Production Profile for Winter Wheat in Nebraska

Prepared: November, 2003

General Production Information

Hard red winter wheat is produced throughout Nebraska; however, 75% of the wheat production is in the western half of the state, with approximately 45% grown in the Panhandle. Approximately 92% of the winter wheat acreage is in dryland production. Because most of the wheat is grown in an arid region (ca. 14-21 inches annual rainfall), water availability is the limiting factor in wheat production in western Nebraska.

In 1999, Nebraska ranked 6th in the United States in winter wheat production. Wheat acreage runs around 2 million acres with 1.8 million harvested in 1999 (Table 1). Record wheat yields were seen in 1999 at 48 bushels per acre. Total production for 1999 was 86.4 million bushels. Few acres of spring wheat are produced in Nebraska because it matures later in the summer than winter wheat resulting reduced yields due to heat stress. Some Nebraska growers are beginning to grow hard white winter wheat, but current acreage is less than 10,000 acres. This is projected to increase in the future, but will be limited by the handling and identity preservation capabilities of the marketing system.

Table 1. Wheat production in Nebraska, 1999 (source Nebraska Ag Statistics Service).

	All wheat (1000 acres)	**Dryland (1000 acres)**	**Irrigated (1000 acres)**
Acres planted	2,000	1,890	110
Acres harvested (grain)	1,800	1,699	101
Yield (bu/A)	48.0	46.9	66.0
Production (bu)	86,400	79,734	6,666

Winter wheat production is characterized by very narrow profits margins. Average wheat yields of 36.1bushels per acre at an average price of $3.25 per bushel results a gross value of $117 per acre. The average production costs in Nebraska are estimated to be $104 (excluding land ownership/rent) resulting in a profit margin of $13 per acre. Limited per acre profits result in growers needing to farm large acreage to make sufficient profits, and this limits the grower's ability to manage pests. Another complicating factor in wheat production in Nebraska is the risk of drought or hail. The western part of

the state being arid is prone to dry periods, but a good portion of western Nebraska is also in an area of highest risk for hail in the United States. These factors make wheat growers in Nebraska very conservative in their management of the wheat crop and in management of the pests of wheat.

Much of the wheat in western Nebraska has historically been grown in a wheat-fallow rotation with the fallow period used to increase water storage in the soil. Over the last two decades there has been an increase in rotations with an additional crop being grown. This crop has included corn, sorghum, millet, or sunflowers. The inclusion of these crops in the rotation has in some cases displaced fallow but most often has been in addition to the wheat-fallow. Because of the need to conserve all available water, the move to increased diversity in the crop rotation has occurred in conjunction with an increase in no-till or minimum till practices. This shift to more intensive rotations and reduced tillage practices has been most prevalent in the wheat growing areas of western Nebraska with the highest rainfall (i.e. southwest, 17-21 inches annual rainfall). Movement to a more diverse rotation has been slower in the Panhandle where moisture is more limiting. However, recent changes in the farm bill have resulted in an increase in the Panhandle in more diverse rotations with growers including more corn, sunflower, millet or other crops in their rotation with wheat and fallow. These rotation considerations, along with the Conservation Reserve Program (CRP), have resulted in reducing wheat acreage in Nebraska about a million acres from 3 million acres in 1980.

Winter wheat planting begins in the west in late August at the higher elevations and proceeds to the east with the latest planting occurring in the east. Harvesting of the previous crop may delay planting in irrigated fields into late September or early October. Moisture availability for seed germination and plant emergence is the greatest concern for growers in the fall, and often growers will risk increased insect or disease problems to plant early when soil moisture is optimum. Reduced growth of the wheat in the fall leaves fields prone to wind erosion through the winter because of the reduced precipitation that occurs through this time. Winter wheat in Nebraska will break dormancy in March, and spring moisture will be critical to developing yield potential. Harvest of wheat in Nebraska begins in the east in late June or early July and continues to the west with harvest in the highest elevations in the west (Panhandle) occurring in mid to late July. During the summer, weed management in fallow fields is critical to maintaining available soil moisture for wheat to be planted in the fall.

Growers rely heavily on the yield and other characteristics associated with the varieties that they plant. First consideration in variety selection is potential yield and seed quality. Wheat Maturity and winter hardiness are extremely important factors in a varieties ability to produce consistent yields in Nebraska. Plant height and straw strength are important factors in maintaining adequate surface residue while preventing lodging. Coleoptile length is important because seeds with longer coleoptile length will emerge better when being planted deep to reach moisture under dry planting conditions. Insect and disease resistant varieties are very important manage tools because they may reduce costly management practices (e.g. pesticide applications).

Insect Pests

There are no insect pests that damage wheat across the entire state of Nebraska. The most serious problems are sporadic and limited to certain regions of the state. The most serious arthropod pest in the state is the wheat curl mite, which transmits two virus diseases to wheat, wheat streak mosaic virus and high plains virus. The most serious insect pest in western Nebraska is the Russian wheat aphid followed by the army and pale western cutworms. The most serious wheat insect problems in eastern Nebraska are the greenbug and the Hessian fly. Because of the narrow profit margins found in dryland wheat production, growers try to minimize the inputs involved for management of insect problems. As a result, they rely on resistant varieties where available and on corrective measures of control. However, the low profit margins and risk involved in wheat production make growers hesitant to treat wheat with costly insecticides.

Wheat curl mite (WCM): The WCM transmits two viruses to wheat, wheat streak mosaic and High Plains viruses. This virus complex is perhaps the most serious disease problem for growers in the western half of Nebraska. The mite is managed by cultural practices, primarily with controlling volunteer wheat after harvest and delaying planting date. Volunteer wheat provides the mite with a summer host, and eliminating volunteer wheat reduces the mites' ability to over-summer and infest wheat in the fall. Delayed fall planting also assists in the management of this disease by reducing the likelihood of significant fall infestations. Effective chemical control is very limited with Furadan 4F applied at planting the only effective method. This is very expensive, especially considering the sporadic nature of the problem. This pest problem occurs statewide, but it is most severe in the western half of the state.

Russian wheat aphid (RWA): The Russian wheat aphid is the most serious insect pest in Nebraska; however, it is primarily found in damaging levels in the Panhandle and southwest counties. It is very damaging when population levels are high, and populations can increase rapidly to cause damage. It was first introduced into Nebraska in 1987 and caused serious damage the first several years it was present. It has been much reduced in its presence in the last several years, but this reduction has been due primarily to favorable environmental conditions that have reduced populations. Management of the insect relies on over-summering volunteer control, avoiding early planting, and scouting and applying insecticides based on economic thresholds. Recently, a few varieties of wheat, released by Colorado State University, have done well in the Panhandle, and have been grown on a limited acreage in high-risk areas. Insecticides that provide the best control of RWA are chlorpyrifos (Lorsban 4E-SG) and disulfoton (Di-Syston 8E). Additional products that may be used are dimethoate (several generic formulations) and lambda-cyhalothrin (Warrior).

Cutworms: Two species of cutworms, the pale western cutworm and the army cutworm, can be found damaging wheat in western Nebraska. The pale western cutworm is the most damaging of the two because it feeds just below the ground on the stems and is more destructive to the plant. The pale western cutworm increases in presence during years of dry conditions, and damaging populations may take several years to build up. The army cutworm is more commonly seen throughout the region, but it is much less damaging as it grazes on the plant leaves and this damage is much less severe to the plant.

Cultural practices have little impact on these insects so management relies primarily on scouting and the application of thresholds. The threshold for the pale western cutworm is 1 or more per foot of row, and the threshold of the army cutworm is 4-5 per foot of row. The most effective insecticides for control of these insects include lambda-cyhalothrin (Warrior) and chlorpyrifos (Lorsban 4E).

Grasshoppers: Grasshoppers are an annual problem in some localized areas, but they become more serious regionally on a 5-10 year cycle. The greatest problem with grasshoppers in winter wheat occurs in the fall when wheat is first emerging. Grasshoppers moving in from border areas, feed on the emerging wheat causing the small plants to die and reducing or eliminating plant stands. Damage to wheat can also occur in the early summer when the wheat is maturing. Grasshoppers move from adjacent grasslands to wheat and feed on the flag leaves and head and can cause serious damage by clipping the head off the plants. Control of grasshoppers at this time is problematic because preharvest intervals preclude use of most registered insecticides. Delaying planting in the fall can reduce the risk of fall grasshopper damage. Insecticides that have been use to control grasshoppers in the fall include phorate (Thimet 20G) and carbofuran (Furadan 4F; SLN registration) applied at planting.

Greenbug: The greenbug can be a serious pest of wheat, but it occurs very sporadically on wheat in Nebraska. It is most likely to develop into a problem in the southern counties of the state. It may be found on wheat in the fall as it moves from other crops to wheat to cause damage as the wheat is establishing. Greenbugs produce direct damage to the plants, but the greenbug can also transmit barely yellow dwarf virus to the wheat. Early planting will increase the risk of infestations. Spring infestations do occur, but rarely develop into economic problems. Other cultural practices have little impact on the greenbug infestations. Insecticide treatments are seldom required, but may be used in the fall to control 'hot spots' infestations.

Hessian fly: The Hessian fly seldom causes serious damage in Nebraska, but has been known to be a problem. Planting after fly free dates works well to control the insect, but many growers do not follow fly-free dates as they try to establish their wheat during the most optimal soil moisture times. Also, in western Nebraska, fly-free dates are not followed because elevation changes do not allow wheat enough time to establish in the fall if wheat is not planted earlier. Control of volunteer wheat is also beneficial in reducing Hessian fly, and several varieties are available that are resistant to Hessian fly. No insecticides are used for control of Hessian fly in Nebraska.

Table 2. Insecticide use on winter wheat in Nebraska for the main insect pests.

Insect	**Infestation Frequency**	**Insecticides used**	**Rate ai/A**	**% acres treated**
Russian wheat aphid	one year in five	Lorsban 4E-SG Di-Syston 8E	0.5 1.0	<5%

Pale western cutworm	one year in seven	Warrior Lorsban 4E-SG	0.02 0.5	<1%
Army cutworm	one year in seven	Warrior Lorsban 4E-SG	0.02 0.5	<1%
Grasshoppers	one year in five	Furadan 4F (SLN) Thimet 20G Lorsban 4E-SG Warrior	0.25 oz [1] 1.2 oz [1] 0.5 0.025	2%
Greenbug	one year in ten			0
Hessian fly	one year in ten			0

[1] Expressed as formulation per 1000 row feet.

Diseases

Several diseases impact winter wheat in Nebraska. In western Nebraska, the most serious diseases are wheat streak mosaic, which is transmitted by the wheat curl mite, and crown and root rot. In eastern Nebraska, soil-borne mosaic and leaf rust are the primary disease problems. Additional diseases, including barley yellow dwarf, smut diseases, Septoria leaf and head diseases, Fusarium head blight (scab), Cephalosporium stripe and tan spot can also become important on a localized scale. Because of the low profit margin in dryland winter wheat and the sporadic nature of the diseases, most disease management practices are cultural practices that require limited input costs. The health of a wheat crop is the result of management factors related to varieties, seed quality, seedbed, planting date, residue management and weed control.

Using adapted varieties that are resistant to major diseases is an important management tactic. Varietal resistance or tolerance is important in leaf rust and soil borne mosaic in eastern Nebraska and for wheat streak mosaic in western Nebraska.

Several diseases can be associated with poor seed quality or bin run seed. Using certified, disease-free seed is an important management tool for these seed associated diseases. Additional control of these diseases can be obtained from fungicide treatments to the seed, but the additional cost of this practice

limits its use. It is estimated that less than 1% of seed planted in Nebraska is treated with a seed treatment fungicide.

Seedbed quality is an important component of disease management. In addition to insuring a rapid germination and emergence of the wheat plant, the health and vigor of the wheat seedling will influence its susceptibility to disease. Crown and root rot is a disease complex caused by the interaction of infection of crowns and roots by fungi, harsh winter conditions, early planting and loose seedbeds. A loose seedbed and prolonged moisture stress coupled with relatively high soil temperatures in the fall enhance early disease development in the crown and root.

Reducing stress on the plants by planting at the optimal date into a firm and moist seedbed will lower the risk from the crown and root rot disease complex. Planting too early will also increase the risk of wheat streak mosaic and barley yellow dwarf as it will allow for earlier vector buildup in the wheat. This will also increase the likelihood of drought stress on the plants, which will increase the risk of root and crown rots.

Some diseases are affected by crop rotation and plant residue management. Cephalosporium stripe and tan spot are most severe in continuous wheat where they carry over on wheat residue and infect the wheat the following season. Rotation of wheat with fallow or other non-cereal crops will reduce the risk from these diseases.

The higher yield potential and per acre value of irrigated wheat influences the management practices of diseases. Growers are more likely to treat irrigated winter wheat with fungicides to protect from leaf rust because of the increased value. Also, certified seed production fields would benefit from foliar fungicide treatment through improved seed quality and health.

Even with fungicide options available, growers in Nebraska likely treat less than 1% of the wheat acreage with foliar fungicides. Propiconazole (Tilt) would be the most used foliar fungicide in Nebraska. Azoxystrobin (Quadris) is newly registered and may be used more in the future.

Table 3. Cultural practices that influence wheat diseases (adapted from Univ. Nebraska Cooperative Extension Publication EC95-1873).

Cultural practice	**Diseases influenced**	**Best Management Practice**	**Other control options**
Varieties	Rusts	resistant varieties	foliar fungicide
	soil-borne mosaic	resistant varieties	proper planting date
Seed quality	loose smut, common smut, scab, black point	certified seed	seed treatment fungicide

Seedbed	root / crown rot	firm/mellow seedbed, proper planting date	seed treatment fungicide
Planting time	root / crown rot	firm/mellow seedbed, proper planting date	seed treatment fungicide
	wheat streak mosaic	proper planting date, post-harvest weed control	tolerant varieties
	High Plains virus	proper planting date, post-harvest weed control	none
	soil-borne mosaic	resistant varieties	proper planting date
	barley yellow dwarf	proper planting date	tolerant varieties
	Cephalosporium stripe	2-year rotation, tolerant varieties	proper planting date
Residue management, post-harvest weed control	tan spot, Septoria diseases	foliar fungicide, rotation	stubble mulching
	Cephalosporium stripe	2-year rotation, tolerant varieties	proper planting date
	wheat streak mosaic High Plains virus	proper planting date, post-harvest weed control	tolerant varieties

Weeds

Good weed management in winter wheat in Nebraska is important to obtaining optimum yields. Limited soil moisture rapidly creates yield limiting competition with weed populations. However, a well established wheat canopy provides very good competition against weeds. This is especially true in relation to spring germinating annual weed species.

The most problematic weeds in winter wheat in Nebraska are the winter annual grasses. Because of their similarity in life cycle to wheat, they are capable of providing the greatest competition with wheat. Also,

their similarity to wheat limits the herbicide options that are effective against these grasses. The most serious winter annual grass weeds are jointed goatgrass, downy brome, and volunteer rye. Management of these winter annual grass weeds relies mostly on cultural practices. Eliminating weed seed sources in and around the fields is important, and planting weed free seed will help maintain uninfested fields weed free. Cleaning out combines before harvesting clean fields will limit spread. Delaying planting date until after the first flush of weed germination in the fall can reduce problems. Also, tillage is used to initiate weed germination and plowing is used to bury seed and reduce its germination potential. The most effective control option for these winter annual grasses is the use of rotations with summer crops to help break the winter annual cycle. The best rotation is to use at least a 4-year rotation, but 3-year rotations will also help to reduce weed pressure. A final important aspect to managing these weeds is to reduce weed seed buildup by maintaining good control of these weeds during the fallow period. Fallow weed control is done using both tillage and herbicide methods. Herbicide treatment for these weeds does occur with Roundup used on very limited acres to control volunteer rye during the spring while the rye is much taller than the wheat and rye seed has not begun developing on the plant.

Wheat competes well against annual, warm season broadleaves, but winter annual broadleaf weeds, such as field pennycress and blue mustard, can be very competitive. Reduced wheat canopy can result in significant warm season broadleaf weed problems. Management of these weed problems relies on good control of these weeds in the other crops in the rotation and in the fallow. Herbicides are effective at reducing these weed problems and are most commonly applied in the spring for weed control. Most of these herbicides are applied in early spring before the wheat has begun jointing. Broadleaf weeds that are problematic include Russian thistle, kochia, common sunflower, field pennycress, and blue and tansy mustard. One problem developing in the region is ALS resistant kochia. These weeds are becoming much more difficult to control with ALS-inhibiting herbicides (sulfonylurea herbicides).

Approximately 70% of Nebraska’s winter wheat is treated with herbicides. Most of this is targeted at controlling the summer annual broad leaves, which are sprayed late in the fall or early in the spring. Most of this herbicide is sprayed with ground equipment either directly by the grower or by commercial applicators. A small amount, less than 5%, is applied aerially.

Glyphosate (Roundup, several formulations) is the primary herbicide used during fallow periods. It is often mixed with 2,4-D or dicamba to increase efficiency on broadleaf weeds such as kochia and Russian thistle. Under dry, stressful conditions, paraquat (Gramoxone Extra) may be substituted for glyphosate. Paraquat (Gramoxone Extra) is often combined with atrazine in the ecofallow system.

Table 4. Estimated herbicide use on winter wheat in Nebraska.

Herbicide	Rate (lbs/A)	Applications per season	Percent Area Treated
2,4-D [1]	0.44	1	32

Metsulfuron-methyl (Ally) [1]	0.004	1	29
Triasulfuron (Amber) [1]	0.01	1	8
Chlorsulfuron (Finesse, Glean) [1]	0.01	1	3
dicamba (Banvel) [2]	0.19	1	3-5%
sulfosulfuron (Maverick) [2]	0.03	1	<1%

[1] Source: Nebraska AG Statistics Service, 1999.

[2] Estimated use of these products.

Contacts

David Baltensperger &#9
Alternative Crops Specialist
University of Nebraska
Panhandle Research and Extension Center
Scottsbluff Nebraska
(308) 632-1261
e-mail: dbaltens@unlnotes.unl.edu

Paul Burgener
Agricultural Economic Research Analyst
University of Nebraska
Panhandle Research and Extension Center
Scottsbluff Nebraska
(308) 632-1241
e-mail: pburgene@unlnotes.unl.edu

Gary Hein
Entomologist University of Nebraska
Panhandle Research and Extension Center
Scottsbluff Nebraska
(308) 632-1369
e-mail: ghein@unlnotes.unl.edu

Drew Lyon

Dryland Crops Specialist
University of Nebraska
Panhandle Research and Extension Center
Scottsbluff Nebraska
(308) 632-1266
e-mail: dlyon@unlnotes.unl.edu

John Watkins
Plant Pathology Specialist
University of Nebraska
Department of Plant Pathology
Lincoln, Nebraska
(402) 472-2559
e-mail: lwyoming@unlnotes.unl.edu

Prepared by:

Dr. Gary Hein
Extension Entomologist
Panhandle Research and Extension Center
4502 Ave. I
Scottsbluff, NE 69361
Ph. (308) 632-1369

Dr. Shripat Kamble
Professor of Entomology
Department of Entomology
University of Nebraska, Lincoln
Plant Industry Bldg. 202
Lincoln, Nebraska 68583
Ph.: (402) 472-6857

References

1. Crop Protection Reference. 1999. 15th Edition. C&P Press. New York.

2. Guide for Weed Management in Nebraska. 2000. University of Nebraska Cooperative Extension EC 00-130-D.

3. High Plains Integrated Pest Management Guide for Colorado-Western Nebraska-Wyoming. No. 564A. 1998. Colorado State University, Fort Collins.

4. Nebraska Agricultural Statistics Service.

5. University of Nebraska, Entomology Website. http://www.ianr.unl.edu/ianr/entomol/entdept.htm