Crop Profile for Wheat in Idaho

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General Production Information

- In 1998, Idaho ranked ninth in U.S. production of all wheat, eighth in winter wheat production, and fifth in all other spring wheat production.
- Wheat ranked fourth in Idaho's total cash receipts from farm markets.
- Idaho wheat ranked third in the U.S. in yield per acre.
- Cash receipts from Idaho wheat were estimated at $271,000,000 with an export value of $213,000,000.
- Idaho produced 102,000,000 bushels of wheat on 1,500,000 harvested acres.
- Production costs averaged $210 per acre in northern Idaho and $220 per acre in southern Idaho.
- Idaho all-wheat production regions:
    - Northern Idaho - 410,000 harvested acres.
    - Eastern Idaho - 689,000 harvested acres.
    - Southcentral Idaho - 284,000 harvested acres.
    - Southwestern Idaho - 117,000 harvested acres.

Cultural Practices

Soft white winter and soft white spring wheat are the predominant small grains grown in Idaho, and comprise about 80% of Idaho's total wheat production. Hard red spring (12%) and hard red winter wheat (12%) account for the remaining small grain crops. Exports are the single most important market for

Idaho and Pacific Northwest soft white wheat. A small percentage is used domestically for seed, pastry flour and oriental noodles. Soft white wheat has a soft texture and low protein content. These traits make it undesirable for bread flour but desirable for pastries and other baked goods. Thus, Idaho=s soft white wheat has a separate export market relative to the red wheats.

Revenue from Idaho wheat varies regionally. Wheat is both a rotational and a main cash crop. In southern Idaho, growers settle for modest returns or even losses, to obtain rotational increased yields on other crops such as potatoes, sugar beets and beans in subsequent years. In the dryland areas of northern and eastern Idaho, wheat is a main cash crop. In relative terms, wheat revenue is greatest in northern and eastern Idaho, and smallest in southcentral and western Idaho.

In southern Idaho, wheat is grown in the following rotations: wheat/corn/alfalfa, wheat/fallow/wheat, alfalfa/wheat/barley, potatoes/wheat/corn, and sugar beets/wheat. In northern Idaho, wheat is typically grown in alternate years with spring peas or lentils, or with spring barley, spring peas or lentils in a three-year rotation.

Annual precipitation in Idaho varies among the wheat producing regions. Southern Idaho receives 10 to 14 inches of precipitation, and northern Idaho receives 15-25 inches. Nearly all precipitation in all production regions occurs during winter and spring. In southern Idaho, irrigation is essential for most wheat production, while in northern Idaho wheat production depends entirely upon winter and spring precipitation.

Optimal seeding dates range from September 10 through November 1 for winter wheat, and from mid-March through May for spring wheat. Seeding rates for winter wheat range from 70-100 lbs/acre on dryland, and from 100-130 lbs/acre on irrigated land. Seeding rates for spring wheat typically are 20% greater than for winter wheat.

Winter wheat is planted using either conservation tillage or conventional tillage. In conventional tillage, seedbed preparation includes fall plowing or chiseling the ground after harvest of the preceding crop. In a conservation tillage system, wheat is planted into the preceding crop residue. This system is especially useful for fall planted wheat in years when there is little available moisture. Reducing the number of tillage operations, combined with planting directly into crop residue conserves soil moisture for the following wheat crop. Most winter wheat receives a fertilizer application before planting and a second application in the spring. Seedbed preparation for spring wheat involves tilling the ground in April, applying fertilizer and cultivating/harrowing and planting. Wheat is harvested directly with a combine, and begins in late July and continues through September. Harvest of spring wheat usually begins in mid-August and continues through September.

IPM Practices

Several different cultural practices are integrated into wheat production to reduce pesticide inputs and to suppress pest populations to an economically acceptable level. About 70 to 90% of wheat growers in southern Idaho delay planting of winter wheat, and plant spring wheat early to avoid aphid flights. Avoiding peak aphid populations minimizes direct aphid damage to wheat plants and the incidence of barley yellow dwarf virus and other aphid transmitted diseases. Crop rotation with certain nonhost crops is practiced by about 80% of growers to reduce the buildup of insect pests, weeds, diseases and nematodes and to increase wheat yields. About 75% of wheat growers scout fields for insect pests and natural predators, and base pesticide applications on an economic threshold.

Insect Pests

APHIDS

The major aphid species that cause damage to Idaho wheat are the English grain aphid, birdcherry oat aphid, greenbug, Russian wheat aphid and the rose grass aphid. These aphids cause economic loss to wheat in years when environmental conditions favor high aphid reproductive rates and survival, and when natural predators are minimal or lag behind aphid development. Warm, dry conditions during the fall promote high aphid numbers and damage to fall planted winter wheat. Cool, dry spring conditions also favor high aphid numbers and cause damage to both fall and spring planted wheat. Summer temperatures above 90 degrees F significantly reduce aphid populations.

Depending on the aphid species and year, grain crops are damaged by direct feeding, injection of toxins or by virus transmission. Aphids generally reduce the number of wheat heads per plant, lower grain weight, reduce grains per head and reduce grain quality.

Greenbug (*Schizaphis graminum*)
The greenbug is found throughout the wheat producing areas east of the Cascades. Greenbug populations are usually highest in the fall because natural enemies become inactive or reproduce much slower during cool fall periods. Like most aphids, greenbugs give birth to live young without mating activity. Greenbugs have piercing, sucking mouthparts for extracting juices from the plant while injecting toxins and enzymes. Greenbugs are important vectors of barley yellow dwarf virus (BYDV), especially in the high mountain valleys of eastern Idaho. Wheat fields must be carefully monitored because high numbers of greenbugs can significantly damage entire wheat fields.

Bird birdcherry-oat aphid (*Rhopalosiphum padi*)
The birdcherry oat aphid (BCOA) is the most important vector of BYDV in western Idaho. This aphid

alternates between chokecherry bushes in winter and grain crops and grasses in summer. They become particularly abundant on maturing corn, which serves as a host for both the aphid and BYDV. The BCOA often occurs in combination with greenbugs in most of the wheat-producing regions.

Rose grass aphid (*Metopolephium dirhodum*)
This aphid alternates between rose bushes in winter and small grain crops and grasses in summer. Peak aphid populations occur on the leaves of spring wheat and barley in the milk to soft dough stages. They are occasionally abundant in the fall on autumn sown crops where they can contribute significantly to the spread of BYDV.

English grain aphid (*Macrosiphum avenae*)
This aphid causes the most direct damage by feeding on heads of maturing grain. The life cycle of the English grain aphid is keyed to cereal development. Eggs are deposited in the autumn on leaves of early-planted winter cereal crops, and hatch in mid-April. After several generations of asexual reproduction, winged forms are produced that disperse to spring planted wheat and late-planted winter wheat. Yield loss results from reduced number of grains per head. Spring wheat is more susceptible to English grain aphid damage because it is in an earlier stage of development than winter wheat at the time of high aphid numbers.

Russian wheat aphid (*Diuraphis noxia*)
The Russian wheat aphid (RWA) is a pest of wheat in southern Idaho. In the fall, feeding females may cause severe damage to late-planted winter wheat. Feeding secretions of RWA are toxic to wheat plants, and result in leaf rolling. RWA usually over-winter as live-bearing females, consequently, fall infestations do not always translate into spring infestations, unless winter conditions are mild and dry. In average years, the RWA does not over-winter in high numbers. Growers who must plant wheat before RWA flights have subsided apply an at-planting insecticide, an insecticide seed treatment, or a foliar insecticide later in the fall season. Treatment generally occurs when 10% of fall wheat plants are infested prior to tillering, or in the spring, if 5% of the plants show fresh aphid damage before jointing.

Control

Aphid populations vary from year to year and among the wheat producing regions. Often natural enemies and local weather conditions hold aphid numbers below the economic threshold. In an average year of moderate aphid infestation, about 10% of the wheat acreage would require an insecticide treatment. About every 4-5 years, environmental conditions favor high aphid survival, and cause about 30% of the wheat acres to be treated with an insecticide. Methods of insecticide application include insecticide seed treatments, at-planting systemics and foliar applied insecticides.

Chemical control:

Insecticide seed treatment:

- **Imidacloprid (Gaucho) --** Applied to about 5% of the wheat acres once per year at a rate of 2 fl oz per 100 lb of seed. PHI is 45 days. For both fall and spring wheat, imidacloprid has both systemic and contact activity properties providing protection well into the growing season when aphid populations are high.

At-planting systemics:
At-planting systemic insecticides will provide some degree of aphid control, and are recommended for early-planted winter wheat where crop emergence and aphid flights coincide. At-planting soil insecticides are not recommended for spring wheat because protection will have dissipated by the time aphid populations have reached damaging levels.

- **Phorate (Thimet 20G) --** Applied to about 3% of the winter wheat at-planting. Phorate provides control of aphids, grasshoppers, and wireworms in early growth stages of wheat. Typically applied once per year at a rate of 0.24 oz ai per1000 ft row. PHI is 70 days.

- **Disulfoton (Di-Syston 15G, Di-Syston 15%) --** Applied to about 3% of winter wheat acres at-planting for aphid, grasshopper, and wireworm control. Typically applied once per year at a rate of 1 lb ai per acre. PHI is 75 days.

Foliar insecticides:
Aphid control on wheat also can be achieved by applying foliar insecticides during the fall or spring on an as needed basis.

- **Disulfoton (Di-Syston EC) --** Applied to 5-10% of the wheat acres in southern Idaho. Usually applied once per year at a rate of 0.75 lb ai/acre. PHI is 30 days. Because disulfoton has a shorter PHI than the other insecticides, it is useful for controlling late season aphids. Disulfoton also provides consistent Russian wheat aphid control.

- **Dimethoate (Dimethoate 2.67, Dimethoate 4EC) --** Applied to 5-10% of the spring wheat acres in northern Idaho. Usually applied once per year at a rate of 0.3 lb ai/acre. PHI is 60 days.

- **Chlorpyrifos (Lorsban) --** Applied to 5-10% of the wheat acres in southern Idaho. Typically applied once per year at a rate of 0.4 lb ai/acre. PHI is 28 days.

Biological control:
Syrphid fly larvae and ladybird beetle larvae are common predators offering some natural aphid control. In addition to these predators, twelve species of parasitic wasps and six species of other predators feed on aphids in Idaho. Aphids continue to damage wheat in spite of the presence of these predators. Growers routinely examine wheat fields to determine the level of aphid control provided by biological agents before applying insecticides. A goal of University of Idaho researchers is to identify and enhance non-crop refuges near field crops that retain aphid predators. Wheat germplasm with promising resistance to Russian wheat aphid is currently being evaluated for release.

Cultural control:
Destroying volunteer grain and delaying planting until nearby crops have matured helps reduce aphid populations. Delayed planting of winter wheat until after aphid populations have subsided reduces exposure to aphids. Spring planted wheat is generally planted as early as possible to avoid aphid damage later in the growing season.

Wireworms (*Limonius* spp.)

Wireworms are the most important soil-dwelling pests infesting Idaho wheat. Wireworms tend to increase rapidly in grain crops, especially wheat and barley. Wireworms spend three years or longer as larvae in soil before emerging as adults. They burrow into the planted wheat seed and feed on and injure the stem of young plants in April and May. Wheat can usually tolerate up to 20% stand reduction without showing a significant yield loss.

Wireworms are able to survive in the soil for several years, and present a continual problem of potential outbreak. If not controlled, wireworms would damage wheat each year in localized areas of Idaho. In these areas, most all the wheat seed is pre-treated with lindane as a protective measure before being marketed to growers. On most of Idaho wheat acreage, wireworms are an incidental pest, and growers will request lindane treated wheat seed on an as needed basis.

Control

Chemical control:

- **Lindane (Lindane 40)** B Lindane as a seed treatment is applied to 20-40% of wheat seed at a rate of 1.4 fl oz/100 lb of seed.

- **Imidacloprid (Gaucho) --** Applied to about 5% of the wheat acres once per year at a rate of 2 fl oz per 100 lb of seed. PHI is 45 days.

Cultural control:
Crop rotation is an important tool in controlling wireworms. Nearly 90% of the wheat grown in Idaho is rotated with different crops to reduce the severity of wireworms and other pests and diseases. Currently, no parasites or biological insecticides are effective in controlling wireworms.

Hessian fly (*Mayetiola destructor*)

The Hessian fly damages spring and fall wheat in northern Idaho. Early planted fall wheat is more susceptible to damage because cool temperatures have not yet reduced fly activity. Tillage systems and weather patterns influence Hessian fly populations. Conservation tillage systems leave more fly-infested stubble and volunteer plants on soil surface than intensive or conventional tillage systems. Because fewer fly larvae or puparia are buried to a satisfactory depth to prevent emergence, there can be a greater survival of the fly under conservation tillage. Hessian fly control under conservation tillage is achieved by rotating wheat with nonhost crops. The potential for fly problems, however, will always exist because flies can continually migrate from field to field.

Precipitation patterns determine the level of fly infestation in regions that receive less than 25 inches of precipitation. Consequently, the fly population does not reach economic threshold every year. Normally there are two or three fly generations each year. The larvae feed for about two weeks on wheat seedlings. Since no single fly generation completes its development uniformly, there are always generations that over-summer and emerge in the fall or continue to over-winter until the next spring. This presents a continual problem of potential fly outbreak.

Control

Cultural control:
Most control measures for Hessian fly are cultural. One practice is to delay wheat planting until late fall, when cool temperatures have reduced fly activity past the fly-free date. In spring planted wheat, fly damage can be avoided by planting as early as possible. Crop rotation with nonhost crops breaks the fly cycle. Another practice is to break the ›green bridge‹ of volunteer wheat and weeds, which serve as a host for future fly generations. Removal of volunteer plants 2-3 weeks before planting also remove flies. Wheat resistance germplasm to Hessian fly is currently being evaluated for release.

Diseases

Barley yellow dwarf virus

Barley yellow dwarf (BYD) is the major virus disease that affects Idaho cereal grains. Several aphid species that feed on Idaho wheat are responsible for transmitting the disease. Barley yellow dwarf (BYD) occurs where there is a constant supply of living hosts for the aphids and the virus, or when volunteer cereals grow between harvesting and planting. Corn in southern Idaho also is considered a reservoir of BYD.

The use of at-planting systemic insecticides helps reduce in-field multiplication and spread of aphids that vector BYDV, but do not prevent aphids in-flight carrying BYDV from adjacent fields. Thus, BYD is a persistent threat to Idaho wheat production. Several practices help minimize the spread and infection BYD to cereal crops. Levels of infection can be reduced by monitoring and controlling aphid populations, controlling volunteer plants and by planting as late as practical during the autumn. Planting wheat late minimizes exposure to aphids. Winter wheat varieties resistant to BYD are being developed, but are currently not available. Depending on the year, economic loss to grain crops due to BYD has exceeded 70% in individual fields.

Wheat Streak Mosiac

Wheat streak mosaic (WSM) occurs sporadically in Idaho wheat, especially in the irrigated regions of southern Idaho. WSM is caused by a virus (wheat streak mosaic virus) that is carried to wheat via an eriophyid mite (*Aceria tulipae*). Winter wheat infected in the autumn usually has a higher incidence of WSM than wheat infected in the spring. Spring infections are consequential, but less frequent. The disease causes leaf stress chlorsis and general plant stress, leading to poorly filled seeds and heads and reduced grain test weight. Individual growers in southern Idaho have experienced 80% yield loss. In an average year, overall wheat loss is estimated at 1-3% from significant WSM development in localized areas.

Insecticides are usually not effective unless the source of mites can be clearly identified. Control of WSM is accomplished by crop rotation and cultivation to break the continuous availability of green host material for the mites. Destruction of volunteer wheat and alternative grass hosts for the mites and virus, and delayed fall seeding reduce the population of mites and the incidence of WSM. Some wheat cultivars are modestly resistant to WSM if they contain appropriate genes from Agropyron. No chemical controls are currently recommended.

Foot Rot

Foot rot is caused by the fungus *Pseudocercosporella herpotrichoides.* This fungus survives on infected crop residue in the soil and causes foot rot on several cereal crops. Foot rot is more prevalent in southeastern Idaho. The fall-planted cereal crops are more susceptible than spring-planted cereals. Several soft white wheat cultivars have moderate resistance to the disease. Cultural practices such as delayed planting, crop rotation, and planting spring cereals in areas with a severe history of the disease can reduce the level of infection.

Seedborne diseases

Dwarf bunt and scab are diseases of spring and/or winter wheat that occasionally cause severe damage and economic loss. Damage from these diseases can be as high as 40% in localized areas. Most growers will know which fields harbor the soil borne dwarf bunt fungus and will plant seed resistant cultivars in those fields. Fungicide treatment of wheat seed is a very important practice to prevent this disease from causing economic loss.

Take-all and Pythium root rot

These diseases can reduce wheat yields by 10-25% in local areas. Take-all is a major root and crown rot disease of winter wheat that is favored by cropping systems where wheat is grown continuously for two or more cropping years. Both diseases are more damaging under reduced tillage systems. Pythium root rot may be a problem on late seeded winter wheat and is more active when straw is left on soil surface in conservation tillage systems. Pythium is also more of a problem in cropping systems where wheat follows wheat.

Crop management practices continue to be the primary methods for reducing take-all damage. These practices include crop rotations, banding starter fertilizer below the seed, applying correct forms of nitrogen, maintaining a moderately acid range of PH, delaying fall planting and reducing crop residue on soil surface.

Cephalosporium stripe

Cephalosporium stripe can reduce wheat yields by 75% in local areas of northern Idaho. When cool, moist conditions prevail in the fall season, the fungus in infected crop residue produces millions of spores that act as primary inoculum for infecting younger plants. Winter conditions have a strong influence on the degree of plant infection. Cold temperatures and lack of snow cover are conducive to frost heaving, which causes root injury, and allows the fungus easy access into the plant. Wireworm damage to roots also allows easy access of fungus into the wheat plant.

Control

Protection from diseases is normally achieved with cultural practices such as crop rotations and delaying fall planting, planting the most resistant variety available and applying seed treatment fungicides. Since wheat varieties vary in tolerance to diseases, growers will plant the variety best adapted to their region

based on yield, maturity and degree of resistance to the prevalent diseases in their region.

Chemical control:

- **Difenoconazole (Dividend) + Mefenoxam (Apron XL) --** This seed treatment combination is marketed as Dividend XL. About 70% of the winter wheat seed is treated with Dividend XL. Provides control of *Pythium* sp., smuts and bunts. Applied at a rate of 1 fl oz /100 lb of seed.

- **Tebuconazole+thiram (Raxil - Thiram) --** This seed treatment is applied to 10-20% of all-wheat seed at a rate of 5 fl oz/100 lb of seed. Provides control of early seed and seedling diseases.

- **Carboxin (Vitavax 200, Vitavax) --** This seed treatment is applied to about 5% of all-wheat seed at a rate of 3.5 fl oz/100 lb of seed. Carboxin is mostly used on wheat seed in southern Idaho. Provides good protection against smuts and other diseases affecting wheat in southern Idaho.

Weeds

Annual and perennial broadleaf and grass weeds are perhaps the most serious and consistent constraints to wheat production. If left uncontrolled, weeds would reduce yields by 50-100% and lower the quality of harvested grain. Weeds also interfere with grain harvest. Some of the more troublesome weeds that compete with wheat include quackgrass, wild oats, thistle, pigweed, henbit, kochia, lambsquarters, mayweed, chickweed, jointed goatgrass and bromes.

According to a 1996 winter wheat survey, the following herbicides were applied to winter wheat to control weeds.

Active ingredient and Trade name	**Acres treated/yr**	**# treatments/yr**	**Rate lb ai/acre**
2,4-D (many trade names)	15%	1	.44
Alachlor + glyphosate (Bronco)	0.7%	1	.65
Bromoxynil (Buctril 2EC, Bronate 4EC)	40%	1	.4
Chlorsulfuron (Glean)	1%	1	.01
Chlorsulfuron +Metsulfuron (Finesse)	6%	1	.25
Clopyralid (Stinger, Curtail)	2%	1	.07

Dicamba (Banvel 4L, Clarity)	2%	1	.1
Diclofop-methyl (Hoelon)	15%	1	.8
Difenzoquat (Avenge)	2%	1	.62
Diuron (Karmex, Direx)	5%	1	.3
Ethephon (Florel)	0.3%	1	.5
Fenoxaprop (Acclaim)	1%	1	.07
Glyphosate (Ruler, Silhouette, Roundup Ultra, Roundup RT)	20%	1	.32
Imazamethabenz (Assert)	6%	1	.34
MCPA	35%	1	.5
Metribuzin (Sencor, Lexone)	0.6%	1	.25
Metsulfuron-methyl (Ally)	6%	1	.004
Paraquat (Gramoxone Extra)	5%	1	.55
Thifensulfuron + Tribenuron methyl (Harmony Extra)	25%	1	.25
Trifluralin (Treflan)	3%	1	.5

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