XXX	XXX	XXX			

Seasonal Pest Occurrence													
Nematodes[1]													
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Damping off (Grasses & Legumes)	Present#				XXX	XXX							
	Treated*												
Leaf blotch (Grasses & Legumes)	Present					XXX	XXX						
	Treated												
Leaf rust (Grasses)	Present								XXX				
	Treated												

Activity Table for Forages in Alaska (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Leaf spot (Grasses & Legumes)	Present					XXX	XXX						
	Treated												
Powdery mildew	Present								XXX				
	Treated												
Silvertop	Present							XXX	XXX				
	Treated												
Snow molds (Grasses)	Present				XXX	XXX							
	Treated												
Stem rust (Grasses)	Present								XXX				
	Treated												
Leaf stripe rust (Grasses)	Present								XXX				
	Treated												
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid spp.	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Black grass bug (Grasses)	Present						XXX	XXX	XXX				
	Treated												
Blister beetles (Grasses)	Present						XXX	XXX					
	Treated												
Capsus bugs	Present						XXX	XXX	XXX				
	Treated												
Cutworms (All Forage Types)	Present					XXX	XXX						
	Treated												
Grasshoppers	Present						XXX	XXX	XXX	XXX			
	Treated							XXX	XXX				
Winter grain mites (Cereals)	Present							XXX	XXX				
	Treated												
Wireworms (All Forage Types)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Perennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Common tansy	Present					XXX	XXX	XXX	XXX	XXX			
	Treated						XXX		XXX	XXX			
Cow parsnip	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX		XXX				
Dandelion	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Fireweed	Present					XXX	XXX	XXX	XXX	XXX			
	Treated						XXX						

Activity Table for Forages in Alaska (continued)

Perennial Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Foxtail barley	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX		XXX		XXX			
Hemp nettle	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Horsetail	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX					
Perennial sowthistle	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Plantago spp.	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						
Sheep sorrel	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						
Tall larkspur	Present						XXX	XXX	XXX				
	Treated						XXX						
Toadflax	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX				
Wild rose	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX		XXX	XXX			
Yarrow	Present					XXX	XXX	XXX	XX	XXX			
	Treated					XXX	XXX						
Orange hawkweed	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX		XXX			
Yellow hawkweed	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX		XXX			
Annual Weeds[2]		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual bluegrass	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Chickweed	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Common lambsquarters	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX				
Corn spurry	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Knotweeds	Present					XXX	XXX	XXX	XXX	XX			
	Treated					XXX	XXX						
Mustards	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX				XXX			
Narrowleaf hawksbeard	Present					XXX	XXX	XXX	XXX	XXX			
	Treated						XXX	XXX	XXX	XXX			
Pineappleweed	Present					XXX	XXX	XXX	XXX	XX			
	Treated					XXX	XXX						

Activity Table for Forages in Alaska (continued)

Annual Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Wild buckwheat	Present					XXX	XXX	XXX	XXX	XX			
	Treated						XXX	XXX					
Wild oats	Present					XXX	XXX	XXX	XXX	XXX			
	Treated						XXX						
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present				XXX	XXX			XXX	XXX	XXX		
	Treated									XXX	XXX		
Bison	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated									XXX	XXX		
Grizzly bears	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Other birds	Present				XXX	XXX				XXX	XXX		
	Treated												
Ungulates	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated									XXX			
Voles	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

[1] Nematodes are not considered to be a pest in this region. They do not survive the winter, so populations do not expand rapidly enough.

[2] Annual weeds in Alaska are not divided into 'Winter Annuals' and 'Summer Annuals,' because the winters are so harsh that annual weeds do not survive over the winter.

Activity Table for Forages in Hawaii

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting (Research)			XXX	XXX								
Fertilizer application (Research)									XXX	XXX		
Irrigation					XXX	XXX	XXX	XXX	XXX			
Grazing	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Take-out/Stand removal												

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.*	XXX				XXX	XXX	XXX				XXX	XXX
Herbicide app.			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Weed surveys	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Keep weather records	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Monitor weed emergence	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Monitor temperature and humidity	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Mowing for weeds	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Seasonal Pest Occurrence													
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Rusts (Grasses)	Present#	XXX	XXX									XXX	XXX
	Treated**												
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
New Possible Pest: Stinging nettle caterpillar	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Sod webworm	Present			XXX	XXX	XXX							
	Treated												
Yellow sugarcane aphid	Present	XXX				XXX	XXX	XXX				XXX	XXX
	Treated	XXX				XXX	XXX	XXX				XXX	XXX
Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Apple of Sodom	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Christmas berry (Bio)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Downy rosemyrtle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	

Activity Table for Forages in Hawaii (continued)

Weeds (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Faya tree (Bio)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Fountain grass	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Gorge (Bio)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Guava	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Koster's curse	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Lantana (Bio)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Madagascar fireweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Sourbush	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Tufted beard grass (Mow)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Yellow Himalayan raspberry	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	

* Spot treatment to control Yellow Sugarcane Aphid.

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

Activity Table for Forages West of the Cascades (OR, WA)

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting			XXX	XXX	XXX	XXX			XXX	XXX	XXX	
Fertilizer application	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	
Cultivation			XXX	XXX	XXX	XXX		XXX	XXX	XXX		
Irrigation				XXX	XXX	XXX	XXX	XXX	XXX			
Harvest/Cutting					XXX	XXX	XXX	XXX	XXX			
Grazing	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Take-out/Stand removal				XXX	XXX				XXX	XXX	XXX	

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Herbicide app.	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Fungicide app.												
Vertebrate controls			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Soil and water analysis		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Soil sampling for symphylans and slugs	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
Weed surveys												
Monitor for wireworms				XXX	XXX	XXX	XXX		XXX	XXX	XXX	
Keep weather records	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Petiole nutrient analysis					XXX	XXX						
Keep water budget												
Monitor soil moisture					XXX	XXX	XXX	XXX	XXX			
Monitor soil temperature	XXX	XXX										
Monitor weed emergence		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor canopy moisture, temperature, and humidity												
Monitor temperature and humidity	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Seasonal Pest Occurrence													
Nematodes[1]													
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Crown rots (Legumes)	Present#					XXX	XXX	XXX	XXX				
	Treated*												
Damping off (Grasses and Legumes)	Present				XXX	XXX				XXX	XXX	XXX	
	Treated												
Ergot (Grasses)	Present						XXX						
	Treated												

Activity Table for Forages West of the Cascades (OR, WA) (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Head smut (Grasses)	Present					XXX	XXX						
	Treated												
Kernel smut (Grasses)	Present						XXX	XXX					
	Treated												
Leaf blotch (Grasses and Legumes)	Present					XXX	XXX	XXX	XXX				
	Treated												
Leaf rust (Grasses)	Present					XXX	XXX						
	Treated												
Leaf spot (Grasses and Legumes)	Present					XXX	XXX	XXX	XXX				
	Treated												
Leaf stripe (Grasses and Legumes)	Present												
	Treated												
Root rots (Legumes)	Present				XXX	XXX	XXX			XXX	XXX	XXX	
	Treated												
Sclerotinia wilt and crown rot (Legumes)	Present				XXX	XXX	XXX						
	Treated												
Seedling blights (Grasses and Legumes)	Present				XXX	XXX	XXX			XXX	XXX	XXX	
	Treated												
Snow molds (Grasses)	Present			XXX	XXX	XXX					XXX	XXX	
	Treated												
Stem rust (Grasses)	Present					XXX	XXX						
	Treated												
Stem smut (Grasses)	Present					XXX							
	Treated												
Leaf stripe Rust (Grasses)	Present					XXX	XXX						
	Treated												
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid, pea (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX
	Treated					XXX	XXX						
Armyworm (P. unipuncta)	Present						XXX	XXX	XXX	XXX			
	Treated							XXX	XXX	XXX			
Billbugs	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX						XXX	XXX	
Cereal leaf beetle (Cereals)[2]	Present				XXX	XXX	XXX	XXX		XXX	XXX	XXX	
	Treated				XXX	XXX			XXX	XXX			

Activity Table for Forages West of the Cascades (OR, WA) (continued)

Insects (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Clover aphids (serious pest–Red Clover)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX						
Clover leaf weevil (Legumes)	Present				XXX	XXX	XXX	XXX					
	Treated	Chronic low levels not treated.											
Clover root Borer[3]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Crane fly[4]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Cutworms (All Forage Types)	Present	XXX	XXX			XXX	XXX	XXX		XXX	XXX	XXX	XXX
	Treated					XXX	XXX				XXX	XXX	
Garden symphylan[5]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Grasshoppers	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX						
Pea leaf weevil (Legumes Non-Seedy)	Present			XXX	XXX	XXX				XXX	XXX	XXX	
	Treated			XXX	XXX	XXX				XXX	XXX	XXX	
Slugs, gray garden, field	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX					XXX	XXX	XXX	XXX
Western spotted cucumber beetle	Present			XXX	XXX	XXX	XXX			XXX	XXX		
	Treated			XXX	XXX	XXX	XXX			XXX	XXX		
Winter grain Mites (Cereals)	Present	XXX	XXX	XXX						XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX					XXX	XXX	XXX	XXX
Wireworms (All Forage Types)[6]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bull thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX
	Treated		XXX	XXX	XXX							XXX	XXX
Musk thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX
	Treated				XXX	XXX	XXX					XXX	XXX
Salsify	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX
	Treated												
Scotch thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX
	Treated												
Tansy ragwort	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX
	Treated				XXX	XXX					XXX	XXX	XXX

Activity Table for Forages West of the Cascades (OR, WA) (continued)

Perennial Weeds		J	F	M	A	M	J	J	A	S	O	N	D
Blackberry	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Bluegrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX					XXX	XXX	XXX
Buttercups	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX							
Canada thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX					XXX	XXX	
Clovers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX						XXX	XXX
Common tansy	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX							
Cow parsnip	Present				XXX								
	Treated				XXX								
Dandelion	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX								
False dandelion	Present				XXX								
	Treated				XXX								XXX
Field bindweed	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX					
Fireweed	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX						
Foxtail barley	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX
	Treated			XXX	XXX	XXX					XXX		XXX
Horsetail	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX						
Knapweeds	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX					
Orchardgrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	XXX
Oxeye daisy	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX					XXX	XXX	
Perennial sowthistle	Present											XXX	
	Treated											XXX	
Plantago spp.	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Sheep sorrel	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX					XXX	XXX	
Stinging nettle	Present				XXX								
	Treated				XXX								

Activity Table for Forages West of the Cascades (OR, WA) (continued)

Perennial Weeds (cont.)		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Tall larkspur	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
White top	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX							
Wild rose	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX					
Yarrow	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX						XXX	
Summer Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual sowthistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX
	Treated		XXX	XXX	XXX							XXX	
Barnyardgrass	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX						
Common lambsquarters	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Foxtails	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						
Groundsel (WA/SA)	Present												
	Treated												XXX
Knotweeds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX					
	Treated		XXX	XXX	XXX								
Mayweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX		XXX				XXX	XXX	XXX
Nightshades	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Pigweeds	Present						XXX	XXX	XXX	XXX			
	Treated						XXX	XXX					
Pineapple weed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX
	Treated			XXX	XXX		XXX				XXX	XXX	XXX
Powell amaranth	Present						XXX	XXX	XXX	XXX			
	Treated						XXX	XXX					
Wild buckwheat	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						
Winter Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual bluegrass	Present	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	XXX
Chickweed	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	XXX
Downy brome	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	XXX

Activity Table for Forages West of the Cascades (OR, WA) (continued)

Winter Annual Weeds (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Fiddleneck	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated		XXX	XXX							XXX	XXX	XXX
Hare or little barley	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	XXX
Henbit	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated			XXX	XXX						XXX	XXX	XXX
Mustards	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	XXX
Prickly lettuce	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	XXX
Ryegrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated		XXX	XXX							XXX	XXX	XXX
Wild oats	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated		XXX	XXX							XXX	XXX	XXX
Windgrass	Present	XXX	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	XXX
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present	XXX	XXX									XXX	XXX
	Treated												
Ground squirrels	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX					XXX			
Moles	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Pocket gophers	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Ungulates	Present	XXX	XXX									XXX	XXX
	Treated												
Voles	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

[1] Growers in western Oregon do not monitor or treat for nematodes.

[2] Larvae in tall fescue have been spring sprayed. Fall adult feeding on perennial rye grass and tall fescue 1st year stands treated.

[3] Specific to red clover. It is a scolytid beetle and is the limiting factor for red clover stands in western Oregon and other places. Has not been controlled since the era of the cyclodiene insecticides

[4] *Tipula paludosa* and *T. oleraceae*. *T. paludosa* has one generation. *T. oleraceae* has 2.

[5] This would be treated at planting. Nothing is labeled for its treatment in grasses or legumes. Planting dates vary from spring through November.

[6] Would treat at planting time spring, summer, and fall. Nothing is registered for their treatment in grasses or clover.

Activity Table for Forages in the Palouse

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting			XXX	XXX	XXX					XXX	XXX	XXX
Fertilizer application			XXX	XXX	XXX					XXX	XXX	
Cultivation			XXX	XXX	XXX					XXX	XXX	
Irrigation				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Harvest/Cutting					XXX	XXX	XXX	XXX	XXX	XXX		
Grazing			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Take-out/Stand removal			XXX	XXX						XXX	XXX	

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.				XXX	XXX	XXX						
Herbicide app.			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Fungicide app.	On cereal seed only.											
Vertebrate controls	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Soil and water analysis		XXX	XXX	XXX					XXX	XXX		
Soil sampling for nematodes		XXX	XXX	XXX					XXX	XXX		
Weed surveys			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor for wireworms												
Keep weather records	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Petiole nutrient analysis												
Keep water budget				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor soil moisture	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Monitor soil temperature			XXX	XXX	XXX					XXX	XXX	
Monitor weed emergence			XXX	XXX	XXX							
Monitor canopy moisture, temperature, and humidity	Continuously with weather stations.											
Monitor temperature and humidity	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Seasonal Pest Occurrence													
Nematodes		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Cereal cyst nematode (Cereals)	Present	Not monitored for in this region.											
	Treated	Not treated.											
Northern root knot nematode	Present#				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated**	Not treated.											

Activity Table for Forages in the Palouse (continued)

Nematodes (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Root lesion nematode (*Pratylenchus neglectus*) (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Root lesion nematode (*P. penetrans*) (Most Forages)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Crown rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Damping off (Grasses and Legumes)	Present				XXX			XXX	XXX				
	Treated	Not treated.											
Ergot (Grasses)	Present						XXX	XXX	XXX				
	Treated	Not treated.											
Head smut (Grasses)	Present							XXX	XXX	XXX			
	Treated	Not treated.											
Kernel smut (Grasses)	Present						XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Leaf blotch (Grasses and Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Leaf rust (Grasses)	Present			XXX	XXX					XXX	XXX		
	Treated	Not treated.											
Leaf spot (Grasses and Legumes)	Present			XXX	XXX					XXX	XXX		
	Treated	Not treated.											
Leaf stripe (Grasses and Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	Not treated.											
Root rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Sclerotinia wilt and crown rot (Legumes)	Present				XXX	XXX				XXX	XXX	XXX	
	Treated	Not treated.											
Seedling blights (Grasses and Legumes)	Present				XXX			XXX	XXX				
	Treated	Not treated.											
Snow molds (Grasses)	Present	XXX	XXX										XXX
	Treated	Not treated.											

Activity Table for Forages in the Palouse (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Stem smut (Grasses)	Present						XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Stripe rust (Grasses)	Present							XXX	XXX	XXX			
	Treated	Not treated.											
Stem rust (Grasses)	Present						XXX	XXX	XXX				
	Treated	Not treated.											
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid, blue alfalfa (Legumes)	Present			XXX	XXX	XXX			XXX	XXX			
	Treated			XXX	XXX	XXX			XXX	XXX			
Aphid, cowpea (Legumes)	Present								XXX	XXX	XXX		
	Treated								XXX	XXX	XXX		
Aphid, pea (Legumes)	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX		XXX	XXX	XXX		
Aphid, spotted alfalfa (Legumes)	Present							XXX	XXX	XXX			
	Treated							XXX	XXX	XXX			
Alfalfa weevil (Legumes)	Present				XXX	XXX	XXX						
	Treated					XXX	XXX						
Billbugs	Present								XXX	XXX	XXX	XXX	
	Treated								XXX	XXX	XXX	XXX	
Black grass bug (Grasses)	Present				XXX	XXX	XXX	XXX					
	Treated						XXX	XXX					
Blister beetles (Grasses)	Present					XXX	XXX	XXX					
	Treated					XXX	XXX	XXX					
Cereal leaf beetle (Cereals)	Present			XXX	XXX								
	Treated			XXX	XXX								
Clover leaf weevil (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Clover root curculio (Legumes)	Present				XXX	XXX				XXX			
	Treated				XXX	XXX				XXX			
Cutworms (All Forage Types)	Present							XXX	XXX				
	Treated							XXX					
Grasshoppers	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Winter grain mites (Cereals)	Present			XXX	XXX								
	Treated			XXX	XXX								
Wireworms (All Forage Types)	Present			XXX	XXX								
	Treated			XXX	XXX								

Activity Table for Forages in the Palouse (continued)

Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bull thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Musk thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Salsify	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Scotch thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Tansy ragwort	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Perennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Blackberry	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Bluegrasses	Present			XXX	XXX	XXX	XXX			XXX	XXX	XXX	
	Treated	Nothing done.											
Buttercups	Present			XXX	XXX	XXX	XXX	XXX					
	Treated												
Canada thistle	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX			XXX	XXX			
Clovers	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX			XXX	XXX		
Cow parsnip	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Dandelion	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX				XXX	XXX		
Field bindweed	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX			XXX	XXX			
Foxtail barley	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated	Only treat alfalfa orchardgrass mix in February.											
Horsetail	Present			XXX	XXX	XXX	XXX	XXX					
	Treated	Nothing registered.											
Knapweeds	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX								
Perennial pepperweed	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX							
Perennial sowthistle	Present				XXX	XXX	XXX	XXX			XXX	XXX	
	Treated					XXX	XXX						
Plantago spp.	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX			XXX	XXX			
Russian olive	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX			XXX	XXX			

Activity Table for Forages in the Palouse (continued)

Perennial Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Russian thistle	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX			XXX	XXX			
Sagebrushes	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX						
Sheep sorrel	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated												
Tall larkspur	Present				XXX	XXX	XXX	XXX	XXX				
	Treated												
Toadflax	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
White top	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX							
Wormwoods	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Yarrow	Present			XXX	XXX	XXX	XXX			XXX	XXX		
	Treated				XXX	XXX	XXX						
Summer Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual sowthistle	Present			XXX	XXX	XXX	XXX						
	Treated				XXX	XXX	XXX						
Barnyardgrass	Present		XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX	
	Treated	Not treated.											
Common lambsquarters	Present			XXX	XXX	XXX	XXX						
	Treated				XXX	XXX	XXX						
Foxtails	Present			XXX	XXX	XXX	XXX			XXX	XXX	XXX	
	Treated	Not treated.											
Knotweeds	Present			XXX	XXX	XXX	XXX	XXX					
	Treated				XXX	XXX	XXX						
Mayweed	Present			XXX	XXX	XXX	XXX	XXX					
	Treated				XXX	XXX	XXX						
Nightshades	Present			XXX	XXX	XXX	XXX						
	Treated				XXX	XXX	XXX						
Pigweeds	Present			XXX	XXX	XXX	XXX			XXX	XXX	XXX	
	Treated				XXX	XXX	XXX						
Pineapple weed	Present				XXX	XXX	XXX	XXX					
	Treated				XXX	XXX	XXX						
Powell amaranth	Present			XXX	XXX	XXX	XXX						
	Treated				XXX	XXX	XXX						
Wild buckwheat	Present				XXX	XXX	XXX	XXX					
	Treated				XXX	XXX	XXX						

Activity Table for Forages in the Palouse (continued)

Winter Annual Weeds		J	F	M	A	M	J	J	A	S	O	N	D
Annual bluegrass	Present		XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX	
	Treated	Not treated in grass.											
Chickweed	Present			XXX	XXX	XXX	XXX						
	Treated			XXX	XXX				XXX	XXX			
Downy brome	Present	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	
Fiddleneck	Present			XXX	XXX	XXX							
	Treated			XXX	XXX								
Hare or little barley	Present			XXX	XXX	XXX							
	Treated	Only treat alfalfa orchardgrass mix in February.											
Henbit	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX								
Jointed goatgrass	Present		XXX	XXX	XXX	XXX				XXX	XXX	XXX	
	Treated	Only treat alfalfa orchardgrass mix in February.											
Medusahead	Present	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Mustards	Present			XXX	XXX	XXX	XXX						
	Treated			XXX	XXX				XXX	XXX	XXX	XXX	
Orchardgrasses	Present			XXX	XXX	XXX	XXX			XXX	XXX	XXX	
	Treated	Not treated in grass.											
Prickly lettuce (WA/SA in Dryland Areas)	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	Only treat alfalfa orchardgrass mix in February.											
Ryegrasses	Present		XXX	XXX	XXX	XXX				XXX	XXX	XXX	
	Treated	Only treat alfalfa orchardgrass mix in February.											
Ventenata grass	Present	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
	Treated												
White cockle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Windgrass	Present	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Wild oats	Present		XXX	XXX	XXX	XXX				XXX	XXX	XXX	
	Treated	Only treat alfalfa orchardgrass mix in February.											
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present	XXX	XXX	XXX							XXX	XXX	XXX
	Treated	No treatment.											
Ground squirrels	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated												
Pocket gophers	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated		XXX	XXX	XXX						XXX	XXX	

Activity Table for Forages in the Palouse (continued)

Vertebrate Pests (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Ungulates	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Voles	Present		XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX	
	Treated												

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

Activity Table for Forages in the Columbia Basin

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting			Spring					Fall				
Fertilizer application		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Cultivation (Preplant)		XXX					XXX					
Irrigation			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Harvest/Cutting					XXX	XXX	XXX	XXX	XXX	XXX		
Grazing		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Take-out/Stand removal			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.				XXX	XXX	XXX	XXX	XXX	XXX			
Herbicide app.			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Fungicide app.[1]												
Vertebrate controls		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Soil and water analysis		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Soil sampling for nematodes												
Weed surveys		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor for wireworms												
Keep weather records	Continuously with weather stations.											
Petiole nutrient analysis					XXX		XXX		XXX			
Keep water budget												
Monitor soil moisture			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor soil temperature			XXX	XXX	XXX							
Monitor weed emergence		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor canopy moisture, temperature, and humidity												
Monitor temperature and humidity	Continuously with weather stations.											

Seasonal Pest Occurrence													
Nematodes		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Cereal cyst nematode (Cereals)	Present#												
	Treated**	Not treated.											
Northern root knot nematode	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											

Activity Table for Forages in the Columbia Basin (continued)

Nematodes (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Root lesion nematode (*Pratylenchus neglectus*) (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Root lesion nematode (*P. penetrans*) (Most Forages)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Crown rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Damping off (Grasses and Legumes)	Present				XXX			XXX	XXX				
	Treated	Not treated.											
Ergot (Grasses)	Present						XXX	XXX	XXX				
	Treated	Not treated.											
Head smut (Grasses)	Present							XXX	XXX	XXX			
	Treated	Not treated.											
Kernel smut (Grasses)	Present						XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Leaf blotch (Grasses and Legumes)	Present			XXX	XXX					XXX	XXX		
	Treated	Not treated.											
Leaf rust (Grasses)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Leaf spot (Grasses and Legumes)	Present			XXX	XXX					XXX	XXX		
	Treated	Not treated.											
Leaf stripe (Grasses and Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	Not treated.											
Root rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Sclerotinia wilt and crown rot (Legumes)	Present				XXX	XXX				XXX	XXX	XXX	
	Treated	Not treated.											
Seedling blights (Grasses and Legumes)	Present				XXX			XXX	XXX				
	Treated	Not treated.											
Snow molds (Grasses)	Present	XXX	XXX										XXX
	Treated	Not treated.											

Activity Table for Forages in the Columbia Basin (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Stem rust (Grasses)	Present						XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Stem smut (Grasses)	Present							XXX	XXX	XXX			
	Treated	Not treated.											
Stripe rust (Grasses)	Present						XXX	XXX	XXX				
	Treated	Not treated.											
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid, blue alfalfa (Legumes)	Present			XXX	XXX	XXX			XXX	XXX			
	Treated			XXX	XXX	XXX			XXX	XXX			
Aphid, cowpea (Legumes)	Present								XXX	XXX	XXX		
	Treated								XXX	XXX	XXX		
Aphid, pea (Legumes)	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX		XXX	XXX	XXX		
Aphid, spotted Alfalfa (Legumes)	Present							XXX	XXX	XXX			
	Treated							XXX	XXX	XXX			
Billbugs	Present								XXX	XXX	XXX	XXX	
	Treated								XXX	XXX	XXX	XXX	
Black grass bug (Grasses)	Present						XXX	XXX	XXX				
	Treated						XXX	XXX	XXX				
Cereal leaf beetle (Cereals)	Present					XXX	XXX	XXX					
	Treated					XXX	XXX	XXX					
Clover leaf weevil (Legumes)	Present			XXX	XXX								
	Treated			XXX	XXX								
Clover root curculio (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Cutworms (All Forage Types)	Present				XXX	XXX				XXX			
	Treated				XXX	XXX				XXX			
Grasshoppers	Present							XXX	XXX				
	Treated							XXX					
Spider mites	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Winter grain mites (Cereals)	Present			XXX	XXX								
	Treated			XXX	XXX								
Wireworms (All Forage Types)	Present			XXX	XXX								
	Treated			XXX	XXX								
Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bull thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			

Activity Table for Forages in the Columbia Basin (continued)

Biennial Weeds (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Musk thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Salsify	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Scotch thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Perennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Clovers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX			XXX	XXX		
Cow parsnip	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Blackberry [1]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX			
Bluegrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Nothing done.											
Canada thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX			XXX	XXX			
Dandelion	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX				XXX	XXX		
Field bindweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX			XXX	XXX			
Horsetail	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Nothing registered.											
Knapweeds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX								
Perennial pepperweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX							
Perennial sowthistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX						
Plantago spp.	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX			XXX	XXX			
Russian olive[1]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX			
Russian thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX				
	Treated			XXX	XXX	XXX							
Sagebrushes	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX						
White top	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX							
Wormwoods[2]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												

Activity Table for Forages in the Columbia Basin (continued)

Summer Annual Weeds		J	F	M	A	M	J	J	A	S	O	N	D
Yarrow	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX						
Annual sowthistle	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX						
Barnyardgrass	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Bur buttercups	Present		XXX	XXX									
	Treated		XXX	XXX									
Common lambsquarters	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX						
Foxtail barley	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Foxtails	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Knotweeds	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Mayweed	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Nightshades	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX						
Pigweeds	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Pineapple weed	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Powell amaranth	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Wild buckwheat	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Winter Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual bluegrass[3]	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated												
Chickweed	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX				XXX	XXX			
Downy brome	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Fiddleneck	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated			XXX	XXX								
Hare or little barley	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Henbit	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX								

Activity Table for Forages in the Columbia Basin (continued)

Winter Annual Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Jointed goatgrass	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Medusahead	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Mustards	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX				XXX	XXX	XXX	XXX	
Orchardgrasses[3]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated												
Prickly lettuce (WA/SA in Dryland Areas)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX			XXX						
Ryegrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Ventenata grass	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
White cockle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Wild oats	Present				XXX	XXX	XXX	XXX	XXX				
	Treated	Only treat alfalfa orchardgrass mix in February.											
Windgrass	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present	XXX	XXX	XXX									
	Treated	No treatment.											
Pocket gophers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Voles	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX									XXX	XXX

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

[1] On cereals seed only.

[2] Fencelines and permanent pastures.

[3] Not treated in grasses.

Activity Table for Forages in the Klamath Basin

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Fertilizer application			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Cultivation				XXX	XXX	XXX	XXX	XXX	XXX			
Irrigation				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Harvest/Cutting					XXX	XXX	XXX	XXX	XXX	XXX		
Grazing			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Take-out/Stand removal			XXX	XXX	XXX				XXX	XXX	XXX	
Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.		XXX	XXX	XXX	XXX							
Herbicide app.		XXX	XXX	XXX	XXX				XXX	XXX		
Fungicide app. (not critical*)						XXX	XXX	XXX				
Vertebrate controls	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Soil and water analysis		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Soil sampling for nematodes		XXX	XXX	XXX					XXX	XXX		
Weed surveys		XXX	XXX	XXX					XXX	XXX		
Monitor for wireworms*												
Keep weather records	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Petiole nutrient analysis			XXX	XXX	XXX	XXX	XXX					
Keep water budget	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Monitor soil moisture				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor soil temperature			XXX	XXX	XXX	XXX						
Monitor temperature and humidity	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

* Not a usual practice but can be done (economics).

Seasonal Pest Occurrence													
Nematodes		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Cereal cyst nematode (Cereals)	Present#					XXX	XXX	XXX	XXX	XXX			
	Treated**												
Northern root knot nematode (Alfalfa/Grass Mixtures)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												

Activity Table for Forages in the Klamath Basin (continued)

Nematodes (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Root lesion nematode (*P. penetrans*) (Most Forages)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Stem nematode (Alfalfa/Grass Mixtures)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Barley yellow dwarf	Present					XXX	XXX	XXX	XXX				
	Treated												
Crown rots (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Damping off (Grasses and Legumes)	Present				XXX	XXX	XXX	XXX	XXX				
	Treated	Apron-coated seed and irrigation management.											
Ergot (Grasses)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Fairy rings	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Head smut (Grasses)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated	Seed treatment.											
Leaf blotch (Grasses and Legumes)	Present						XXX	XXX	XXX	XXX			
	Treated												
Leaf rust (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX					
Leaf spot (Grasses and Legumes)	Present						XXX	XXX	XXX	XXX			
	Treated												
Loose kernel smut (Grasses)	Present						XXX	XXX	XXX	XXX			
	Treated	Seed treatment.											
Necrotic ring spot	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Purple spot	Present				XXX	XXX	XXX	XXX					
	Treated												
Root rots (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												

Activity Table for Forages in the Klamath Basin (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Sclerotinia wilt and crown rot (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Seedling blights (Grasses and Legumes)	Present				XXX	XXX	XXX	XXX	XXX				
	Treated												
Snow molds (Grasses)	Present		XXX	XXX	XXX								
	Treated												
Stem rust (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX					
Stripe rust (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX					
Take-all	Present				XXX	XXX	XXX	XXX					
	Treated	Cultural practices.											
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid, blue alfalfa (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						
Aphid, cowpea (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						
Aphid, pea (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						
Aphid, spotted alfalfa (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						
Billbugs	Present					XXX	XXX			XXX			
	Treated												
Black grass bug (Grasses)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX					
Cereal leaf beetle (Cereals)	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						
Chinch bugs	Present					XXX	XXX	XXX					
	Treated												
Clover mites	Present		XXX	XXX	XXX	XXX	XXX				XXX	XXX	
	Treated	No treatments available.											
Clover root curculio (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not yet considered an economically important pest.											
Cutworms (All Forage Types)	Present				XXX	XXX	XXX						
	Treated				XXX	XXX	XXX						

Activity Table for Forages in the Klamath Basin (continued)

Insects (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Grasshoppers	Present					XXX	XXX	XXX	XXX				
	Treated					XXX	XXX	XXX	XXX				
Mosquitoes	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Wheat stem maggot	Present						XXX	XXX	XXX				
	Treated												
Winter grain mites (Cereals)	Present		XXX	XXX	XXX	XXX	XXX				XXX	XXX	
	Treated		XXX	XXX	XXX	XXX	XXX						
Wireworms (All Forage Types)	Present			XXX	XXX								
	Treated												
Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bull thistle	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Musk thistle	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Salsify, western	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Scotch thistle	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Perennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bluegrasses	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Buttercups	Present		XXX	XXX	XXX	XXX							
	Treated		XXX	XXX	XXX	XXX							
Canada thistle	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Clovers	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Dandelion	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Dock (Broadleaf and Narrowleaf)	Present						XXX	XXX	XXX	XXX			
	Treated												
Field bindweed	Present						XXX	XXX	XXX	XXX			
	Treated							XXX	XXX	XXX			
Foxtail barley	Present			XXX	XXX	XXX	XXX						
	Treated												
Horsetail	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Knapweeds	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		

Activity Table for Forages in the Klamath Basin (continued)

Perennial Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Perennial pepperweed	Present						XXX	XXX	XXX	XXX			
	Treated						XXX	XXX	XXX	XXX			
Plantago spp.	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Russian olive	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Russian thistle	Present						XXX	XXX	XXX	XXX			
	Treated						XXX	XXX	XXX	XXX			
Sagebrushes	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
White top	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Common tansy	Present			XXX	XXX	XXX	XXX						
	Treated				XXX	XXX	XXX						
Cow parsnip	Present						XXX	XXX	XXX	XXX	XXX		
	Treated						XXX	XXX	XXX	XXX	XXX		
False dandelion	Present			XXX	XXX	XXX	XXX						
	Treated			XXX	XXX	XXX	XXX						
Quackgrass	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Perennial sowthistle	Present						XXX	XXX	XXX	XXX			
	Treated												
Stinging nettle	Present						XXX	XXX	XXX	XXX			
	Treated						XXX	XXX	XXX	XXX			
Toadflax	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Wild rose	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Yarrow	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Summer Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual sowthistle	Present							XXX	XXX	XXX			
	Treated							XXX	XXX	XXX			
Common lambsquarters	Present			XXX	XXX	XXX	XXX						
	Treated			XXX	XXX	XXX	XXX						
Knotweeds	Present						XXX	XXX	XXX				
	Treated						XXX	XXX	XXX				
Kochia	Present						XXX	XXX	XXX	XXX	XXX		
	Treated												
Mollein, common	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												

Activity Table for Forages in the Klamath Basin (continued)

Summer Annual Weeds (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Nightshades	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Pigweeds	Present						XXX	XXX	XXX	XXX			
	Treated						XXX	XXX	XXX	XXX			
Puncturevine	Present						XXX	XXX	XXX	XXX			
	Treated												
Redroof pigweed	Present							XXX	XXX	XXX			
	Treated												
Witchgrass	Present							XXX	XXX	XXX			
	Treated												
Winter Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual bluegrass	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Chickweed	Present						XXX	XXX	XXX	XXX			
	Treated						XXX	XXX	XXX				
Downy brome	Present	XXX	XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX								
Foxtails	Present		XXX	XXX	XXX	XXX	XXX	XXX					
	Treated												
Groundsel, common (WA/SA)	Present		XXX	XXX	XXX	XXX	XXX						
	Treated												
Fiddleneck	Present						XXX	XXX	XXX				
	Treated						XXX	XXX	XXX				
Flixweed	Present			XXX	XXX	XXX	XXX						
	Treated												
Hare or little barley	Present			XXX	XXX	XXX	XXX	XXX					
	Treated												
Henbit	Present					XXX	XXX	XXX					
	Treated												
Mallow, common (WA/SA)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Medusahead	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX				
	Treated												
Mustards	Present		XXX	XXX	XXX								
	Treated		XXX	XXX	XXX								
Prickly lettuce (WA/SA in Dryland Areas)	Present						XXX	XXX	XXX	XXX			
	Treated						XXX	XXX	XXX	XXX			
Redstem filaree	Present				XXX	XXX	XXX	XXX					
	Treated												

Activity Table for Forages in the Klamath Basin (continued)

Winter Annual Weeds (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Ryegrasses	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Shepherds purse	Present		XXX	XXX	XXX	XXX	XXX						
	Treated												
Wild oats	Present			XXX	XXX	XXX	XXX						
	Treated			XXX	XXX	XXX							
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Blackbirds	Present						XXX	XXX	XXX				
	Treated												
Canada geese	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Ground squirrels	Present		XXX	XXX	XXX	XXX	XXX			XXX	XXX		
	Treated												
Pocket gophers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX				XXX	XXX		
Rock chucks	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Ungulates	Present				XXX	XXX				XXX	XXX		
	Treated												
Voles	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

Activity Table for Forages in the Great Basin

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Fertilizer application			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Cultivation			XXX	XXX					XXX			
Irrigation			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Harvest/Cutting					XXX	XXX	XXX	XXX	XXX	XXX		
Grazing	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Take-out/Stand removal	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Herbicide app.			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Fungicide app.	None.											
Vertebrate controls	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Soil and water analysis			XXX	XXX					XXX	XXX		
Soil sampling for nematodes			XXX	XXX					XXX	XXX		
Weed surveys			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor for wireworms			XXX	XXX								
Keep weather records	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Petiole nutrient analysis	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Keep water budget			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor soil moisture			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor soil temperature			XXX	XXX	XXX	XXX						
Monitor weed emergence			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor canopy moisture, temperature, and humidity	When recorded.											
Monitor temperature and humidity	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Seasonal Pest Occurrence													
Nematodes		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Cereal cyst nematode (Cereals)	Present				XXX	XXX	XXX	XXX	XXX				
	Treated						XXX						
Northern root knot nematode	Present#	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated**				XXX	XXX							

Activity Table for Forages in the Great Basin (continued)

Nematodes (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Root lesion nematode (*Pratylenchus neglectus*) (Grasses)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX							
Root lesion nematode (*P. penetrans*) (Most Forages)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX							
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Barley yellow dwarf	Present												
	Treated	Not treated.											
Crown rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Damping off (Grasses and Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Seed treatment.											
Ergot (Grasses)	Present						XXX	XXX	XXX				
	Treated	Not treated.											
Head smut (Grasses)	Present						XXX	XXX	XXX				
	Treated	Not treated.											
Kernel smut (Grasses)	Present						XXX	XXX	XXX				
	Treated	Not treated.											
Leaf blotch (Grasses and Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated	Not treated.											
Leaf rust (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated	Not treated.											
Leaf spot (Grasses and Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX	X	
	Treated	Not treated.											
Leaf stripe (Grasses and Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated	Not treated.											
Root rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Sclerotinia wilt and crown rot (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Seedling blights (Grasses and Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											

Activity Table for Forages in the Great Basin (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Snow molds (Grasses)	Present	XXX	XXX	XXX								XXX	XXX
	Treated	Not treated.											
Stem rust (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated	Not treated.											
Stem smut (Grasses)	Present				XXX	XXX	XXX	XXX					
	Treated	Cultural practices.											
Stripe rust (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated	Not treated.											
Wheat streak Mosaic Virus	Present												
	Treated	Not treated.											
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid, blue alfalfa (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Aphid, cowpea (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Aphid, pea (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Aphid, spotted alfalfa (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Billbugs	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX					
Bird cherry oat aphid	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Black grass bug (Grasses)	Present					XXX	XXX	XXX	XXX				
	Treated					XXX	XXX	XXX	XXX				
Blister beetles (Grasses)	Present						XXX	XXX	XXX	XXX	XXX		
	Treated						XXX	XXX	XXX	XXX	XXX		
Cereal leaf beetle (Cereals)	Present				XXX	XXX	XXX						
	Treated				XXX	XXX	XXX						
Clover leaf weevil (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Clover root curculio (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	No treatment.											
Cutworms (All Forage Types)	Present		XX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XX		
	Treated		XX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XX		
Grasshoppers	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XX		

Activity Table for Forages in the Great Basin (continued)

Insects (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Winter grain mites (Cereals and Grasses)[1]	Present	XXX	XXX	XXX						XXX	XXX	XXX	XXX
	Treated												
Wireworms (All Forage Types)	Present			XXX	XXX	XXX	XXX						
	Treated												
Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Thistle, bull, musk, and scotch	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	X			XXX	XXX	X	
Salsify	Present	XXX	XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX			XXX	XXX	XXX	
Spurge	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Tansy ragwort	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	X						
Perennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Blackberry	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX							
Bluegrasses (B/P/A)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX							
Rush skeletonweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX					XXX	XXX		
Buttercups	Present			XXX	XXX	XXX	XXX						
	Treated			XXX	XXX	XXX	XXX						
Canada thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX				XXX	XXX		
Clovers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Common tansy	Present					XXX	XXX	XXX	XXX				
	Treated			X	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Cow parsnip	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Dandelion	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Field bindweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX				XXX	XXX		
Horsetail	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX	XXX						
Fireweed	Present					XXX	XXX	XXX					
	Treated					XXX	XXX	XXX					

Activity Table for Forages in the Great Basin (continued)

Perennial Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Foxtail barley	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated								XXX	XXX	XXX	XXX	
Knapweeds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX				XXX	XXX		
Other larkspurs	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX	XXX					
Perennial pepperweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX							
Perennial sowthistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX			XXX	XXX	XXX		
Russian olive	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated						XXX	XXX	XXX	XXX			
Sagebrushes	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX									
Stinging nettle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Tall larkspur	Present				XXX	XXX	XXX	XXX	XXX				
	Treated					XXX	XXX	XXX					
Toadflax	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX	XXX	XXX	
White top	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX							
Wild rose	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Yarrow	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX						
Summer Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual sowthistle	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Barnyardgrass	Present						XXX	XXX	XXX	XXX	XXX		
	Treated						XXX	XXX	XXX	XXX	XXX		
Common lambsquarters	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Foxtails	Present						XXX	XXX	XXX	XXX	XXX		
	Treated						XXX	XXX	XXX	XXX	XXX		
Knotweeds	Present				XX	XXX	XXX	XXX	XXX				
	Treated				XX	XXX	XXX	XXX	XXX				
Mayweed	Present				XX	XXX	XXX	XXX	XXX				
	Treated				XX	XXX	XXX	XXX	XXX				

Activity Table for Forages in the Great Basin (continued)

Summer Annual Weeds (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Nightshades	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				X	XXX	XXX	XXX	XXX	XXX	XXX		
Pigweeds	Present					XXX	XXX	XXX	XXX				
	Treated					XXX	XXX	XXX	XXX				
Powell amaranth	Present					XXX	XXX	XXX	XXX				
	Treated					XXX	XXX	XXX	XXX				
Russian thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated			XXX	XXX								
Wild buckwheat	Present			XXX	XXX	XXX							
	Treated			XXX	XXX	XXX							
Winter Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual bluegrass	Present			XXX	XXX	XXX							
	Treated			XXX	XXX	XXX							
Chickweed	Present				XXX	XXX							
	Treated				XXX	XXX							
Downy brome	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX						XXX	XXX	XXX	XXX
Fiddleneck	Present				XXX	XXX	XXX						
	Treated				XXX	XXX	XXX						
Hare or little barley	Present	XXX	XXX	XXX	XXX						XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	May not treat.					XXX	XXX	XXX
Henbit	Present			XX	XXX								
	Treated			XX	XXX								
Jointed goatgrass	Present								XXX	XXX	XXX	XXX	
	Treated								XXX	XXX	XXX	XXX	
Medusahead	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX						XXX	XXX	XXX	XXX
Mustards	Present	XXX	XXX	XXX	XXX					XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX					XXX	XXX	XXX	XXX
Orchardgrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Prickly lettuce (WA/SA in Dryland Areas)	Present						XXX	XXX	XXX				
	Treated						XXX	XXX	XXX				
Ryegrasses	Present	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
Wild oats	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX					XXX		
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			

Activity Table for Forages in the Great Basin (continued)

Vertebrate Pests (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Ground squirrels	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Other birds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX						
Pocket gophers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Ungulates	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Voles	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

[1] Suspected to be a pest in this region during this time period.

Activity Table for Forages in the Colorado Plateau

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Fertilizer application	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Cultivation		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Irrigation			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Harvest/Cutting				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Grazing	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Take-out/Stand removal		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Herbicide app.		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Fungicide app.				XXX	XXX	XXX	XXX	XXX				
Vertebrate controls	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Soil and water analysis	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Soil sampling for nematodes		XXX	XXX	XXX						XXX	XXX	
Weed surveys			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor for wireworms			XXX	XXX								
Keep weather records	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Petiole nutrient analysis					XXX	XXX	XXX	XXX				
Keep water budget	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Monitor soil moisture			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor soil temperature			XXX	XXX	XXX	XXX						
Monitor weed emergence		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Monitor canopy moisture, temperature, and humidity					XXX	XXX	XXX	XXX	XXX			
Monitor temperature and humidity			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	

Seasonal Pest Occurrence													
Nematodes		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Cereal cyst nematode (Cereals)	Present#	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated**						XXX						
Northern root knot nematode	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX							

Activity Table for Forages in the Colorado Plateau (continued)

Nematodes (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Root lesion nematode (*Pratylenchus neglectus*) (Grasses)	Present												
	Treated	Not treated.											
Root lesion nematode (Most Forages)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX							
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Root rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Crown rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Sclerotinia wilt and crown rot (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Cultural practices.											
Stem smut (Grasses)	Present					XXX	XXX	XXX					
	Treated	Not treated.											
Head smut (Grasses)	Present					XXX	XXX	XXX	XXX				
	Treated	Not treated.											
Kernel smut (Grasses)	Present					XXX	XXX	XXX	XXX				
	Treated	Not treated.											
Stripe rust (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Ergot (Grasses)	Present							XXX	XXX				
	Treated	Not treated.											
Damping off (Grasses and Legumes)	Present			XXX	XXX	XXX							
	Treated	Not treated.											
Seedling blights (Grasses and Legumes)	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated	Not treated.											
Leaf spot (Grasses and Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated	Not treated.											
Leaf blotch (Grasses and Legumes)	Present												
	Treated	Not treated.											
Barley yellow dwarf (Cereals)	Present			XXX	XXX	XXX					XXX	XXX	XXX
	Treated	Not treated.											

Activity Table for Forages in the Colorado Plateau (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Wheat streak mosaic virus (Cereals)	Present	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
	Treated	Not treated.											
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid, cowpea (Legumes)[1]	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Aphid, blue alfalfa (Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Aphid, pea (Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Aphid, spotted alfalfa (Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Billbugs	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Black grass bug (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Blister beetles (Grasses)	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Cereal leaf beetle (Cereals)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Clover leaf weevil (Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Clover root curculio (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Cutworms (All Forage Types)	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Grasshoppers	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Winter grain mites (Cereals)	Present									XXX	XXX	XXX	
	Treated	Not treated.											
Wireworms (All Forage Types)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Mormon crickets	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bull thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX

Activity Table for Forages in the Colorado Plateau (continued)

Biennial Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Burdock, common	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Musk thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX				XXX	XXX	XXX	
Salsify	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX					
Scotch thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
Perennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bluegrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX						
Buttercups	Present		XXX	XXX	XXX	XXX							
	Treated		XXX	XXX	XXX	XXX							
Canada thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Clovers	Present												
	Treated	Not treated.											
Common tansy	Present		XXX	XXX	XXX	XXX	XXX						
	Treated		XXX	XXX	XXX	XXX	XXX						
Cow parsnip	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Curly Dock	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Dandelion	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Field bindweed	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Foxtail barley	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Horsetail	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX						
Knapweeds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX				XXX	XXX		
Other larkspurs	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX						
Perennial pepperweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX				
Perennial sowthistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX				
Plantago spp.	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX							

Activity Table for Forages in the Colorado Plateau (continued)

Perennial Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Rocky mountain iris	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Russian olive	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Russian thistle	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX				
	Treated		XXX	XXX	XXX	XXX	XXX						
Sagebrushes	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX				
Stinging nettle	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Tall larkspur	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX						
Toadflax	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
White top	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX								
Wild rose	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Yarrow	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX					
Summer Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual sowthistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX				
Barnyardgrass	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Cocklebar, common	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Common lambsquarters	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX	XXX	XXX				
Foxtails	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Knotweeds	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Kochia	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX						
Mallow, common (WA/SA)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Mayweed	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Nightshades	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX			

Activity Table for Forages in the Colorado Plateau (continued)

Summer Annual Weeds (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Pigweeds	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX				
Pineapple weed	Present					XXX	XXX	XXX	XXX				
	Treated					XXX	XXX	XXX	XXX				
Powell amaranth	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX				
Sunflower	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Wild buckwheat	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated			XXX	XXX	XXX	XXX	XXX	XXX				
Winter Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual bluegrass	Present		XXX	XXX	XXX	XXX	XXX						
	Treated		XXX	XXX	XXX	XXX	XXX						
Chickweed	Present			XXX	XXX	XXX							
	Treated			XXX	XXX	XXX							
Downy brome	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX						XXX	XXX	
Hare or little barley	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX					XXX	XXX	
Henbit	Present			XXX	XXX	XXX	XXX						
	Treated			XXX	XXX	XXX	XXX						
Mustards	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Prickly lettuce (WA/SA in Dryland Areas)	Present						XXX	XXX	XXX				
	Treated						XXX	XXX	XXX				
Ryegrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX						XXX	XXX	
Sandbur	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Wild oats	Present			XXX	XXX	XXX	XXX				XXX	XXX	
	Treated			XXX	XXX	XXX	XXX				XXX	XXX	
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX	XXX						
Ground squirrels	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX	XXX	XXX	XXX				
Moles	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Other birds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												

Activity Table for Forages in the Colorado Plateau (continued)

Vertebrate Pests (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Pocket gophers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Ungulates	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Voles	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

[1] Fall and spring.

Activity Table for Forages in the Western Great Plains

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Fertilizer application		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Cultivation			XXX	XXX	XXX				XXX	XXX	XXX	
Irrigation			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Harvest/Cutting					XXX	XXX	XXX	XXX	XXX	XXX		
Grazing	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Take-out/Stand removal			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Herbicide app.	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Fungicide app.				XXX	XXX			XXX	XXX			
Vertebrate controls		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Soil and water analysis		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Soil sampling for nematodes					XXX	XXX		XXX	XXX			
Weed surveys		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor for wireworms				XXX	XXX							
Keep weather records	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Petiole nutrient analysis					XXX	XXX	XXX	XXX	XXX			
Keep water budget				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor soil moisture				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor soil temperature			XXX	XXX	XXX			XXX	XXX			
Monitor weed emergence		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor canopy moisture, temperature and humidity					XXX	XXX	XXX	XXX	XXX	XXX		
Monitor temperature and humidity					XXX	XXX	XXX	XXX	XXX	XXX		

Seasonal Pest Occurrence													
Nematodes		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Cereal cyst nematode (Cereals)	Present#					XXX	XXX	XXX	XXX	XXX			
	Treated**												
Northern root knot nematode	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												

Activity Table for Forages in the Western Great Plains (continued)

Nematodes (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Root lesion nematode (*Pratylenchus neglectus*) (Grasses)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Root lesion nematode (Most Forages)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Crown rots (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Damping off (Grasses and Legumes)	Present			XXX	XXX	XXX				XXX	XXX		
	Treated				XXX	XXX							
Ergot (Grasses)	Present					XXX	XXX	XXX					
	Treated												
Head smut (Grasses)	Present					XXX	XXX	XXX	XXX				
	Treated												
Kernel smut (Grasses)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Leaf blotch (Grasses and Legumes)	Present							XXX	XXX				
	Treated												
Leaf rust (Grasses)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Leaf spot (Grasses and Legumes)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Leaf stripe (Grasses and Legumes)	Present							XXX	XXX				
	Treated												
Root rots (Legumes)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Sclerotinia wilt and crown rot (Legumes)	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Seedling blights (Grasses and Legumes)	Present			XXX	XXX	XXX				XXX	XXX		
	Treated				XXX	XXX							
Snow molds (Grasses)	Present	XXX	XXX	XXX									
	Treated												

Activity Table for Forages in the Western Great Plains (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Stem rust (Grasses)	Present					XXX	XXX	XXX					
	Treated												
Stripe rust (Grasses)	Present					XXX	XXX	XXX					
	Treated												
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid, blue alfalfa (Legumes)	Present					XXX	XXX						
	Treated												
Aphid, cowpea (Legumes)	Present					XXX	XXX						
	Treated												
Aphid, pea (Legumes)	Present					XXX	XXX						
	Treated												
Billbugs	Present				XXX	XXX	XXX						
	Treated												
Black grass bug (Grasses)	Present						XXX	XXX	XXX				
	Treated												
Blister beetles (Grasses)	Present						XXX	XXX	XXX				
	Treated												
Cereal leaf beetle (Cereals)	Present						XXX	XXX					
	Treated												
Clover leaf weevil (Legumes)	Present					XXX	XXX						
	Treated												
Clover root curculio (Legumes)	Present				XXX	XXX	XXX						
	Treated												
Cutworms (All Forage Types)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX				XXX	XXX		
Grasshoppers	Present					XXX	XXX	XXX	XXX	XXX	XXX		
	Treated						XXX	XXX	XXX	XXX	XXX		
Winter grain mites (Cereals)	Present			XXX	XXX	XXX							
	Treated												
Wireworms (All Forage Types)	Present				XXX	XXX	XXX						
	Treated												
Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Musk thistle	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX		XXX	XXX			
Salsify	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Tansy ragwort	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX		XXX	XXX			

Activity Table for Forages in the Western Great Plains (continued)

Perennial Weeds		J	F	M	A	M	J	J	A	S	O	N	D
Bluegrasses	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX			XXX	XXX	XXX		
Canada thistle	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX			XXX	XXX		
Clovers	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX				XXX	XXX		
Cow parsnip	Present				XXX	XXX	XXX						
	Treated					XXX	XXX						
Dandelion	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
False dandelion	Present				XXX	XXX	XXX						
	Treated												
Field bindweed	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX			XXX	XXX		
Foxtail barley	Present				XXX	XXX	XXX			XXX	XXX		
	Treated				XXX	XXX	XXX			XXX	XXX		
Hemp nettle	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Horsetail	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Knapweeds	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX			XXX	XXX		
Oxeye daisy	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Perennial pepperweed	Present					XXX	XXX	XXX					
	Treated					XXX	XXX						
Plantago spp.	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Russian thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Stinging nettle	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Toadflax	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
White top	Present				XXX	XXX	XXX						
	Treated				XXX	XXX	XXX						
Russian olive	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Sagebrushes	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX						

Activity Table for Forages in the Western Great Plains (continued)

Perennial Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Wild rose	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Yarrow	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX			XXX	XXX		
Summer Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Barnyardgrass	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Common lambsquarters	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX			
Foxtails	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Knotweeds	Present					XXX	XXX	XXX	XXX	XXX			
	Treated						XXX	XXX	XXX	XXX			
Nightshades	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Pigweeds	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Pineapple weed	Present					XXX	XXX	XXX	XXX	XXX			
	Treated												
Powell amaranth	Present					XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX	XXX	XXX			
Wild buckwheat	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated						XXX	XXX	XXX	XXX			
Winter Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual bluegrass	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Downy brome	Present	XXX	XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX					XXX	XXX	
Jointed goatgrass	Present		XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX	
	Treated		XXX	XXX	XXX						XXX	XXX	
Mustards	Present		XXX	XXX	XXX	XXX	XXX			XXX	XXX	XXX	
	Treated	XXX	XXX	XXX								XXX	
Prickly lettuce (WA/SA in Dryland Areas)	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present	XXX	XXX	XXX	XXX						XXX	XXX	XXX
	Treated												
Ground squirrels	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX	XXX	XXX			
Moles	Present				XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated												

Activity Table for Forages in the Western Great Plains (continued)

Vertebrate Pests (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Pocket gophers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Ungulates	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Voles	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX				XXX	XXX		

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This DOES indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

Activity Table for Forages in the Northern Great Plains

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Fertilizer application				XXX	XXX					XXX		
Cultivation/Tillage		XXX	XXX	XXX	XXX					XXX	XXX	
Irrigation				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Harvest/Cutting					XXX	XXX	XXX	XXX	XXX			
Grazing			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Take-out/Stand removal					XXX	XXX	XXX	XXX	XXX			

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.					XXX	XXX	XXX	XXX	XXX			
Herbicide app.				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Fungicide app.				XXX	XXX	XXX	XXX	XXX				
Vertebrate controls	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Soil analysis		XXX	XXX	XXX					XXX	XXX	XXX	
Weed surveys			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Monitor for wireworms			XXX	XXX	XXX	XXX						
Keep weather records	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Monitor soil moisture			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Monitor soil temperature			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Monitor weed emergence			XXX	XXX	XXX	XXX	XXX	XXX	XXX			

Seasonal Pest Occurrence													
Nematodes[1]													
Diseases[2]		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Crown rots (Legumes)	Present					XXX	XXX	XXX					
	Treated												
Damping off (Grasses and Legumes)	Present					XXX	XXX	XXX	XXX				
	Treated												
Ergot (Grasses)	Present					XXX	XXX	XXX	XXX				
	Treated												
Head smut (Grasses)	Present						XXX	XXX	XXX				
	Treated												
Kernel smut (Grasses)	Present						XXX	XXX	XXX				
	Treated												

Activity Table for Forages in the Northern Great Plains (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Leaf blotch (Grasses and Legumes)	Present					XXX	XXX	XXX					
	Treated												
Leaf rust (Grasses)	Present					XXX	XXX	XXX					
	Treated												
Leaf spot (Grasses and Legumes)	Present					XXX	XXX	XXX					
	Treated												
Leaf stripe (Grasses and Legumes)	Present					XXX	XXX	XXX					
	Treated												
Root rots (Legumes)	Present					XXX	XXX	XXX	XXX				
	Treated												
Sclerotinia wilt and crown rot (Legumes)	Present					XXX	XXX	XXX	XXX				
	Treated												
Seedling blights (Grasses and Legumes)	Present					XXX	XXX						
	Treated												
Snow molds (Grasses)	Present				XXX	XXX							
	Treated												
Stem rust (Grasses)	Present					XXX	XXX	XXX	XXX				
	Treated												
Stem smut (Grasses)	Present					XXX	XXX	XXX	XXX				
	Treated												
Stripe rust (Grasses)	Present					XXX	XXX	XXX	XXX				
	Treated												
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid, cowpea (Legumes)	Present				XXX	XXX	XXX	XXX	XXX				
	Treated					XXX	XXX	XXX					
Aphid, pea (Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated												
Aphid, spotted alfalfa (Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated												
Billbugs	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated												
Black grass bug (Grasses)	Present				XXX	XXX	XXX	XXX	XXX				
	Treated			XXX		XXX	XXX	XXX			XXX	XXX	XXX
Blister beetles (Grasses)	Present					XXX	XXX	XXX	XXX				
	Treated												

Activity Table for Forages in the Northern Great Plains (continued)

Insects (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Cereal leaf beetle (Cereals)	Present				XXX	XXX	XXX	XXX					
	Treated					XXX	XXX						
Clover leaf weevil (Legumes)	Present				XXX	XXX	XXX	XXX					
	Treated					XXX	XXX						
Clover root curculio (Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated												
Cutworms (All Forage Types)	Present				XXX	XXX	XXX	XXX					
	Treated					XXX							
Grasshoppers	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated							XXX	XXX				
Hessian fly (Cereals)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX				XXX				
Winter grain mites (Cereals)	Present				XXX	XXX	XXX	XXX					
	Treated					XXX							
Wireworms (All Forage Types)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX				XXX	XXX				
Wheat stem sawfly (Cereals)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX			XXX				
Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bull thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX							
Scotch thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX							
Musk thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX							
Perennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bluegrasses	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	No treatment.											
Canada thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX	XXX	XXX	XXX				
Dandelion	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	No treatment.											
Field bindweed	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated					XXX	XXX						
Foxtail barley	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated							XXX	XXX				
Knapweeds	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX				XXX	XXX	XXX	

Activity Table for Forages in the Northern Great Plains (continued)

Perennial Weeds (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Orange hawkweed	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	No treatment.											
Other larkspurs	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Oxeye daisy	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX					XXX	XXX	
Perennial pepperweed	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX							
Perennial sowthistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	No treatment.											
Russian olive	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX							
Russian thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX							
Sagebrushes	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated				XXX								
Tall larkspur	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Toadflax	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
White top	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX							
Wormwoods	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX					XXX	XXX	
Yellow hawkweed	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	No treatment.											
Summer Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Foxtails	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated					XXX	XXX	XXX					
Pigweeds	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated	No treatment.											
Common lambsquarters	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	No treatment.											
Annual sowthistle	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	No treatment.											
Wild buckwheat	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	No treatment.											
Pineapple weed	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	No treatment.											

Activity Table for Forages in the Northern Great Plains (continued)

Winter Annual Weeds		J	F	M	A	M	J	J	A	S	O	N	D
Annual bluegrass	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated	No treatment.											
Downy brome	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX								
Chickweed	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	No treatment.											
Jointed goatgrass	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX							
Mustards	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX	XXX						
Wild oats	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated				XXX	XXX							
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated									XXX	XXX	XXX	
Ground squirrels	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Other birds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	No treatment.											
Pocket gophers	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX							
Ungulates	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated									XXX	XXX	XXX	
Voles	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated	No treatment.											

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

[1] While nematode pests may be present in forages grown in the Northern Great Plains, they are not a serious enough problem for growers to scout for them or to treat them.

[2] Disease pests are not treated for.

Activity Table for Forages in the Columbia Basin Uplands

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting			Spring					Fall				
Fertilizer application		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Cultivation[1]		XXX					XXX					
Irrigation			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Harvest/Cutting					XXX	XXX	XXX	XXX	XXX	XXX		
Grazing		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Take-out/Stand removal			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.				XXX	XXX	XXX	XXX	XXX	XXX			
Herbicide app.			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Fungicide app.	On cereal seed only.											
Vertebrate controls		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Soil and water analysis		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Soil sampling for nematodes		XXX	XXX	XXX					XXX	XXX		
Weed surveys		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Keep weather records	Continuously with weather stations.											
Petiole nutrient analysis					XXX		XXX		XXX			
Keep water budget	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Monitor soil moisture			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor soil temperature			XXX	XXX	XXX							
Monitor weed emergence		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor canopy moisture, temperature, and humidity			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Monitor temperature and humidity	continuously with weather stations.											

Seasonal Pest Occurrence													
Nematodes		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Cereal cyst nematode (Cereals)	Present	Not monitored for in this region.											
	Treated	Not treated.											
Northern root knot nematode	Present#				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated**	Not treated.											

Activity Table for Forages in the Columbia Basin Uplands (continued)

Nematodes (continued)		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Root lesion nematode (*Pratylenchus neglectus*) (Grasses)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Root lesion nematode (*P. penetrans*) (Most Forages)	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Crown rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Damping off (Grasses and Legumes)	Present				XXX			XXX	XXX				
	Treated	Not treated.											
Ergot (Grasses)	Present						XXX	XXX	XXX				
	Treated	Not treated.											
Head smut (Grasses)	Present							XXX	XXX	XXX			
	Treated	Not treated.											
Kernel smut (Grasses)	Present						XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Leaf rust (Grasses)	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Leaf blotch (Grasses and Legumes)	Present			XXX	XXX					XXX	XXX		
	Treated	Not treated.											
Leaf spot (Grasses and Legumes)	Present			XXX	XXX					XXX	XXX		
	Treated	Not treated.											
Leaf stripe (Grasses and Legumes)	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated	Not treated.											
Root rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Not treated.											
Sclerotinia wilt and crown rot (Legumes)	Present				XXX	XXX				XXX	XXX	XXX	
	Treated	Not treated.											
Seedling blights (Grasses and Legumes)	Present				XXX			XXX	XXX				
	Treated	Not treated.											
Snow molds (Grasses)	Present	XXX	XXX										XXX
	Treated	Not treated.											
Stem rust (Grasses)	Present						XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Stem smut (Grasses)	Present							XXX	XXX	XXX			
	Treated	Not treated.											
Stripe rust (Grasses)	Present						XXX	XXX	XXX				
	Treated	Not treated.											

Activity Table for Forages in the Columbia Basin Uplands (continued)

Insects		J	F	M	A	M	J	J	A	S	O	N	D
Aphid, blue alfalfa (Legumes)	Present			XXX	XXX	XXX			XXX	XXX			
	Treated			XXX	XXX	XXX			XXX	XXX			
Aphid, cowpea (Legumes)	Present								XXX	XXX	XXX		
	Treated								XXX	XXX	XXX		
Aphid, pea (Legumes)	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX		XXX	XXX	XXX		
Aphid, spotted alfalfa (Legumes)	Present							XXX	XXX	XXX			
	Treated							XXX	XXX	XXX			
Billbugs	Present								XXX	XXX	XXX	XXX	
	Treated								XXX	XXX	XXX	XXX	
Black grass bug (Grasses)	Present						XXX	XXX	XXX				
	Treated						XXX	XXX	XXX				
Cereal leaf beetle (Cereals)	Present					XXX	XXX	XXX					
	Treated					XXX	XXX	XXX					
Clover leaf weevil (Legumes)	Present			XXX	XXX								
	Treated			XXX	XXX								
Clover root curculio (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Cutworms (All Forage Types)	Present				XXX	XXX				XXX			
	Treated				XXX	XXX				XXX			
Grasshoppers	Present							XXX	XXX				
	Treated							XXX					
Spider mites	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Winter grain mites (Cereals)	Present			XXX	XXX								
	Treated			XXX	XXX								
Wireworms (All Forage Types)	Present			XXX	XXX								
	Treated			XXX	XXX								
Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bull thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Musk thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Salsify	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			
Scotch thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX		XXX	XXX	XXX			

Activity Table for Forages in the Columbia Basin Uplands (continued)

Perennial Weeds		J	F	M	A	M	J	J	A	S	O	N	D
Blackberry[2]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX			
Bluegrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Nothing done.											
Canada thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX			XXX	XXX			
Clovers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX			XXX	XXX		
Cow parsnip	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Dandelion	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX				XXX	XXX		
Field bindweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX			XXX	XXX			
Foxtail barley	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Horsetail	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	Nothing registered.											
Knapweeds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX								
Perennial pepperweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX							
Perennial sowthistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX						
Plantago spp.	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX			XXX	XXX			
Russian olive[2]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX			XXX	XXX			
Russian thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX				
	Treated			XXX	XXX	XXX			XXX	XXX			
Sagebrushes	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX						
White top	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX							
Wormwoods[2]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Yarrow	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX						

Activity Table for Forages in the Columbia Basin Uplands (continued)

Summer Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual sowthistle	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX						
Barnyardgrass	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Bur buttercups	Present		XXX	XXX									
	Treated		XXX	XXX									
Common lambsquarters	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX						
Knotweeds	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated in grass.											
Foxtails	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated	Not treated.											
Mayweed	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Nightshades	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX						
Pigweeds	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Pineapple weed	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Powell amaranth	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Wild buckwheat	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX						
Winter Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual bluegrass	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Not treated in grass.											
Chickweed	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX				XXX	XXX			
Downy brome	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Fiddleneck	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated			XXX	XXX								
Hare or little barley	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Henbit	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX								
Jointed goatgrass	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Medusahead	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											

Activity Table for Forages in the Columbia Basin Uplands (continued)

Winter Annual Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Mustards	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX				XXX	XXX	XXX	XXX	
Orchardgrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated	Not treated in grass.											
Prickly lettuce (WA/SA in Dryland areas)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX			XXX						
Ryegrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Ventenata grass	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
White cockle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Windgrass	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated	Only treat alfalfa orchardgrass mix in February.											
Wild oats	Present				XXX	XXX	XXX	XXX	XXX				
	Treated	Only treat alfalfa orchardgrass mix in February.											
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present	XXX	XXX	XXX									
	Treated	No treatment.											
Gophers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Voles	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated	XXX	XXX									XXX	XXX

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.

** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

[1] Preplant.

[2] Fencelines and permanent pastures.

Activity Table for Forages in Kittitas County WA

Cultural Activities												
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Planting			XXX	XXX				XXX	XXX			
Fertilizer application			XXX	XXX				XXX	XXX			
Cultivation			XXX	XXX			XXX	XXX	XXX	XXX		
Irrigation				XXX	XXX	XXX	XXX	XXX				
Harvest/Cutting					XXX	XXX	XXX	XXX	XXX	XXX		
Grazing										XXX	XXX	
Take-out/Stand removal			XXX						XXX	XXX		

Pest Management Activities												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Insecticide app.					XXX	XXX	XXX	XXX				
Herbicide app.			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Fungicide app.												
Vertebrate controls	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Soil and water analysis		XXX	XXX					XXX	XXX			
Weed surveys				XXX	XXX	XXX	XXX	XXX				
Keep weather records	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Plant tissue nutrient analysis				XXX	XXX	XXX	XXX	XXX	XXX			
Keep water budget	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Monitor soil moisture	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Monitor soil temperature	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Monitor weed emergence			XXX	XXX	XXX	XXX	XXX	XXX				
Monitor canopy moisture, temperature and humidity				XXX	XXX	XXX	XXX	XXX	XXX			
Monitor temperature and humidity	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Seasonal Pest Occurrence													
Nematodes[1]		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Columbia root knot nematode (*Meloidogyne chitwoodi*)	Present#												
	Treated**												
Stunt nematode	Present												
	Treated												
Ring nematode	Present												
	Treated												

Activity Table for Forages in Kittitas County WA (continued)

Nematodes (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Root lesion nematode (*Pratylenchus neglectus*) (Grasses)	Present												
	Treated												
Root lesion nematode (*P. penetrans*) (Most Forages)	Present												
	Treated												
Diseases		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Damping off (Grasses and Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Ergot (Grasses)	Present						XXX	XXX	XXX				
	Treated												
Head smut (Grasses)	Present							XXX	XXX	XXX			
	Treated												
Kernel smut (Grasses)	Present						XXX	XXX	XXX	XXX			
	Treated												
Leaf blotch (Grasses and Legumes)	Present			XXX	XXX					XXX	XXX		
	Treated												
Leaf rust (Grasses)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Leaf spot (Grasses and Legumes)	Present			XXX	XXX					XXX	XXX		
	Treated												
Leaf stripe (Grasses and Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Root rots (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Sclerotinia wilt and crown rot (Legumes)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated												
Seedling blights (Grasses and Legumes)	Present				XXX			XXX	XXX				
	Treated												
Snow molds (Grasses)	Present	XXX	XXX										XXX
	Treated												
Stem rust (Grasses)	Present						XXX	XXX	XXX	XXX			
	Treated												

Activity Table for Forages in Kittitas County WA (continued)

Diseases (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Stem smut (Grasses)	Present							XXX	XXX	XXX			
	Treated												
Stripe rust (Grasses)	Present						XXX	XXX	XXX				
	Treated												
Insects		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Aphid, spotted alfalfa (Legumes)[2]	Present							XXX	XXX	XXX			
	Treated												
Billbugs	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated								XXX	XXX	XXX		
Black grass bug (Grasses)	Present							XXX	XXX				
	Treated												
Cereal leaf beetle (Cereals)	Present						XXX	XXX					
	Treated						XXX	XXX					
Cutworms (All Forage Types)	Present			XXX	XXX								
	Treated												
Grasshoppers	Present							XXX	XXX	XXX	XXX		
	Treated												
Winter grain mites (Cereals)	Present										XXX	XXX	
	Treated												
Wireworms (All Forage Types)	Present			XXX	XXX								
	Treated												
Mites (Timothy)	Present						XXX	XXX	XXX				
	Treated						XXX	XXX	XXX				
Biennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Bull thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX			XXX	XXX	
Musk thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX			XXX	XXX	
Salsify	Present				XXX	XXX	XXX						
	Treated				XXX	XXX	XXX				XXX	XXX	
Scotch thistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX			XXX	XXX	
Tansy ragwort	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated					XXX	XXX	XXX	XXX		XXX	XXX	
Perennial Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Blackberry	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Bluegrasses	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Buttercups	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX				XXX	XXX	

Activity Table for Forages in Kittitas County WA (continued)

Perennial Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Canada thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX		
Clovers	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Common tansy	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX			XXX	XXX	
Cow parsnip	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX		XXX	XXX	
Dandelion	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
False dandelion	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated					XXX	XXX	XXX			XXX	XXX	
Field bindweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Foxtail barley	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Fireweed	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated					XXX	XXX	XXX	XXX	XXX	XXX		
Hemp nettle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX			XXX	XXX	
Horsetail	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Knapweeds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX					
Knotweeds	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated							XXX	XXX	XXX	XXX	XXX	
Orange hawkweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX			XXX	XXX	
Other larkspurs	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX	XXX				XXX	XXX	
Oxeye daisy	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX			XXX	XXX	
Perennial pepperweed	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX			XXX	XXX	
Perennial sowthistle	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX			XXX	XXX	
Tall larkspur	Present		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX	XXX				XXX	XXX	
Toadflax	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX	XXX	XXX	
White top	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX				XXX	XXX	

Activity Table for Forages in Kittitas County WA (continued)

Perennial Weeds (cont.)		J	F	M	A	M	J	J	A	S	O	N	D
Wild rose	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Wormwoods	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated					XXX	XXX	XXX	XXX		XXX	XXX	
Summer Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual sowthistle	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX	XXX	XXX				
Barnyardgrass	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX	XXX	XXX				
Common lambsquarters	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX	XXX	XXX				
Foxtails	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX	XXX	XXX				
Mayweed	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated					XXX	XXX	XXX			XXX	XXX	
Nightshades	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX	XXX	XXX				
Pigweeds	Present				XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX	XXX	XXX				
Pineapple weed	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Powell amaranth	Present				XXX	XXX	XXX	XXX	XXX	XXX			
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Russian thistle	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Winter Annual Weeds		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Annual bluegrass	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX							
Chickweed	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated			XXX	XXX	XXX	XXX	XXX	XXX				
Downy brome	Present	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
Fiddleneck	Present			XXX	XXX	XXX	XXX	XXX	XXX				
	Treated				XXX	XXX	XXX	XXX					
Hare or little barley[3]	Present	XXX	XXX	XXX	XXX	XXX	XXX		XXX	XXX	XXX	XXX	XXX
	Treated								XXX	XXX			
Henbit	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX				
Jointed goatgrass	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX			XXX	XXX	XXX	
Mustards	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			

Activity Table for Forages in Kittitas County WA (continued)

Winter Annual Weeds (continued)		J	F	M	A	M	J	J	A	S	O	N	D
Orchardgrasses[4]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated			XXX	XXX	XXX							
Prickly lettuce (WA/SA in Dryland Areas)	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated				XXX	XXX	XXX	XXX	XXX	XXX			
Ryegrasses[4]	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated			XXX	XXX	XXX	XXX	XXX	XXX	XXX			
Volunteer oats[4]	Present				XXX	XXX	XXX	XXX	XXX				
	Treated												
White cockle[3]	Present			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	Treated				XXX	XXX	XXX	XXX	XXX		XXX	XXX	
Wild oats[4]	Present				XXX	XXX	XXX	XXX	XXX				
	Treated												
Vertebrate Pests		**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Canada geese	Present	XXX	XXX	XXX						XXX	XXX		
	Treated	XXX	XXX	XXX									
Voles	Present	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	Treated		XXX	XXX	XXX							XXX	XXX

[1] These nematodes are suspected of being present in timothy fields in this region. Fumigation with metam sodium (Vapam) is occasionally done to target other pests (mainly billbugs and Kentucky bluegrass seeds), which may also help control nematodes as well.

[2] There are a few timothy/alfalfa stands. It is in these fields that spotted alfalfa aphid may be found. Chemicals registered for spotted alfalfa aphid control are not registered on timothy, so no controls would be used for this pest.

[3] Since there are not many good grass control options in timothy, these weeds are managed with tillage.

[4] These weeds emerge much earlier than the timothy and may be able to be controlled with a wiper or wicking application.

# Indicates periods when pests occur in fields. Population densities may or may not reach treatable levels. This ***DOES*** indicate the mere presence of pests in a field.
** When field activities are likely. This ***DOES NOT*** indicate the mere presence of pests in a field (e.g., perennial weeds and some insect and nematode pests may be found in fields all year, but management activities only occur as indicated in the table).

Insect Management in Forages (excluding Alfalfa)

This table is a compilation of information concerning the efficacy of various compounds and practices on forage insects. They are not an indication of registration for specific pests, although we have indicated their general registration on forage species. The tables do compare the relative efficacy of available and potential products for each pest, thereby indicating where research and registration efforts are needed.

Management Tool	Aphid, bird cherry oat	Aphid, clover	Aphid, cowpea	Aphids (pea, blue alfalfa and alfalfa)	Aphid, Russian wheat	Aphid, spotted alfalfa	Aphid, yellow sugarcane	Armyworm	Black cutworm	Black grass bug	Blister beetle (adult)	Caspus bugs (AK)	Cereal leaf beetle	Clover leaf weevil	Clover crown/root borer	Clover root curculio	Clover seed chalcid	Crane flies	Garden symphylan	Grasshoppers	Gray garden slug	Pea leaf weevil	Sod webworm (HI)	Western spotted cucumber Beetle	Wireworms	Spider mites	Alfalfa weevil	Cutworms	Wheat stem sawfly	Winter grain mites	Clover mites	Mormon crickets	Comments
Registered Insecticides																																	
bifenazate (Acramite)	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	G	P						(Section 18 NV and WA)
bifenthrin (Capture)	?	?	?	G		G	?	G	G	G	?	?	?	?						?		?		?	1	G	G						Causes mite and aphid flareups. Issues with resistance. 1. Soil-applied - Not yet registered on forage crops.
carbaryl (Sevin)										F										?												G-E*	Causes mite flareups. *UT
clothianidin (Poncho 600) (seed treatment)																									G								
chlorpyrifos (Lorsban)				G		G														G (when small)							G	E					Registered for wheat.
cyfluthrin (Baythroid)																																	

Insect Management in Forages (excluding Alfalfa) (continued)

Management Tool	Aphid, bird cherry oat	Aphid, clover	Aphid, cowpea	Aphids (pea, blue alfalfa and alfalfa)	Aphid, Russian wheat	Aphid, spotted alfalfa	Aphid, yellow sugarcane	Armyworm	Black cutworm	Black grass bug	Blister beetle (adult)	Caspus bugs (AK)	Cereal leaf beetle	Clover leaf weevil	Clover crown/root borer	Clover root curculio	Clover seed chalcid	Crane flies	Garden symphylan	Grasshoppers	Gray garden slug	Pea leaf weevil	Sod webworm (HI)	Western spotted cucumber Beetle	Wireworms	Spider mites	Alfalfa weevil	Cutworms	Wheat stem sawfly	Winter grain mites	Clover mites	Mormon crickets	Comments
Registered Insecticides (continued)																																	
diflubenzuron (Dimilin)																				G-E*												G-E*	*UT
dormant oils																																	
imidacloprid (Gaucho) (seed treatment)	E				E																				G-F								Aphid control only lasts 30-60 days.
lambda-cyhalothrin (Warrior)	?	?	?	?		?	?	E	E	?	?		?	?						?		?		?						E			Same spectrum as bifenthrin. Better activity on Aphids than bifenthrin.
malathion																																	
methidathion (Supracide) (24(c) in WA)	?	?	?	?		?	?	G	G	G	?			?						G*					G	F							Flares mites in Summer; *UT; 24(c) in ID, NV, WA.
methyl parathion																																	
spinosad (Success, Tracer)																																	
thiamethoxam (Cruiser) (seed treatment)	E				E																				G								Registered on grains.
zeta-cypermethrin (Mustang)																																	Aphid control only lasts 30-60 days.

Insect Management in Forages (excluding Alfalfa) (continued)

Management Tool	Aphid, bird cherry oat	Aphid, clover	Aphid, cowpea	Aphids (pea, blue alfalfa and alfalfa)	Aphid, Russian wheat	Aphid, spotted alfalfa	Aphid, yellow sugarcane	Armyworm	Black cutworm	Black grass bug	Blister beetle (adult)	Caspus bugs (AK)	Cereal leaf beetle	Clover leaf weevil	Clover crown/root borer	Clover root curculio	Clover seed chalcid	Crane flies	Garden symphylan	Grasshoppers	Gray garden slug	Pea leaf weevil	Sod webworm (HI)	Western spotted cucumber beetle	Wireworms	Spider mites	Alfalfa weevil	Cutworms	Wheat stem sawfly	Winter grain mites	Clover mites	Mormon crickets	Comments
IPM and Cultural Controls																																	
Adequate fertilization				*		*										G														F	F		
Adequate irrigation				*		*										G														F	F		
Early cutting																											G						
Plant resistant varieties				E		E					P			P	P	G				P		P							E				
Pre-plant cultivation																																	
Post-harvest cultivation																				G													
Rotate to non-host crops														G	G	G																	
Suppress weed hosts																																	
Spring light cultivation																											F						
Spring grazing										F																	F				F - P	F - P	
Fall grazing										F																							
Burning										F							G														G	?	
Biological Controls																																	
Bacillus thuringiensis																																	Can be good on small caterpillars.

Insect Management in Forages (excluding Alfalfa) (continued)

Management Tool	Aphid, Bird Cherry Oat	Aphid, Clover	Aphid, Cowpea	Aphids (Pea, Blue Alfalfa and Alfalfa)	Aphid, Russian Wheat	Aphid, Spotted Alfalfa	Aphid, Yellow Sugarcane	Armyworm	Black Cutworm	Black Grass Bug	Blister Beetle (Adult)	Caspus Bugs (AK)	Cereal Leaf Beetle	Clover Leaf Weevil	Clover Crown/Root Borer	Clover Root Curculio	Clover Seed Chalcid	Crane Flies	Garden Symphylan	Grasshoppers	Gray Garden Slug	Pea Leaf Weevil	Sod Webworm (HI)	Western Spotted Cucumber Beetle	Wireworms	Spider Mites	Alfalfa Weevil	Cutworms	Wheat Stem Sawfly	Winter Grain Mites	Clover Mites	Mormon Crickets	Comments
Biological Controls (continued)																																	
Bathyplectes curculionis wasp																																	
Beauvaria bassiana fungus																						*											
Generalist predators				*		*																											
Nosema locustae																				F													Can be effective on small instars.
Peristenus wasps																																	
Predatory mites																																	
Predatory wasps *Anaphes* and *T. Julis*													G																				

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; *=not a stand-alone practice.

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA)

This table is a compilation of information concerning the efficacy of various compounds and practices on forage weeds. They are not an indication of registration for specific pests, although we have indicated their general registration on forages. The tables do compare the relative efficacy of available and potential products for each pest, thereby indicating where research and registration efforts are needed.

Winter Annuals	Annual bluegrass	Annual mustard species	Chickweed	Cow cockle	Downy brome	Fiddleneck	Barley	Henbit	Jointed goatgrass	Medusahead	Mustard spp.	Orchardgrasses	Prickly lettuce	Ryegrasses	Shepherd's-purse	Ventenata grass	White cockle	Wild oats	Windgrass																	Comments
Registered Herbicides - Grasses and Cereals																																					
2,4-D amine	N	E	P		N	F	N	G	N	N	G	N	G	N	E	N		N	N																		
2,4-D ester																																					
aminopyralid (Milestone)																																					
clopyralid (Stinger)	N	P	P		N	P	N	P	N	N		N	G	N		N		N	N																		
clopyralid + 2,4-D (Curtail)		E	F		N	?	N	G		N	G	P	G	N		N		N	N																		
dicamba (Banvel, Clarity)	N	F	F		N	?	N	G	N	N	F	N	G	N		N		N	N																		
dicamba + 2,4-D (Weedmaster, Pasturemaster)	N	E	G		N	?	N	G	N	N	G	N	G	N		N		N	N																		
glyphosate (Roundup)	E	G	E		E	G	E	G			G	E	G	E				E	G																		Dormant or pre-plant application only.
gramoxone (Paraquat)																																					Dormant or pre-plant application only.
MCPA (Clean Crop)	N	E	P		N	F	N	F	N	N	G	N	G	N		N		N	N																		
metribuzin (Sencor)	F	G	E		E		P		E		G	F	G	F				P	?																		Grass grown for seed?
metsulfuron (Ally)	P	E	G			?		G		?		P	G	P				P	?																		

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

Winter Annuals (continued)	Annual bluegrass	Annual mustard species	Chickweed	Cow cockle	Downy brome	Fiddleneck	Barley	Henbit	Jointed goatgrass	Medusahead	Mustard spp.	Orchardgrasses	Prickly lettuce	Ryegrasses	Shepherd's-purse	Ventenata grass	White cockle	Wild oats	Windgrass															Comments
Registered Herbicides - Grasses and Cereals (continued)																																		
picloram (Tordon)																																		
triasulfuron (Amber)																																		
triasulfuron + dicamba (Rave)	?	E	G			?	?	G		?	G	?	G	?				?	?															Not registered on W. OR pasture grasses.
triclopyr + 2,4-D (Crossbow)	N	E	G		N	?	N			N	G	N	G	N		N		N	N															
triclopyr + clopyralid (Redeem R & P)	N	?	?		N	?	N			N		N	G	N		N		N	N															
triallate (Far-GO)					G						G				G																			
Registered Herbicides - Legumes																																		
2,4-DB (Butyrac)	N	G	P		N	P	N	G		N	G	N	G	N		N		N	N															
benefin (Balan)	G	P	G		F	G	P	?			P		P	G				A	?															
bromoxynil (Buctril)																																		
clethodim (Select)	G	N	N		G	N	G	N			N	G	N	E	N			E	G															
diuron (Karmex)	G P	G	E		P	G	P	G			G	P	G	F				P																W. OR only.
EPTC (Eptam)	G	P	G				P	F			G	G	G	G				G	G															
glyphosate	E	E	E		E	G	E	G			G	E		E				E	G															
imazamox (Raptor)																																		

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

Winter Annuals (continued)	Annual bluegrass	Annual mustard species	Chickweed	Cow cockle	Downy brome	Fiddleneck	Barley	Henbit	Jointed goatgrass	Medusahead	Mustard spp.	Orchardgrasses	Prickly lettuce	Ryegrasses	Shepherd's-purse	Ventenata grass	White cockle	Wild oats	Windgrass															Comments
Registered Herbicides – Legumes (continued)																																		
imazethapyr (Pursuit)																																		
metribuzin (Sencor)	F	G	E		E		P		E		G	F	G	F				P	?															Grass grown for seed?
pronamide (Kerb)	G	F	E		G	G	G	?			F	P	P	E				G	?															
sethoxydim (Poast)	P	N	N		F	N	F	N			N	G	N	E	N			E	G															
Registered Herbicides - Grass Legume Mixtures																																		
imazapic (Plateau)																																		
metribuzin (Sencor)	F	G	E		E		P		E		G	F	G	F				P	?															Grass grown for seed?

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

Summer Annuals	Annual sowthistle	Barnyardgrass	Common lambsquarters	Green foxtail	Knotweeds	Kochia - surface temp. needed - timing important (needs to be little)	Mayweed	Narrow leaf hawksbeard	Nightshades	Pigweeds	Pineapple weed	Powell amaranth	Prostrate knotweed	Wild buckwheat	Yellow foxtail																				Comments
Registered Herbicides - Grasses and cereals																																		
2,4-D amine	G	R	E	N	F	P - E	F		F	E	F	G		P	N																			
2,4-D ester																																		
aminopyralid (Milestone)																																		
clopyralid (Stinger)	E	N	P	N	F		G		P	P	G	P			N																			
Clopyralid + 2,4-D (Curtail)	E	N	E	N	P		G		G	G	G	G			N																			
dicamba (Banvel, Clarity)	G	N	G	N	G	P - G	G		G	G	G	G		G	N																			Kochia tolerance found.
dicamba + 2,4-D (Weedmaster, Pasturemaster)	E	N	E	N	G	F - E	G		G	E	G	E		E	N																			
glyphosate (Roundup)	G	E	G		E	G	G		G	G	G	G			E																			Dormant or pre-plant application only.
gramoxone (Paraquat)																																		Dormant or pre-plant application only.
MCPA (Clean Crop)	G	N	G	N	F		P		F	G	P	G		P	N																			
metribuzin (Sencor)	F	P	P	P	F	G	F		P	P		P		P	P																			

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

Summer Annuals (continued)	Annual sowthistle	Barnyardgrass	Common lambsquarters	Green foxtail	Knotweeds	Kochia - surface temp. needed - timing important (needs to be little)	Mayweed	Narrow leaf hawksbeard	Nightshades	Pigweeds	Pineapple weed	Powell amaranth	Prostrate knotweed	Wild buckwheat	Yellow foxtail																						Comments
Registered Herbicides - Grasses and cereals (continued)																																				
metsulfuron (Ally)	?		G	?	?		F		G	G		G																								
picloram (Tordon)																																				
triasulfuron (Amber)	?			?	?		?		?																										Not W. OR.
triasulfuron + dicamba (Rave)	G	P	?	?	G		?		?	G		G																								Not grasses grown in W. OR.
triclopyr + 2,4-D (Crossbow)	G	N	E	N	G		F		G	G		G			N																					
triclopyr + clopyralid (Redeem R&P)	G	N	G	N	?		G		G	?	G	?			N																					
triallate (Far-GO)																																				
Registered Herbicides - Legumes																																				
2,4-DB (Butyrac)	G	N	G	N	F		P		F	G	P	G		P	N																					
benefin (Balan)	N	G	G	G	G		P		P	G	P	G			G																					
bromoxynil (Buctril)																																				
clethodim (Select)	N	E	N	E	N		N	N	N	N	N	N		N	E																					
diuron (Karmex)	G	P	P	P	G		G		P	P	G	P		P	P																					W. OR only.

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

Summer Annuals (continued)	Annual sowthistle	Barnyardgrass	Common lambsquarters	Green foxtail	Knotweeds	Kochia - surface temp. needed - timing important (needs to be little)	Mayweed	Narrow leaf hawksbeard	Nightshades	Pigweeds	Pineapple weed	Powell amaranth	Prostrate knotweed	Wild buckwheat	Yellow foxtail																			Comments
Registered Herbicides - Legumes (continued)																																	
EPTC (Eptam)	G	G	G	G	F		?		G	G		G			G																		
glyphosate (Roundup)	G	E	G	E	G		G		G	G	G	G			E																		Dormant or pre-plant application only.
imazamox (Raptor)																																	
imazethapyr (Pursuit)																																	
metribuzin (Sencor)																																	
pronamide (Kerb)	F	G	G	F	G		P		G	G	P	G			F																		
sethoxydim (Poast)	N	G	N	E	N		N		N	N	N	N			E																		
Registered Herbicides - Grass Legume Mixtures																																	
imazapic (Plateau)																																	
metribuzin (Sencor)																																	Alfalfa, sainfoin/grass but can injure grain.

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

Perennials	Blackberry	Butter and eggs/Yellow toadflax	Buttercups	Canada thistle	Clovers (cause bloat)	Common tansy	Cow parsnip	Dandelions	False dandelion	Field bindweed	Fireweed	Foxtail barley	Hemp nettle	Hoarycress/White top	Horsetail rush	Kentucky bluegrass	Knapweeds	Orange Hawkweed	Other larkspurs	Oxeye daisy	Perennial pepperweed	Perennial sowthistle	*Plantago* spp.	Quackgrass									Comments
Registered Herbicides - Grasses and Cereals																																	
2,4-D amine	F	P	P		F		?	G		G	E	N		F	F	P	F	F		F		F	G										
2,4-D ester																																	
aminopyralid (Milestone)																																	
clopyralid (Stinger, Transline)	P			E	G		?	G		P	P	N				P	G	G					P										
clopyralid + 2,4-D (Curtail)				E	G		?	G				N				P	G	G				G	G										
dicamba (Banvel, Clarity)		F			G	F	?	G		F		N				P		F		F			F										
dicamba + 2,4-D (Weedmaster, Pasturemaster)					G		?	E *		G		N		F		P	F						G										*AK
glyphosate (Roundup)	G			G	F		?	G		G	F	G				G	G						F	G									Dormant or pre-plant application only.
gramoxone (Paraquat)																																	Dormant or pre-plant application only.
MCPA (Clean Crop)	P	P	F		P		?	F		G		N			F	P							F										

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

Perennials (continued)	Blackberry	Butter and eggs/Yellow toadflax	Buttercups	Canada thistle	Clovers (cause bloat)	Common tansy	Cow parsnip	Dandelions	False dandelion	Field bindweed	Fireweed	Foxtail barley	Hemp nettle	Hoarycress/White top	Horsetail rush	Kentucky bluegrass	Knapweeds	Orange Hawkweed	Other larkspurs	Oxeye daisy	Perennial pepperweed	Perennial sowthistle	*Plantago* spp.	Quackgrass									Comments
Registered Herbicides - Grasses and Cereals (continued)																																	
metribuzin (Sencor)	P	P			F		?	F		P				P	P	F																	
metsulfuron (Ally)	G			E		G	?							G					G				F									
picloram (Tordon)																																	
triasulfuron (Amber)							?																										
triasulfuron + dicamba (Rave)							?																										
triclopyr + 2,4-D (Crossbow)	G						?	G		G		N											G										
triclopyr + clopyralid (Redeem R & P, Milestone)	G						?	G				N					G						G										
triallate (Far-GO)																																	
Registered Herbicides - Legumes																																	
2,4-DB (Butyrac)	P	P	P		P		?	F		F	P	N			P	P							F										
benefin (Balan)	P				P	P	?	P		P	P				P		P			P													
clethodim (Select)	N	N			N	N	N	N		N	N	G		N	N	G	N			N			N										

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

Perennials (continued)	Blackberry	Butter and eggs/Yellow toadflax	Buttercups	Canada thistle	Clovers (cause bloat)	Common tansy	Cow parsnip	Dandelions	False dandelion	Field bindweed	Fireweed	Foxtail barley	Hemp nettle	Hoarycress/White top	Horsetail rush	Kentucky bluegrass	Knapweeds	Orange Hawkweed	Other larkspurs	Oxeye daisy	Perennial pepperweed	Perennial sowthistle	*Plantago* spp.	Quackgrass									Comments
Registered Herbicides - Legumes (continued)																																	
diuron (Karmex)	P	P			P-F		?	P		P	P	G			P	P							P										W. OR only.
EPTC (Eptam)	P				P		?	P		P					P																		
glyphosate	G				F		?	G		G	F	G				G	G						F										
metribuzin (Sencor)	P	P			F		?	F		P				P	P	F																	
pronamide (Kerb)	P				P		?	P		P		G		N	P	G	P			P													
sethoxydim (Poast)	N	N			N	N	N	N		N	N	G		N	N	G	N			N			N										
Registered Herbicides - Grass Legume Mixtures																																	
imazapic (Plateau)																																	
metribuzin (Sencor)																																	

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

	Perennials (continued)									Biennials					
	Sheep sorrel	Stinging nettle	Tall larkspur	Toadflax	Wild rose	Wormwoods	Yarrow	Yellow hawkweed	White campion	Bull thistle	Musk thistle	Salsify	Scotch thistle	Tansy ragwort	Comments
Registered Herbicides - Grasses and Cereals															
2,4-D amine	F						F	F		G		G		G	
2,4-D ester															
aminopyralid (Milestone)															
clopyralid (Stinger)	G							G		G		G			
clopyralid + 2,4-D (Curtail)	G							G		G		G		G	
dicamba (Banvel, Clarity)	G						G	F				F		G	
dicamba + 2,4-D (Weedmaster, Pasturemaster)	G									G		G		G	
glyphosate (Roundup)	G				G					G					Dormant or pre-plant application only.
gramoxone (Paraquat)															Dormant or pre-plant application only.
MCPA (Clean Crop)	F									G					
metribuzin (Sencor)															
metsulfuron (Ally)			G											G	

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

	Perennials (continued)									Biennials																							
	Sheep sorrel	Stinging nettle	Tall larkspur	Toadflax	Wild rose	Wormwoods	Yarrow	Yellow hawkweed	White campion	Bull thistle	Musk thistle	Salsify	Scotch thistle	Tansy ragwort																			Comments
Registered Herbicides - Grasses and Cereals (continued)																																	
picloram (Tordon)																																	
triasulfuron (Amber)																																	
triasulfuron + dicamba (Rave)																																	
triclopyr + 2,4-D (Crossbow)					G		G							G																			
triclopyr + clopyralid (Redeem R & P)	G				G																												
triallate (Far-GO)																																	
Registered Herbicides - Legumes																																	
2,4-DB (Butyrac)	F																																
benefin (Balan)														P																			
bromoxynil (Buctril)																																	
clethodim (Select)	N	N	N	N	N	N	N	N	N		N	N	N	N	N																		
diuron (Karmex)	P			G	E	G					P			G																			W. OR only.
EPTC (Eptam)																																	
glyphosate (Roundup)	G				G																												Dormant or pre-plant application only.

Weed Management in Forages (excluding Alfalfa) West of the Cascades (OR, WA) (continued)

	Perennials (continued)										Biennials																							
	Sheep sorrel	Stinging nettle	Tall larkspur	Toadflax	Wild rose	Wormwoods	Yarrow	Yellow hawkweed	White campion		Bull thistle	Musk thistle	Salsify	Scotch thistle	Tansy ragwort																				Comments
Registered Herbicides - Legumes (continued)																																		
imazamox (Raptor)																																		
imazethapyr (Pursuit)																																		
metribuzin (Sencor)																																		
pronamide (Kerb)															P																			
sethoxydim (Poast)	N	N	N	N	N	N	N	N	N		N	N	N	N	N																			
Registered Herbicides - Grass Legume Mixtures																																		
imazapic (Plateau)																																		
metribuzin (Sencor)																																		

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

Weed Management in Forages (excluding Alfalfa) in Alaska

This table is a compilation of information concerning the efficacy of various compounds and practices on weed pests of forage crops in Alaska. Entries do not indicate registration for specific pests. The tables compare the relative efficacies of available and potential products for each weed, thereby indicating where research and registration efforts are needed.

	Annuals																								
Registered Herbicides	**Annual bluegrass**	**Chickweed**	**Common lambsquarters**	**Corn spurry**	**Cow cockle**	**Hemp-nettle**	**Narrow leaf hawksbeard**	**Northern bedstraw**	**Mustard spp.**	**Pineapple weed**	**Prostrate knotweed**	**Rattlebox**	**Shepherd's-purse**	**Wild buckwheat**	**Wild oats**											**Comments**
2,4-D			E						G				E												
2,4-D + dicamba + metsulfuron (Cimarron Max)						G	G					G													
dicamba (Banvel, Clarity)		G	G			G		G		G	F	G		G											
dicamba + 2,4-D (Weedmaster)		G	E		G					G				E											
clopyralid (Stinger, Transline)										G															
clopyralid + 2,4-D (Curtail)			E				G			G			G	G											
glyphosate (Roundup)	E										F		G		E										Dormant or pre-plant application only.
MCPA (Clean Crop)			G			G			G			F	F												
metsulfuron (Cimarron)		G	G		G	G	G		G		G	F	G	G											
metsulfuron + thifensulfuron + tribenuron (Ally Extra)				G	G	G	G	G				G		G											
thifensulfuron + tribenuron (Harmony Extra)		G		E	G			G	G	G	F														

Weed Management in Forages (excluding Alfalfa) in Alaska (continued)

	Annuals																							
Registered Herbicides (continued)	**Annual bluegrass**	**Chickweed**	**Common lambsquarters**	**Corn spurry**	**Cow cockle**	**Hemp-nettle**	**Narrow leaf hawksbeard**	**Northern bedstraw**	**Mustard spp.**	**Pineapple weed**	**Prostrate knotweed**	**Rattlebox**	**Shepherd's-purse**	**Wild buckwheat**	**Wild oats**										**Comments**
triclopyr (Garlon, Remedy)		G	G										F											
triclopyr + 2,4-D (Crossbow)		G							G															
triclopyr + clopyralid (Redeem)											F		F											

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

	Perennials																							
Registered Herbicides	**Bluejoint**	**Buttercups**	**Canada thistle**	**Common tansy**	**Cow parsnip**	**Dandelions**	**Dock**	**Fall dandelion**	**Fireweed**	**Foxtail barley**	**Horsetail**	**Larkspur, tall**	**Orange hawkweed**	**Oxeye daisy**	**Perennial sowthistle**	***Plantago* spp.**	**Quackgrass**	**Sheep sorrel**	**Toadflax**	**Tufted hairgrass**	**Yarrow**	**Yellow hawkweed**	**Wild iris**	**Wild rose**	**Comments**
2,4-D						G	P		E		F			F	G	G		F			F	F	G	G	
2,4-D + dicamba + metsulfuron (Cimarron Max)							G								G								G		
aminopyralid (Milestone VM)							G						E	G							G	E			
clopyralid (Stinger, Transline)			E			G		G	P				G	G					G		P			G	

Weed Management in Forages (excluding Alfalfa) in Alaska (continued)

	Perennials																							
Registered Herbicides (continued)	**Bluejoint**	**Buttercups**	**Canada thistle**	**Common tansy**	**Cow parsnip**	**Dandelions**	**Dock**	**Fall dandelion**	**Fireweed**	**Foxtail barley**	**Horsetail**	**Larkspur, tall**	**Orange hawkweed**	**Oxeye daisy**	**Perennial sowthistle**	***Plantago* spp.**	**Quackgrass**	**Sheep sorrel**	**Toadflax**	**Tufted hairgrass**	**Yarrow**	**Yellow hawkweed**	**Wild iris**	**Wild rose**	**Comments**
clopyralid + 2,4-D (Curtail)			E			G		G						G	G			G				G			
dicamba (Banvel)				F			G							F				G	G		G				
dicamba + 2,4-D (Weedmaster)						E												G							
glyphosate (Roundup)	G		E						F	G					E		G	G		G					dormant or pre-plant application only
gramoxone (Paraquat)									G																dormant or pre-plant application only
MCPA (Clean Crop)		F	G								F			G		G					G				
metsulfuron (Cimarron)			G	G			G	F				G			G	G					G			G	
metsulfuron + thifensulfuron + tribenuron (Ally Extra)																G									
thifensulfuron + tribenuron (Harmony extra) triclopyr (Garlon, Remedy)																					G			G	
triclopyr + 2,4-D (Crossbow)					E						E														
triclopyr + clopyralid (Redeem)																G									

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

Weed Management in Forages (excluding Alfalfa)

This table is a compilation of information concerning the efficacy of various compounds and practices on forage weeds. They are not an indication of registration for specific pests, although we have indicated their general registration on forages. The tables do compare the relative efficacy of available and potential products for each pest, thereby indicating where research and registration efforts are needed.

Winter Annuals	Annual bluegrass	Annual mustard species	Chickweed	Cow cockle	Downy brome	Fiddleneck	Barley	Henbit	Jointed goatgrass	Medusahead	Mustard spp.	Nightflowering Silene	Orchardgrasses	Prickly lettuce	Ryegrasses	Shepherd's-purse	Ventenata grass	White cockle	Wild oats	Windgrass													Comments
Registered Herbicides - Grasses and Cereals																																	
2,4-D amine	N		P	P	N		N		N	N	G-E		N	E	N	G	N		N	N													
2,4-D ester	N		P	P	N		N		N	N	G-E		N	E	N	G	N		N	N													
aminopyralid (Milestone)	N		P		N		N		N	N			N		N		N		N	N													
clopyralid (Stinger, Transline)	N		P	P	N	N	N	N	N	N	N	P	N	E	N	N	N	N	N	N													
clopyralid + 2,4-D (Curtail)	N				N		N		N	N	G		N	E	N		N		N	N													
dicamba (Banvel, Clarity)	N		G		N		N		N	N	F		N	E	N	F	N		N	N													
dicamba + 2,4-D (Weedmaster, Pasturemaster)	N		G		N		N		N	N	G		N	E	N	G	N		N	N													
glyphosate (Roundup)	E				E				N	G	G				N		E		E	G													Dormant or pre-plant application only.
gramoxone (Paraquat)																																	Dormant or pre-plant application only.
MCPA (Clean Crop)	N		P	P	N		N	P	N	N	F		N	G	N	F	N		N	N													

Weed Management in Forages (excluding Alfalfa) (continued)

Winter Annuals (continued)	Annual bluegrass	Annual mustard species	Chickweed	Cow cockle	Downy brome	Fiddleneck	Barley	Henbit	Jointed goatgrass	Medusahead	Mustard spp.	Nightflowering Silene	Orchardgrasses	Prickly lettuce	Ryegrasses	Shepherd's-purse	Ventenata grass	White cockle	Wild oats	Windgrass																	Comments
Registered Herbicides - Grasses and Cereals (continued)																																					
Metribuzin (Sencor)	G		F		E				E				F	G	G	G	G	F	E																		
metsulfuron (Cimarron)				G																																	
picloram (Tordon)	N				N		N			N			N		N		N		N	N																	
triasulfuron (Amber)						E		G			E			E		E			N																		
triasulfuron + dicamba (Rave)						E					E			E		E																					
triclopyr + 2,4-D (Crossbow)	N				N		N		N	N	G		N		N		N		N	N																	
triclopyr + clopyralid (Redeem R & P)	N				N		N		N	N			N		N		N		N	N																	
triallate (Far-GO)																																					
Registered Herbicides - Legumes																																					
2,4-DB (Butyrac)	N		P		N		N		N	N				F	N		N		N	N																	
benefin (Balan)	E				G		E												G																	
bromoxynil (Buctril)																																					
clethodim (Select)	F		N	N	G	N	E	N		N	N	N	G	N	E	N		N	G																		
diuron (Karmex)				F	G		E	G						P			G		G																		W. OR only.
EPTC (Eptam)	E				E		E												G																	
glyphosate (Roundup)	E				E		E												G																	Dormant or pre-plant application only.

Weed Management in Forages (excluding Alfalfa) (continued)

Winter Annuals (continued)	Annual bluegrass	Annual mustard species	Chickweed	Cow cockle	Downy brome	Fiddleneck	Barley	Henbit	Jointed goatgrass	Medusahead	Mustard spp.	Nightflowering Silene	Orchardgrasses	Prickly lettuce	Ryegrasses	Shepherd's-purse	Ventenata grass	White cockle	Wild oats	Windgrass																Comments
Registered Herbicides - Legumes (continued)																																				
imazamox (Raptor)																																				
imazethapyr (Pursuit)																																				
metribuzin (Sencor)							E				G			E		G			G																	
pronamide (Kerb)						N	E	N			N	N		N		N		N	G																	
sethoxydim (Poast)	P		N	N	F	N	E	N			N	N		N		N		N	G																	
Registered Herbicides - Grass Legume Mixtures																																				
imazapic (Plateau)																																				
metribuzin (Sencor)			F		E			E			G					G			E																	

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

Weed Management in Forages (excluding Alfalfa) (continued)

Summer Annuals	Annual sowthistle	Barnyardgrass	Common lambsquarters	Corn spurry	Green foxtail	Knotweeds	Kochia - surface temp. needed - timing important (needs to be little)	Lambsquarters	Mayweed	Narrow leaf hawksbeard	Nightshades	Pigweeds	Pineapple weed	Powell amaranth	Prickly lettuce	Prostrate knotweed	Wild buckwheat	Wild buckwheat	Yellow foxtail	Russian thistle													Comments
Registered Herbicides - Grasses and Cereals																																	
2,4-D amine	E	N	E		N	P	P - E	G	P		G	E	P		E		P		N	F													
2,4-D ester	E	N	E		N	P	G	G	P		G	E	P		E		P		N	G													
aminopyralid (Milestone)		N			N														N														
clopyralid (Stinger, Transline)	E	N	P		N	G	P	P	G		P	P	P		P		G		N	P													
Clopyralid + 2,4-D (Curtail)	E	N	G		N	G	F	G	G		G	G			E				N	F													
dicamba (Banvel, Clarity)	P	N	G		N	G	P-G	E	F		F		P		E		G		N	E													Kochia tolerance found.
dicamba + 2,4-D (Weedmaster, Pasturemaster)	E	N	E		N	E	F - E	E	G		G	E	F		G		G		N	E													
glyphosate (Roundup)		E	G		E		G												G	G													Dormant or pre-plant application only.
gramoxone (Paraquat)																																	Dormant or pre-plant application only.
MCPA (Clean Crop)	F	N			N		P	G	P		F	G	P		G		P		N														
metribuzin (Sencor)	G	G				G	G	E	F		F	G	P		G		P			G													
metsulfuron (Cimarron)						P	F									G			N														

Weed Management in Forages (excluding Alfalfa) (continued)

Summer Annuals (continued)	Annual sowthistle	Barnyardgrass	Common lambsquarters	Corn spurry	Green foxtail	Knotweeds	Kochia - surface temp. needed - timing important (needs to be little)	Lambsquarters	Mayweed	Narrow leaf hawksbeard	Nightshades	Pigweeds	Pineapple weed	Powell amaranth	Prickly lettuce	Prostrate knotweed	Wild buckwheat	Wild buckwheat	Yellow foxtail	Russian thistle																	Comments
Registered Herbicides - Grasses and Cereals (continued)																																					
picloram (Tordon)		N			N		F										G		N																	
triasulfuron (Amber)		P				F	G	P	F			E	E		E		G			P																
triasulfuron + dicamba (Rave)		P				G		G	F			E	E		E		G			G																
triclopyr + 2,4-D (Crossbow)		N									G	G							N																	
triclopyr + clopyralid (Redeem R & P)	E	N							G								G		N																	
triallate (Far-GO)																																					
Registered Herbicides - Legumes																																					
2,4-DB (Butyrac)					N		F				F				F				N	P																
benefin (Balan)							G				N									F																
bromoxynil (Buctril)																																					
clethodim (Select)	N		N		G	N	N	N	N	N	N	N	N	N	N	N	N		G	N																
diuron (Karmex)	F						E				P									G																W. OR only.
EPTC (Eptam)							G				G									F																
glyphosate (Roundup)					E		G	E			G	G			G				G	G																Dormant or pre-plant application only.
imazamox (Raptor)																																					

Weed Management in Forages (excluding Alfalfa) (continued)

Summer Annuals (continued)	Annual sowthistle	Barnyardgrass	Common lambsquarters	Corn spurry	Green foxtail	Knotweeds	Kochia - surface temp. needed - timing important (needs to be little)	Lambsquarters	Mayweed	Narrow leaf hawksbeard	Nightshades	Pigweeds	Pineapple weed	Powell amaranth	Prickly lettuce	Prostrate knotweed	Wild buckwheat	Wild buckwheat	Yellow foxtail	Russian thistle														Comments
Registered Herbicides - Legumes (continued)																																		
Imazethapyr (Pursuit)																																		
metribuzin (Sencor)	G					G	G	E	F		F	G	P		G		P			G														
pronamide (Kerb)	P										P									P													
sethoxydim (Poast)	H	G	N		G	N	N	N	N	N	N	N	N	N	N	N	N		G	N														
Registered Herbicides - Grass Legume Mixtures																																		
imazapic (Plateau)																																		
metribuzin (Sencor)	G					G	G	E			F	G	P		G		P			G														Alfalfa, Sainfoin/grass but can injure grain.

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

Weed Management in Forages (excluding Alfalfa) (continued)

Perennials	Blackberry	Buttercups	Canada thistle	Clovers (cause bloat)	Common tansy	Cow parsnip	Dandelions	False dandelion	Field bindweed	Fireweed	Foxtail barley	Hemp nettle	Hoarycress/White top	Horsetail	Kentucky	Knapweeds	Orange hawkweed	Other larkspurs	Oxeye daisy	Perennial pepperweed	Perennial sowthistle	*Plantago* spp.	Plantain	Quackgrass	Russian olive	Russian Thistle	Sagebrushes	Sedge spp.					Comments
Registered Herbicides - Grasses and Cereals																																	
2,4-D amine							G																										
2,4-D ester																																	
aminopyralid (Milestone)																																	
clopyralid (Stinger, Transline)							F																										
clopyralid + 2,4-D (Curtail)			E				G																										
dicamba (Banvel, Clarity)							G																										
dicamba + 2,4-D (Weedmaster, Pasturemaster)							E *																										*AK.
glyphosate (Roundup)			E																					G									Dormant or pre-plant application only.
gramoxone (Paraquat)																																	Dormant or pre-plant application only.
MCPA (Clean Crop)																																	
metsulfuron (Cimarron)			E																														

Weed Management in Forages (excluding Alfalfa) (continued)

Perennials (continued)	Blackberry	Buttercups	Canada thistle	Clovers (cause bloat)	Common tansy	Cow parsnip	Dandelions	False dandelion	Field bindweed	Fireweed	Foxtail barley	Hemp nettle	Hoarycress/White top	Horsetail	Kentucky	Knapweeds	Orange hawkweed	Other larkspurs	Oxeye daisy	Perennial pepperweed	Perennial sowthistle	*Plantago* spp.	Plantain	Quackgrass	Russian olive	Russian Thistle	Sagebrushes	Sedge spp.					Comments
Registered Herbicides - Grasses and Cereals (continued)																																	
picloram (Tordon)																																	
triasulfuron (Amber)																																	
triasulfuron + dicamba (Rave)																																	
triclopyr + 2,4-D (Crossbow)						E																											
triclopyr + clopyralid (Redeem R & P, Milestone)																																	
triallate (Far-GO)																																	
Registered Herbicides - Legumes																																	
2,4-DB (Butyrac)																																	
benefin (Balan)																																	
bromoxynil (Buctril)																																	
clethodim (Select)																																	
diuron (Karmex)											G																						W. OR only
EPTC (Eptam)																																	

Weed Management in Forages (excluding Alfalfa) (continued)

Perennials (continued)	Blackberry	Buttercups	Canada thistle	Clovers (cause bloat)	Common tansy	Cow parsnip	Dandelions	False dandelion	Field bindweed	Fireweed	Foxtail barley	Hemp nettle	Hoarycress/White top	Horsetail	Kentucky	Knapweeds	Orange hawkweed	Other larkspurs	Oxeye daisy	Perennial pepperweed	Perennial sowthistle	*Plantago* spp.	Plantain	Quackgrass	Russian olive	Russian Thistle	Sagebrushes	Sedge spp.					Comments
Registered Herbicides - Legumes (continued)																																	
glyphosate (Roundup)																																	dormant or pre-plant application only
metribuzin (Sencor)							F																										
pronamide (Kerb)																																	
sethoxydim (Poast)																																	
Registered Herbicides - Grass Legume Mixtures																																	
imazapic (Plateau)																																	
metribuzin (Sencor)																																	

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

Weed Management in Forages (excluding Alfalfa) (continued)

	Perennials (continued)										Biennials						
	Sheep sorrel	Stinging nettle	Tall larkspur	Toadflax	Tufted hairgrass	Wild rose	Wormwoods	Yarrow	Yellow hawkweed	White campion	Bull thistle	Musk thistle	Salsify	Scotch thistle	Tansy ragwort	Wormwoods	Comments
Registered Herbicides - Grasses																	
2,4-D amine	G	G	F	N	N	F		F			G	G	F	G			
2,4-D ester			F	F	N	F		F		F	G	G		G	G		
aminopyralid (Milestone)				P	N			G	E		E	E		E			
clopyralid (Stinger, Transline)	P	P	P	N		N		P	E	N	E	E	G	E	E		
clopyralid + 2,4-D (Curtail)			P	P		P		P			E	E	G	E	E		
dicamba (Banvel, Clarity)				P		P		F			E	E		E	E		
dicamba + 2,4-D (Weedmaster, Pasturemaster)				P							E	E		E	E		
glyphosate (Roundup)				P							E	E		E	E		Dormant or pre-plant application only.
gramoxone (Paraquat)																	Dormant or pre-plant application only.
MCPA (Clean Crop)				P				G			G	G		G	G		
metribuzin (Sencor)			P	P		P	P			N							
metsulfuron (Cimarron)						F		G									

Weed Management in Forages (excluding Alfalfa) (continued)

	Perennials (continued)											Biennials																							
	Sheep sorrel	Stinging nettle	Tall larkspur	Toadflax	Tufted hairgrass	Wild rose	Wormwoods	Yarrow	Yellow hawkweed	White campion		Bull thistle	Musk thistle	Salsify	Scotch thistle	Tansy ragwort	Wormwoods																			Comments
Registered Herbicides - Grasses (continued)																																			
picloram (Tordon)			G	G		G						E	E		E	E																			
triasulfuron (Amber)												F	F		F	F																			
triasulfuron + dicamba (Rave)												G	G		G	G																			
triclopyr + 2,4-D (Crossbow)				P								E	E		E	E																			
triclopyr + clopyralid (Redeem R & P)				P								E	E		E	E																			
triallate (Far-GO)																																			
Registered Herbicides - Legumes																																			
2,4-DB (Butyrac)	F	F	N	N		N	N	F	F	N		F	F	P	F	F																			
benefin (Balan)	N	N	N	N	N	N	N	N	N	N		N	N	N	N	N	N																		
bromoxynil (Buctril)																																			
clethodim (Select)	N	N	N	N	N	N	N	N	N	N		N	N	N	N	N	N																		
diuron (Karmex)				N																														W. OR only.
EPTC (Eptam)	N	N	N	N	N	N	N	N	N	N		N	N	N	N	N	N																		
glyphosate (Roundup)				P																														Dormant or pre-plant application only.
metribuzin (Sencor)			P	P		P	P			N																									

Weed Management in Forages (excluding Alfalfa) (continued)

	Perennials (continued)											Biennials																							
	Sheep sorrel	Stinging nettle	Tall larkspur	Toadflax	Tufted hairgrass	Wild rose	Wormwoods	Yarrow	Yellow hawkweed	White campion		Bull thistle	Musk thistle	Salsify	Scotch thistle	Tansy ragwort	Wormwoods																			Comments
Registered Herbicides - Legumes (continued)																																			
pronamide (Kerb)	N	N	N	N	N	N	N	N	N	N		N	N	N	N	N	N																		
sethoxydim (Poast)	N	N	N	N		N	N	N	N	N		N	N	N	N	N	N																		
Registered Herbicides - Grass Legume Mixtures																																			
imazapic (Plateau)																																			
metribuzin (Sencor)			P	P		P	P			N																									

Efficacy Rating Symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=No Data; N=No control because not the right chemistry; Blank=Efficacy unknown.

Disease Management on Forages (Excluding Alfalfa)

This table is a compilation of information concerning the efficacy of various compounds and practices on Forage diseases. They are not an indication of registration for specific pests although we have indicated their general registration on Forages. The tables do compare the relative efficacy of available and potential products for each pest thereby indicating where research and registration efforts are needed.

	Bacterial stripe	Barley stripe	Barley yellow dwarf virus	Damping off and Seedling blight (Fusarium)	Damping off and Seedling blight (Phytophthora)	Damping off and Seedling blight (Pythium)	Damping off and Seedling blight (Rhizoctonia)	Ergot	Halo ring	Head smut	High plains disease	Kernel smut	Leaf blotch	Leaf rust	Leaf spot	Leaf stripe	Loose smut	Net blotch	Powdery mildew	Root and crown rot (Fusarium)	Root and crown rot (Phytophthora)	Root and crown rot (Pythium)	Root and crown rot (Rhizoctonia)	Scald	Sclerotinia (white mold)	Silvertop	Snow molds	Stagonospora root rot	Stem rust	Stem smut	Stripe rust	Take-all	Wheat streak mosaic virus	Comments
Registered Fungicides																																		
carboxin (Vitavax) (seed treatment)										G		G					G													G				In cereals.
fludioxonil (Maxim) (seed treatment)				G		G	G																											In legumes and cereals (forage grasses are on the label—cannot be grazed until 30 days after planting).
mefenoxam (Apron) (seed treatment)					E	E																												
metalaxyl (Allegiance) (seed treatment)						E																												In legumes.
mefenoxam (Ridomil)				-	G	G	-																											

Disease Management on Forages (Excluding Alfalfa) (continued)

	Bacterial stripe	Barley stripe	Barley yellow dwarf virus	Damping off and Seedling blight (Fusarium)	Damping off and Seedling blight (Phytophthora)	Damping off and Seedling blight (Pythium)	Damping off and Seedling blight (Rhizoctonia)	Ergot	Halo ring	Head smut	High plains disease	Kernel smut	Leaf blotch	Leaf rust	Leaf spot	Leaf stripe	Loose smut	Net blotch	Powdery mildew	Root and crown rot (Fusarium)	Root and crown rot (Phytophthora)	Root and crown rot (Pythium)	Root and crown rot (Rhizoctonia)	Scald	Sclerotinia (white mold)	Silvertop	Snow molds	Stagonospora root rot	Stem rust	Stem smut	Stripe rust	Take-all	Wheat streak mosaic virus	Comments
IPM and Cultural Controls																																		
Avoid plant injury								E												E														
Certified seed								E																	E									
Crop rotation																									E							G		
Deep plow																									F							G		Deep plowing is only given an "F" for sclerotinia, because the next time you deep plow, you'll turn up surviving sclerotia. (They'll persist for longer than 8 years.)
Delay planting			F	F		F	F				F																					F		
Early cutting													P																P	P	P			
Irrigation management				E	E	E	E						F						P G	G	E	E	G								F			

Disease Management on Forages (Excluding Alfalfa) (continued)

	Bacterial stripe	Barley stripe	Barley yellow dwarf virus	Damping off and Seedling blight (Fusarium)	Damping off and Seedling blight (Phytophthora)	Damping off and Seedling blight (Pythium)	Damping off and Seedling blight (Rhizoctonia)	Ergot	Halo ring	Head smut	High plains disease	Kernel smut	Leaf blotch	Leaf rust	Leaf spot	Leaf stripe	Loose smut	Net blotch	Powdery mildew	Root and crown rot (Fusarium)	Root and crown rot (Phytophthora)	Root and crown rot (Pythium)	Root and crown rot (Rhizoctonia)	Scald	Sclerotinia (white mold)	Silvertop	Snow molds	Stagonospora root rot	Stem rust	Stem smut	Stripe rust	Take-all	Wheat streak mosaic virus	Comments
IPM and Cultural Controls (continued)																																	
Nutrient management																															F G		
Resistant cultivars													E						F G	G ?	E	G ?	G ?										
Sanitation of equipment																																	
Stubble burning								F												F													Open field burning.
Stubble tillage																																	
Weed management																									G								
Vector control			P G								G																						
Biological Controls																																	

Efficacy rating symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=no data, but suspected of being efficacious; X=no rating given; NU=Not used.

Nematode Management on Forages (Excluding Alfalfa)

This table is a compilation of information concerning the efficacy of various compounds and practices on alfalfa and clover seed insects. They are not an indication of registration for specific pests, although we have indicated their general registration on alfalfa and clover seed. The tables do compare the relative efficacy of available and potential products for each pest, thereby indicating where research and registration efforts are needed.

Management Tool	Root-knot nematode	Root nematode	Root lesion	Cereal cyst	Stem	Columbia root-knot	Comments
Fumigants							
metam-sodium (Vapam)							In timothy hay, metam-sodium applications are used to target insect and weed pests. Some nematode control is achieved as a side benefit.
IPM and Cultural Controls							
Adequate fertilization	G	G	G	G	G		
Adequate irrigation	F		F	F	F		
Green manures	F		F	F	F		
Plant resistant varieties	F-P		P?	?	P		
Pre-plant cultivation			P		F-P		
Pre-plant burning							
Rotate to non-host crops	G				G-E		
Suppression of weed hosts	G		F-P		G-E		

Efficacy rating symbols: E=Excellent (90-100% control); G=Good (80-90% control); F=Fair (70-80% control); P=Poor (<70% control); ?=no data, but suspected of being efficacious; X=no rating given.

Toxicity Ratings on Pollinators and Beneficial Insects in Forages

AB=Alkali bee (*Nomia melanderi* Cockerell), **HB**=Honey bee (*Apis mellifera* Linnaeus), **LCB**=Alfalfa Leafcutting bee (*Megachile rotundata* Fabricius), **BEB**=Big-eyed bugs (*Geocoris* spp.), **CB**=Carabid beetles (Carabidae family) and Rove beetles (Staphylinidae family), **DB**=Damsel bugs (*Nabis* spp.), **LW**=Lacewings (*Chrysopa* spp.), **LB**=Lady beetles (*Coccinella septempunctata*, *Harmonia axyridis*, *Hippodamia convergens, Stethorus* spp., many others), **MPB**=Minute pirate bugs (*Orius* spp.), **PBT**=Predatory beetles (*Stethorus* spp.), **PM**=Predatory mites (Acari: Phytoseiidae), **PN**=Predatory nematodes, **PW**=Parasitic wasps (Braconidae, Chalcidae, Ichneumonidae and Mymaridae families), **S**=Dwarf spiders (*Erigone aletris*, *E. blaesa*, and *E. dentosa*), **SF**=Syrphid flies and Flower flies (Syrphidae family), **TF**=Tachinid flies, and **TSS**=Two-spotted stinkbug (*Perillus bioculatus* Fabricius).

Rating Scale: E=Excellent survivability (non-toxic), G=Good survivability (slightly toxic), F=Fair survivability (moderately toxic), P=Poor survivability (highly toxic), ND=No Data, Blank=do not know, NA=Not applicable.

Rating Scale (Pollinators Only): 0=no data or experience available, 1=do not apply to blooming plants (residual greater than 1 day), 2=apply in evening after bees have stopped foraging (residual 4-12 hours), 3=apply in late evening until early morning (residual 2-4 hours), 4=apply at any time with reasonable safety to bees (residual negligible).

	Pollinators			Beneficial Insects												
	AB	**HB**	**LCB**	**BEB**	**CB**	**DB**	**LW**	**LB**	**MPB**	**PBT**	**PM**	**PN**	**PW**	**S**	**SF**	**TF**	**TSS**
Registered Insecticides/Miticides																	
bifenazate (Acramite)	1	1	1	G	G	G	G	G-E	G-E	G	G	ND	G	G	G	G	G
bifenthrin (Capture)	1	1	1	F-P	P	F-P	F-P	F-P	F-P	F-P	P	ND	P	P	P	P	P
carbaryl (Sevin)	1	1	1	F-G	FP	F-G	F-G	F-P	F-P	F-P	P	ND	F	F	F	F	P
carbofuran (Furadan)	1	1	1	F-P	P	F-P	F-P	F-P	F-P	F-P	P	F-P	P	F-P	P	P	P
chlorpyrifos (Lorsban)	1	1	1	F-P	P	F-P	P	F-P	F-P	F-P	F-P	P	P	P	P	P	P
cyfluthrin (Baythroid)	1	1	1	F?	F-P	F-P	F-P	F-P	F-P	F-P	P	ND	P	P?	P	P	P
diflubenzuron (Dimilin)	2	0	0	F	G	F	F	F-P	F	G	F	ND	ND	ND	ND	ND	ND
imidacloprid (Gaucho) (seed treatment)	NA	NA	NA	E	G	E	E	E	E	ND	G	ND	E	E	E	E	E
lambda-cyhalothrin (Warrior)	1	1	1	F-P	P	F-P	F-P	F-P	F-P	P	P	ND	F-P	P	F-P	F-P	FP

Toxicity Ratings on Pollinators and Beneficial Insects in Forages (continued)

Registered Insecticides/Miticides (continued)																	
methidathion (Supracide)	1	1	1	F-P	P	F-P	F-P	F-P	F-P	P	F-P	ND	FP	P	P	P	F-P
methyl parathion (Penncap-M, Methyl Parathion)	1	1	1	P	P	P	P	P	P	P	P	P	P	P	P	P	P
spinosad (Entrust, SpinTor, Success, Tracer)	F	F	F	F	G	F	F-G	F	F	G	G	ND	F	F	F	F	ND
sulfur (Sulfur)	4	4	4	G	G	G	F-G	F-G	G-P	F-G	P	ND	F	ND	F	F	F-P
thiamethoxam (Cruiser) (seed treatment)		E		E	G	E	E	E	E	G	G		E	E	E	E	E
zeta-cypermethrin (Mustang)	1	1	1	F-P	FP	F-P	F-P	F-P	F-P	F-P	P	ND	F-P	F	F-P	F-P	F-P
Insect Biocontrols																	
Bacillus thuringiensis	4	4	4	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Bathyplectes curculionis wasp	4	4	4	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Beauvaria bassiana fungus	0	0	0	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Nosema locustae	4	4	4	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Peristenus wasps	4	4	4	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Predatory Wasps *Anaphes* & *T. Julis*	4	4	4	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Predatory flies	4	4	4	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Fungicides																	
mefenoxam (Ridomil Gold)				ND		ND	ND	ND	ND		G	P	ND	ND	ND	ND	

Toxicity Ratings on Pollinators and Beneficial Insects in Forages (continued)

Cultural/Non-chemical Controls	
Adjacent area management	May be hazardous if habitat is removed.
Avoid excessive nitrogen	Neutral.
Baited traps	Neutral.
Cover crops	Provide good habitat, shelter, and alternative prey for the beneficials.
Crop rotation	Variable ecological impacts on polyphagous natural enemies.
Enhancing habitat for beneficials	Beneficial, habitat, shelter, and alternative prey.
Equipment sanitation	Neutral.
Flaming	Temporary hazard to soil surface and foliage-borne fauna.
Irrigation scheduling	Neutral.
Irrigation amount	Neutral.
Mowing	Short-term disruption to foliage dwellers.
Mulching	Beneficial, habitat, shelter, and alternative prey.
Plant resistant varieties	Neutral.
Tillage	Short-term disruption to soil dwellers.
Weed management	May impact habitat/alternative prey for some species.