

# Crop Profile for Barley in Utah

**Prepared: May 2006**

## General Production Information

In 2004, Utah ranked eleventh in U.S. barley production and produced 1.2 percent of the total U.S. barley crop. A total of 3.44 million bushels were produced from 40,000 harvested acres of 50,000 planted acres in 2004, with a production value of about \$7.6 million based on a unit value of \$2.21 per bushel. An average yield of 86.0 bushels per acre was produced in 2004. Adjusted with an annual inflation rate of 3% for production costs based on 2001 data, the annual production costs for Utah wheel-line irrigated barley were about \$231 per acre in 2004. (1, 2)

In 2005, Utah produced 0.9 percent of the total U. S. barley crop. A total of 1.92 million bushels were produced from 24,000 harvested acres of 40,000 planted acres in 2005, with a production value of \$4.03 million based on a unit value of \$2.10 per bushel. An average yield of 80.0 bushels per acre was produced in 2005. Adjusted with an annual inflation rate of 3% for production costs based on 2001 data, the annual production costs for Utah wheel-line irrigated barley were about \$238 per acre in 2005. (2, 3)

Utilization of barley may include more than one market or use. Use of grain for feed was reported by 66% of growers, for processing by 27% of growers, for on-farm use by 50% of growers, and for seed production by 20% of growers. (4)

## Production Regions

For the purposes of agricultural statistics, Utah is divided into four regions: Northern, Central, Eastern, and Southern. Northern and Central agricultural regions include Great Basin, Wasatch Front and mountain valley areas, while the Eastern and Southern agricultural regions can be generally described as high deserts with some additional mountain valleys. (1)

Because of limitations on available water in many areas of Utah, major barley production areas are near mountain ranges or have some other major source of water. Urbanized counties of the Wasatch Front produce relatively little barley due to land-use restrictions. Counties consisting mostly of high desert areas produce little or no barley. A shorter growing season and limited areas of suitable acreage restrict barley production in counties consisting mostly of mountain areas. (1)

In 2004, the Northern region produced 2.035 million bushels (59%), the Central region produced 1.033 million bushels (30%), the Eastern region produced 0.222 million bushels (6%), and the Southern region produced 0.148 million bushels (4%) of the total Utah barley crop. The largest producer of barley was Cache County at 1.058 million bushels (31%). Harvested acreages in 2004 ranged from less than 1,000

acres in several counties to 13,900 acres in Cache County. (1)

## Cultural Practices

Utah barley is typically planted between about March 20 and May 10, with the most active planting period being from about April 1 to April 20. Typical harvest dates range from July 10 to September 1, with the most active harvest period being from about July 25 to August 15. Fertilization and irrigation management practices are utilized by the majority of barley producers but actual practices vary with soil type, rainfall, and other factors. (1, 4)

Some dry land barley is produced in Utah but it represents a minor proportion of the total production. Dry land barley produced less than half the yield (38 bushels per acre, 2003) of irrigated barley (87 bushels per acre, 2003) in Utah. In 2003, dry land barley accounted for about 14% of Utah barley acreage and for about 7% of total production. (1)

Worker activities are minimal, such pest scouting and field examinations, and are not done at times of pesticide application. (4)

## Cultural Controls and Integrated Pest Management Practices

A variety of integrated pest management (IPM) practices are utilized by Utah barley growers. Cultural practices are the most common. These practices are utilized primarily to reduce weed and insect pest problems and, largely for economic reasons, to limit the amounts of pesticides needed to control these pests. Specific pests targeted by IPM practices vary with individual growers and regions. (4)

As reported in a 1996 survey, IPM practices used by Utah barley producers included: crop rotation (80%), use of pesticides (76%), deep tilling and cultivation (75%), inspections to determine pest levels (70%), use of certified seed (67%), sanitation practices (64%), use of resistant barley varieties (40%), use of pest thresholds to determine treatment needs (36%), reduced rates of pesticides to preserve beneficials (33%), spot treatments (25%), burning stubble (17%), grazing cattle on stubble (16%), release of natural enemies (11%), use of cover crops to enhance beneficials (6%), and placing land into fallow (6%). (4)

## Insect/Mites Pests

Insect pests reported by Utah barley growers included nine different types: armyworms, black grass bug, cereal leaf beetle, cutworms, grain aphids (other than Russian wheat aphid), grasshoppers, Mormon

cricket, Russian wheat aphid, and wireworms. Among these pests, only cereal leaf beetle and Russian wheat aphid were reported as requiring pesticide treatments by more than 5% of growers. There were no mite pests reported by Utah barley growers. (5)

### Cereal leaf beetle

As of 1998, cereal leaf beetle (CLB) was established in 17 of the state's 29 counties, which includes about 73% of the total barley acreage (73,000 acres). Yearly surveys are conducted to detect any changes in the distribution of this pest within the state. (5)

Adults over winter and emerge beginning in early April, with peak activity in May. Eggs are laid within 10 days and hatch within 4 to 23 days. Peak egg hatch is about the last week of May and peak larval populations occur about mid-June. There is a single generation per year. (6)

Adults cause damage by chewing elongate rectangular holes in the leaves. Larvae feed by removing the upper leaf surface (skeletonizing) and leave a characteristic "window" in affected leaves. (6)

Control of CLB is recommended when there is a total of three or more eggs and larvae per stem before the boot stage, or one or more larva per flag leaf during heading. An average of one-and-one-half larvae per stem in barley can reduce yields by \$10 per acre. (6)

Chemical Control - Carbofuran (Furadan 4F, flowable) - Applied to 7.2% of barley acreage (7,200 acres) at an average rate of 0.20 pounds a.i. per acre and an average annual application frequency of 0.87. Applied by ground equipment or aircraft. Restrictions: Apply prior to head emergence from boot and not more than twice per season. Do not feed forage. (5, 7)

Malathion (Fyfanon and other generic brands; emulsifiable concentrate or ultra-low-volume) - Applied to 1.7% of barley acreage (1,700 acres) at an average rate of 1.11 pounds a.i. per acre and an average annual application frequency of 1.10. Applied by ground equipment or aircraft. Restrictions: 7-day pre-harvest interval. (5, 7)

Alternative Insecticides - Uses of any other insecticides labeled for barley were not reported by Utah growers. Alternative insecticides labeled for control of cereal leaf beetle on barley include formulations of endosulfan (Phaser, Thionex, and generic brands), methomyl (Lannate), pyrethrins (Pyroicide), and spinosad (Success). The insect growth regulator diflubenzuron (Dimilin) is labeled for cereal leaf beetle eggs on barley. (5, 7)

Biological Control - Tetrastichus julis, a parasite of CLB larvae, is known to be established in five Utah counties as the result of extensive insectary and release programs conducted in conjunction with USDA-APHIS. Attempts to establish the egg parasite Anaphes flavipes in five counties have failed to recover insects except in the year of release. Use of natural enemies to control grain pests was reported by 3% of Utah barley growers. A fungal biological control agent, Beauveria bassiana GHA (Botanigard), is

labeled for cereal leaf beetle control on barley. (4, 7, 8)

Cultural Control - Resistant varieties, fertilization and irrigation to stimulate crop growth. Cultural practices to enhance populations of biological control agents include planting of ground covers, reduced rates of insecticides, and reduced number or altered timing of insecticide treatments. (4, 6)

### Russian wheat aphid

As of 1998, Russian wheat aphid (RWA) was known to be established in 27 of Utah's 29 counties, with the remaining two counties producing little or no grain. It can therefore be considered a potential pest in 100% of Utah's barley acreage (100,000 acres). (5)

This species spends its entire life cycle on grains and grasses and has many hosts. RWA over winters as wingless nymphs or adults and seems to be more cold-hardy than the other cereal grain species. Females of RWA can reproduce asexually. Throughout the year, overcrowding and weather conditions may stimulate the production of winged forms, which are easily dispersed on wind currents. After a short feeding period on new plants, these females begin giving birth to wingless living young at a rate of 4-5 per day for about four weeks. The new young females can mature in as little as 7-10 days. (9, 10)

RWA damage is caused by injection of a toxin into the plant as it feeds which prevents the production of chlorophyll and causes the leaves to curl. The toxin first causes white streaks along the veins which may turn to a bright purple discoloration. Under cold conditions, purple streaking and longitudinal white streaks will both be present. Later infestation and damage causes the flag leaf to curl and prevents the head from completely emerging. This produces a "gooseneck" head that does not properly mature the grain. Aphids remain primarily inside the curled leaves, where they are protected from direct contact with insecticides. Systemic insecticides are usually required for adequate control and are the most effective insecticides for this aphid. (9, 10)

In spring-planted grains, control of RWA is recommended when 10% or more of the plants are infested from emergence to the flowering stage. An alternative recommendation is to treat if 5% of plants are infested with reproducing populations and fresh damage up to the first-node stage. From the flowering stage to the milk stage, treatments are recommended when 20% or more of the plants are infested. Insecticide treatments do not provide any benefit after the soft dough stage is reached. In fall-planted grains, control of RWA is recommended when 10% of the plants are infested in seedlings with one tiller. Larger fall-planted grain plants may be treated if plants are stressed or there is danger of winter kill. Generally, each 1% infestation level will result in a 0.5% yield loss at harvest. (9, 10)

Chemical Control - Carbofuran (Furadan, flowable) - Applied to less than 1% of barley acreage (780 acres) at an average rate of 0.118 pounds a.i. per acre and an average annual application frequency of 1.00. Applied by ground equipment. Restrictions: Apply prior to head emergence from boot and not more than twice per season. Do not feed forage. (5, 7)

Alternative Insecticides – The only other insecticide reportedly used by some Utah barley growers for the control of Russian wheat aphid was malathion. Disulfoton (Di-Syston, granular formulation only) and methomyl (Lannate) are systemic insecticides available for use on barley in Utah. Endosulfan (Phaser, Thionex, and generic brands) is labeled for Russian wheat aphid control in barley. Thiamethoxam (Adage, Cruiser) is labeled as a seed treatment for Russian wheat aphid control in barley. (5, 7)

Biological Control - Attempts to introduce and spread parasites of this aphid have recently been partially successful, but many large-scale early efforts failed to establish any detectable beneficial insect populations. The general severity of infestations of this pest seem to have lessened since its introduction, which may be due to parasitism and predation by natural enemies that have adapted to the population or been introduced naturally (such as Diaeretiella rapae). Regardless, pesticide applications to control the Russian wheat aphid are still an occasional necessity for many Utah barley producers. A fungal biological control agent, Beauveria bassiana GHA (Botanigard), is labeled for Russian wheat aphid control in barley. (4, 7, 8)

Cultural Control - 1) control of volunteer grains in field areas to eliminate alternate hosts; 2) control of host plants and/or aphids in field borders and along ditch banks; 3) grazing of volunteer plants after harvesting (permitted even with grazing restrictions). (9, 10)

## Weeds

Weed pests reported by Utah barley growers included eight different species or groups: field bindweed, broadleaf annuals (in general), Canada thistle, foxtails, jointed goatgrass, kochia, quackgrass, and wild oats. Among these, broadleaf annuals (in general), field bindweed, kochia, Canada thistle, and wild oats were reported as requiring pesticide treatments by more than 10% of growers. (5)

### Broadleaf annuals (in general)

Broadleaf annuals that are problems in Utah barley include members of the mustard, sunflower, and goosefoot family. With the exception of kochia, specific broadleaf annuals that were treated were generally not indicated by growers responding to survey questions. Discussions of occurrence and life cycle of specific broadleaf annuals are therefore not included here. Broadleaf annuals were reported as a problem from nine of eleven barley-producing counties responding to a 1996 small grain survey. (5, 11)

Chemical Control - 2,4-D (various brands; soluble or emulsifiable concentrate) - For suppression only, applied to 27.2% of barley acreage (27,200 acres) at an average rate of 0.53 pounds a.i. per acre and an average annual application frequency of 1.04. Applied by ground equipment or aircraft. Applied when crop is about six inches high but before jointing. (5, 12)

Dicamba (Banvel/Clarity, soluble concentrate) - Applied to 2.8% of barley acreage (2,800 acres) at an average rate of 0.091 pounds a.i. per acre. Average annual application frequency of 0.91. Applied by ground equipment. Used before 4-leaf stage in spring barley. (5, 12)

Alternative Herbicides - The only other herbicide reportedly used by some Utah growers for control of broadleaf annuals was a mixture of thifensulfuron and tribenuron (Harmony Extra). (5)

Cultural Control - 1) tillage, 2) cultivation, 3) crop rotation into small grains allows use of broadleaf herbicides. (11)

### Field bindweed

Field bindweed is a common pest throughout the west and may be found at altitudes up to 10,000 feet. The weed was reported as a pest problem in ten of eleven barley-producing counties responding to a 1996 small grain survey. It is a perennial weed with an extensive lateral root system and a deep taproot. Seeds remain viable up to 50 years. The flowering period is from late June until frost in the fall. (5, 13)

Chemical Control - 2,4-D (various brands; soluble or emulsifiable concentrate) - For suppression only, applied to 16.6% of barley acreage (16,600 acres) at an average rate of 0.53 pounds a.i. per acre and an average annual application frequency of 1.15. Applied by ground equipment or aircraft. Applied when crop is about six inches high but before jointing. (5, 12)

Dicamba (Banvel/Clarity, soluble concentrate) with 2,4-D (Formula 40, etc.), or dicamba plus 2,4-D (Weedmaster) - Applied to 3.3% of barley acreage (3,300 acres) at an average rate of 0.125 pounds a.i. per acre of dicamba and 0.375 pounds a.i. per acre of 2,4-D. Average annual application frequency of 0.92. Applied by ground equipment. Used before 4-leaf stage in spring barley. (5, 12)

Glyphosate (Roundup, soluble concentrate) with 2,4-D (Formula 40, etc.), or glyphosate plus 2,4-D (Landmaster BW) - Applied to 2.4% of barley acreage (2,400 acres) at an average rate of 0.33 pounds glyphosate plus 0.50 pounds 2,4-D as a tank mixture, or 0.50 pounds glyphosate plus 0.80 pounds 2,4-D a.i. per acre using Landmaster BW. Average annual application frequency of 1.07. Applied by ground equipment. Used for pre-planting, pre-emergent, post-harvest, or fallow land treatments. (5, 12)

Alternative Herbicides - Other herbicides reportedly used by some Utah growers for field bindweed control include glyphosate (Roundup) and mixtures of thifensulfuron and tribenuron (Harmony Extra). (5)

Cultural Control - 1) deep plowing followed by tillage of regrowth; 2) discing regrowth after herbicide treatments in fallow land; 3) mowing of forage crops (suppression only); 4) sanitation measures to prevent spread of roots or seeds by equipment. (11)

## Kochia

Kochia was reported as a pest problem from ten of eleven barley-producing counties responding to a 1996 small grain survey. It is an annual weed that is common in cultivated fields, gardens, roadsides, ditch banks, and waste areas. It is more difficult to control in spring-planted barley. Flowering and seed production may occur from July to October. (5, 11, 13)

Chemical Control - 2,4-D - (various brands; soluble or emulsifiable concentrate) - Applied to 19.5% of barley acreage (19,500 acres) at an average rate of 0.29 pounds a.i. per acre and an average annual application frequency of 1.07. Applied by ground equipment or aircraft. Applied when crop is about six inches high but before jointing. (5, 12)

Thifensulfuron plus Tribenuron (Harmony Extra, dry flowable) - Applied to 4.8% of barley acreage (4,800 acres) at an average rate of 0.013 pounds a.i. per acre of thifensulfuron plus 0.0065 pounds a.i. per acre of tribenuron. Average annual application frequency of 0.94. Applied by ground equipment or aircraft. Applied to barley after the 2-leaf stage and when weeds are in the seedling stage. (5, 12)

Dicamba (Banvel/Clarity, soluble concentrate) alone or with 2,4-D) - Applied to 3.8% of barley acreage (3,800 acres) at an average rate of 0.083 pounds a.i. per acre of dicamba and 0.31 pounds a.i. per acre of 2,4-D. Average annual application frequency of 1.125. Applied by ground equipment. Used before 4-leaf stage in spring barley. (5, 12)

Alternative Herbicides - Other herbicides reportedly used by some Utah growers for kochia control include clopyralid (Curtail), glyphosate (Roundup), and tribenuron (Express). Fluroxypyr-methyl (Starane) is now also available as an alternative. (5, 12)

Cultural Control - 1) deep plowing followed by tillage of regrowth; 2) discing regrowth after herbicide treatments in fallow land; 3) grazing by cattle (however, kochia may contain potentially toxic levels of nitrogen). (11, 13)

## Canada thistle

Canada thistle was reported as a pest problem from eight of eleven barley-producing counties responding to a 1996 small grain survey. It is a colony-forming perennial with deep and extensive horizontal root systems. Flowering occurs during July and August. (5, 13)

Chemical Control - 2,4-D - (various brands; soluble or emulsifiable concentrate) - Applied to 17.3% of barley acreage (17,300 acres) at an average rate of 0.56 pounds a.i. per acre and an average annual application frequency of 1.04. Applied by ground equipment or aircraft. Applied when crop is about six inches high but before jointing. (5, 12)

Dicamba (Banvel/Clarity, soluble concentrate) - Applied to 2.7% of barley acreage (2,700 acres) at an

average rate of 0.094 pounds a.i. per acre of dicamba. Average annual application frequency of 0.93. Applied by ground equipment. Used before 4-leaf stage in spring barley. (5, 12)

Thifensulfuron plus Tribenuron (Harmony Extra, dry flowable) - Applied to 2.3% of barley acreage (2,300 acres) at an average rate of 0.014 pounds a.i. per acre of thifensulfuron plus 0.007 pounds a.i. per acre of tribenuron. Average annual application frequency of 1.00. Applied by ground equipment. Applied to barley after the 2-leaf stage and when weeds are in the seedling stage. (5, 12)

Alternative Herbicides - Other herbicides reportedly used by some Utah barley growers for Canada thistle control included clopyralid plus 2,4-D (Curtail) and glyphosate (Roundup). (5)

Biological Control - Attempts to introduce insect biological control agents including the musk thistle weevil, Rhinocyllus conicus, and the tephritid stem gall fly Urophora cardui failed to establish these insects in Utah. The crown and root weevil Ceutorhynchus litura is found in limited distributions in Utah but is not presently collectible in large enough numbers for further distribution. (12)

### Wild oats

Wild oats was reported as a pest problem from six of eleven barley-producing counties responding to a 1996 small grain survey. It is an annual weed that is highly competitive with small grains. Seeds can remain dormant for up to 10 years. Flowering and seed production occur from June to August. The economic threshold for wild oats varies from 0.5 to 4 plants per square foot. (4, 11, 13)

Chemical Control - Imazamethabenz-methyl (Assert, emulsifiable concentrate) - Applied to 1.8% of barley acreage (1,800 acres) at an average rate of 0.43 pounds a.i. per acre and an average annual application frequency of 0.92. Applied by ground equipment or aircraft. Applied when crop is from the 2-leaf to the internode stage. (5, 12)

Alternative Herbicides - The only other herbicide reportedly used by some Utah growers for wild oats control was glyphosate (Roundup). Other herbicides useful for wild oats control in barley include diclofop-methyl (Hoelon) and difenzoquat (Avenge). (5, 12)

Cultural Control - 1) pre-plant tillage, 2) high grain plant density, 3) harvesting grain crop for hay before seed is formed. (11)

## **Diseases**

Plant diseases are a minor problem in Utah barley. Very little pesticide use for the control of plant diseases was reported in a 1996 survey. No growers indicated a plant disease as their major pest

problem. The only diseases reported were loose smut (1.0% of barley acreage, or 1,000 acres, requiring treatment) and seed decay (0.2% of barley acreage, or 200 acres, requiring treatment). These diseases are both controlled with seed treatments, using either thiram or a formulation mixture of carboxin plus lindane plus maneb. (5)

Other barley diseases that occur in Utah include barley stripe, barley yellow dwarf virus, common foot rot, rust stripe, and powdery mildew. A few growers are known to use seed treatments of imazalil (Nu-Zone) for barley stripe. Some incidental control of aphids that vector barley yellow dwarf virus probably occurs with the application of barley insecticides for other pests. In 2005, some barley growers reported take-all as occurring in some barley fields. There is no chemical control, but culturally growers can rotate crops and/or deep plow. (14)

## Nematodes

There were no nematode pests or nematicide uses reported by Utah barley growers. (5)

## Vertebrates

Vertebrate pests are a minor problem in Utah barley. Very little pesticide use for the control of vertebrates was reported in a 1996 survey. Only one grower indicated a vertebrate (birds) as the major pest problem in barley. Controls for birds were used on 1.0% of barley acreage (1,000 acres), controls for rodents on 0.5% (500 acres), and controls for deer on 0.1% (100 acres). Birds and deer were controlled using the seed-treatment repellents captan or thiram, while rodents were controlled using poison in the form of strychnine- treated grain. (5)

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