Crop Profile for Barley in Kansas

Prepared July 2001
Updated September 2005

General Production Information

Approximately one-third of all U. S. barley was produced in the Northern and Central Plains (KS, NE, ND, and SD) during 2002 and 2003. North Dakota led these states in barley production during 2002 and 2003, contributing 58.5 and 118.8 million bu respectively, followed by much smaller harvests in SD, KS, and NE. Winter barley can produce high quality forage, or can be used as a feed grain (Kadir et al. 2001). The following table summarizes barley area, yield, production, price per unit, ranks, and value of production in the region during 2002 and 2003.

Year	State	Planted	Harvested	Yield	Production	Price per Unit	Value of production	Rank
		acres - thousand	acres - thousand	bushel	1000 bushels	$/bu	X $1,000	
2002	KS	8	7	37	259	1.85	440	24
2002	NE	6	4	32	128	1.85	398	26
2002	ND	1600	1300	45	58500	2.56	146022	2
2002	SD	80	45	35	1575	2.51	4631	14
2002	Total	1694	1356		60462		151491	
2002	*Proportion	33.83%	32.89%		26.65%		25.09%	
2002	US Total	5008	4123	55	226906	2.72	603796	
2003	KS	9	8	57	456	1.9	866	23

The Crop Profile/PMSP database, including this document, is supported by USDA NIFA.

2003	NE	6	4	50	200	1.9	380	26
2003	ND	2050	1980	60	118800	2.7	320760	1
2003	SD	75	55	53	2915	2.4	6996	12
2003	Total	2140	2047		122371		329002	
2003	*Proportion	40.38%	43.66%		44.32%		42.96%	
2003	US Total	5299	4688	58.9	276087	2.9	765783	

***Proportion of the four-state total to the US total.**

Pesticide Usage on Barley for 2003

Barley is one of the major commodities in this region. The pesticide usage survey on barley in the region during 2003 was conducted by the Kansas Agricultural Statistics Service (KASS) and Kansas State University from October through December 2003. Questionnaires were mailed directly to all sampled barley growers identified by KASS based on historic data. In total, 273 questionnaires were distributed. Overall valid responses to questionnaires were very low during the 2003 survey. Even though a 90% response rate was achieved, most sampled growers relied that they did not grow Barley in 2003. Only 14 responses contained valid data from three states and 15 counties. The following table displays the sample distributions in terms of states and counties in the Northern and Central Plains.

Sampling Data Distribution

State	Sample Allocated	Sample Collected	Return Rate %	County	Sample %
KS	30	8	26.67	8	2.99
NE	30	2	6.67	2	0.75
ND	30	0	0.00	0	0.00
SD	183	4	2.19	4	1.49
Total	273	14	5.13	14	5.22

Responses indicated that approximately 26% of the pesticide applications were undertaken directly by farmers/growers against various pests while 74% were applied by commercial entities.

Cultural Practices

Barley is grown for grazing, silage, and haying. The majority of North Dakota barley acres are spring planted, starting in early to mid April. Winter barley can produce high quality forage, or be used as a feed grain. Six-row winter barley varieties are planted from October 1 to October 20 in the southeastern region. In northwestern Kansas, suggested planting dates ranging from September 5 to September 20 whereas September 10 to early October was recommended for the rest of Kansas. Two-row spring barley is planted from February 20 through early March in the southeastern region, March 1 to March 15 is recommended for the central regions and March 1 to March 25 is recommended for the northwestern region.

Barley can grow on various soils, however, fertile well-drained soils are preferred over sandy soils. Barley is susceptible to harsh winter conditions, thus only winter-hardy varieties are typically selected for sowing. Winter barley is drilled between 1 to 3 inches deep, 1 to 2 inches for spring barley. Barley seeding rates vary with seasons and areas in this region. For instance, winter barley seeding rates range between 30 to 48 lb/a in western Kansas and between 72 to 96 lb/a is recommended for the eastern part of the same state. Where barley is planted for pasture, the seeding rate is increased by 50%.

Worker Activities

Barley production in the Northern and Central Plains is primarily mechanized. Worker activities for barley production involve field preparation, planting, fertilizer and pesticide application, pest scouting, and harvesting. Most of these activities are conducted by growers, family members, their employees, or consultants with machines. The primary worker activities in the early season involve irrigation and herbicide application against broadleaf weeds. The major activities during the summer involve pest monitoring the fungicide applications against several plant disease including Barley Stem Rust and Bacterial Blight**.** Activities that bring workers in direct contact with barley during the growing season are limited.

Insect Pests

Barley fields may serve as source of infestations for many insects that migrate later into wheat, corn, and sorghum. There were no reports regarding insecticide applications being made to barley during 2003. However, certain non-chemical approaches may be applied against various insects during barley production in this region.

Fungicide Usage in 2003

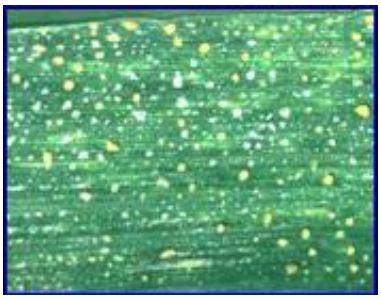
Several plant diseases were treated with fungicides by barley farmers/producers during 2003. Approximately 7% planted barley areas were treated with fungicides, indicating plant diseases may be a minor problem during barley production in the Northern and Central Plains. The survey shows at least 2 fungicides (ingredients) were applied in the control of at least 5 different plant diseases on barley. The following table lists the fungicides used and plant diseases controlled explicitly. Certain non-chemical methods may also be applied for the control of plant diseases.

Fungicides used and plant disease targeted

Fungicide (Ingredient)	Plant Disease Targeted
captan	Barley Stem Rust
carboxin	Bacterial Blight, Barley Stem Rust, Covered Smut, Loose Smut, Nematodes

Barley Stem Rust (*Puccinia graminis f. sp. tritici and f. sp. secalis*). Barley and wheat are hosts for *Puccinia graminis f. sp. tritici*, while barley and rye are hosts to *Puccinia graminis f. sp. secalis*. Symptoms of barley stem rust include masses of brick-red spores (pustules) erupting primarily on stems and leaf sheaths, with leaf blades, glumes and awns also being infected. Spores are easily spread by wind to other plants, and the disease is favored by warm, moist weather. Most current varieties are susceptible to race QCC of *Puccinia graminis f. sp. tritici*, but resistance is being incorporated into new lines. All commercial varieties are susceptible to *Puccinia graminis f. sp. secalis*, but this form is rarely found. Stem rust also can be controlled with systemic fungicides. Development of stem rust on the barley crop depends on several factors, including how extensively the fungus overwinters in this region, environmental conditions that favor buildup of spores that could be carried by prevailing winds, and planting time of the barley crop. A late-maturing crop is more likely to be damaged by stem rust because the grain has not yet filled at the time the rust spores generally arrive. Treatments on Barley Stem Rust using fungicides were reported in North Dakota based on the 2003 survey. (Image courtesy of http://www.oznet.ksu.edu/path-ext/factSheets/wheat/wheat%20stripe%20rust.asp).

Planting early is the most effective preventative measure to avoid major yield and quality losses from stem rust. The earlier the field is planted, the better the chance of avoiding heavy levels of infection on stems and heads. Barley producers should also avoid high levels of nitrogen fertilizer to lessen lodging problems. Lodged grain is a more favorable environment for stem rust infection. Mancozeb and Tilt are fungicides registered particularly for rust control on barley. Tilt must be applied at early flag leaf emergence, which may be before stem rust is detected. Mancozeb is applied at flag leaf emergence and seven to ten days later.



Bacterial Blight (*Xanthomonas campestris* pv. *Translucens).* Bacterial blight occurs in poorly drained wet areas. The bacterium is easily spread in the field by tillage equipment, surface water and animal life in the soil. Bacterial leaf blight usually only occurs on the upper leaves. Small, water-soaked lesions form that eventually coalesce into larger lesions that may cover the entire leaf. These spots can advance rapidly to cause blight and are generally associated with sprinkler irrigation in cool wet weather. The bacteria overwinter on and in seed and in debris. Management practices for bacterial diseases include use of pathogen-free seed, pre-treated seed, crop rotation, field sanitation, and use of copper-based bactericides. Treatments on Bacterial Blight using fungicides were reported in Kansas based on the survey. (Damage symptom of courtesy of http://www.uidaho.edu/ag/plantdisease/bkchf2a.htm).

Covered Smut. Pathogen (*Ustilago hordei).* **Symptoms:** Black spore masses replace the kernels and are enclosed by a whitish cover until broken during harvesting. Covered Smut could be seen occasionally on barley in South Dakota. (Image courtesy of http://www.darzau.de/en/projects/barley_covered_smut.htm).

Favorable Conditions that increase disease infestations include moist soil and soil temperature between 50 to 70ºF after seeding. Fungus is carried on seed. Spores on the seed surface infect germinating seedlings. Management measurements include using seed treatment fungicides.

Loose Smut. Pathogen *Ustilago tritici (= U. nuda).* **Symptoms:** Fungus destroys all of the flower parts, producing black powdery spore masses that take over the heads and can easily break apart leaving a bare rachis. (Image courtesy of http://www.darzau.de/en/projects/barley_loose_smut.htm). Certain conditions may enhance disease infestations such as cool and moist weather at flowering increases infection. The fungus survives in seed. Infection begins at the flowering and penetrates into the embryo of the developing seed. Management approaches include systemic seed treatment fungicides. Treatments using fungicides were reported in Kansas based on the 2003 survey.

Nematodes

Nematodes. Plant parasitic nematodes are microscopic roundworms that feed on plant roots. They survive in soil and plant tissues, and several species may occur in a field. Their damage is mostly on subsequent rotation crops. (Barley root knot nematodes cause small galls to form on barley roots, image courtesy of http://www.ipm.ucdavis.edu/PMG/M/N-RK-MNAA-CD.007.html).

Fungicide usage on Barley

Fungicide (Ingredient)	Trade name	Acres Treated	Percent Treated*	Rate (lb a.i./ a)
captan	Enhance	20	33	0.05
carboxin	Enhance, Vitavax	40	67	0.03

*: Percent Treated = (acreage treated with a given fungicide / the total acreage treated)*100.

Fungicide Enhance and Vitavax were more frequently used against various plant diseases on barley in the Northern and Central Plains.

Weeds

Following are brief descriptions of the major weeds in barley fields, which were treated using herbicides and cultural practices on barley production based upon the 2003 survey:

Blue mustard (*Chorispora tenella*), **(purple mustard, bean-podded mustard, tenella mustard)** is a native of Asia. Flowering season is from May to July. Seeds are the source of reproduction. Found in small grain fields, fallow, and cultivated fields. Treatments on this weed using herbicides were reported in Kansas and North Dakota based on the 2003 survey. (Image courtesy of http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=CHTE2).

Downy brome (*Bromus tectorum* L.), **(cheatgrass, wild oats, military grass)** a cool season grass, native of Europe. Seeds are the source of reproduction. Found in rangeland, fields, disturbed sites, roadsides, and waste areas. Treatments on Downy brome using herbicides were reported in North Dakota based on the 2993 survey. (Image courtesy of http://tncweeds.ucdavis.edu/photos/brote05.jpg).

Field bindweed (*Convolvulus arvensis* L.), **(creeping Jenny)** is a native of Eurasia. Summer is flowering season. Seeds and spreading roots are the sources of reproduction. Found on both cultivated and uncultivated land. It is most common in small-grain fields, waste places, gardens, and roadsides. Treatments on Field bindweed using herbicides

were reported in North Dakota based on the 2003 survey. (Image courtesy of http://tncweeds.ucdavis.edu/photos/conar02.jpg).

Sunflower (*Helianthus annuus*), a member of the Sunflower family, is a native weed. It is an annual, 1 - 10' tall. Stems are erect, simple to branched and rough. Leaves are alternate, simple, rough, and hairy. Ray flowers are yellow to orange-yellow and disk flowers are brown. Summer is flowering season. Seed are the only source of reproduction. Sunflower was an annoying weed in Kansas and was treated using herbicides based on the 2003 survey. (Image courtesy of http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=HEAN3&photoID=hean3_005_avp.tif).

Wild Oat (*Avena fatua*), is a cool season annual, one to four feet tall. It is native to Europe but is common throughout much of western North America, including all of North Dakota. Wild oat is one of the most serious weed problems in small grains. It germinates quickly in the spring and can out-compete small grains resulting in severe yield losses. It is difficult to eradicate because the plants drop their seed prior to the crop being harvested. Seed dormancy results in delayed germination. (Image courtesy of http://plants.usda.gov/cgi_bin/topics.cgi?earl=plant_profile.cgi&symbol=AVFA).

Delaying seeding is one of the most practical approaches of culturally controlling wild oats. By delaying seeding, one or more cultivations can be made to destroy emerged wild oats prior to seeding the crop. Harrowing emerging wild oats following crop seeding may also be effective in reducing wild oat populations before the crop emerges.

Pre-emerge herbicides applied in the fall or spring prior to seeding can provide effective wild oat control. Products such as triallate and triallate + trifluralin (Buckle) can be applied to the soil and incorporated with tillage equipment in advance of seeding. This practice can save the producer time during the growing season and simplifies the timing of herbicide applications. Herbicides applied to the crop after emergence requires careful timing of the treatment. Timing treatment at the proper growth stage of the wild oat and the crop is essential for optimum wild oat control. Careful reading of the herbicide label provides the necessary information as to when and how much product to apply.

Herbicide Usage in 2003

Various weeds may potentially compete for resources in barley production, only a few of them became problematic and treated with herbicides based upon the 2003 survey. In 2003, approximately 94% barley planting areas were treated with herbicides, indicating weed control was one of the important practices in barley production in the Northern and Central Plains. At least 6 herbicides (ingredients) were applied in the control of 5 different weeds on barley production. The following table lists the herbicides used and targeted weeds controlled explicitly. Certain non-chemical methods may also be applied in weed control.

Herbicides Used and Weed Targeted

Herbicide (Ingredients)	Weeds Targeted

2,4-D	Sunflower
MCPA	Wild Oat
fenoxaprop-p-ethyl	Downy brome, Field bindweed
thifensulfuron	Wild Oat
triallate	Blue mustard
tribenuron	Wild Oat

The following table displays the herbicide trade names, acres treated, percentage of area treated, and application rate.

Herbicide usage survey on barley

Herbicide (Ingredient)	Trade name	Acres Treated	Percent Treated*	Rate (lb a.i./ a)
2,4-D	2,4-D amine	20	2	1.17
MCPA	MCPA amine	240	24	3.036
fenoxaprop-p-ethyl	Puma 1EC	250	25	0.009
thifensulfuron	Harmony Extra	240	24	0.16
triallate	Far-Go Granular 10	30	3	0.012
tribenuron	Harmony Extra	240	24	0.078

*: Percent Treated = (acreage treated with a given herbicide / the total acreage treated)*100.

Fenoxaprop-p-ethyl, thifensulfuron, and tribenuron were the most frequently applied herbicides for weed control on barley production in the Northern and Central Plains.

Pesticide Application methods

Pesticide application methods may vary with target pests and crops. The table '**Application Methods**' lists pesticide application methods used by farmers/producers on barley production in 2003.

Application Methods

Control Method	Weed (%)	Insect (%)	Disease (%)
1 Broadcast (ground)	0.75	#	0
2 Broadcast (by air)	0.00	#	0
3 Spot Treatment	0.00	#	0
4 In irrigation	0.00	#	0
5 Banded in or over row	0.00	#	0
6 Foliar or directed spray	0.25	#	0
7 In seed furrow	#	#	100

Unspecified.

Broadcast (ground) is the most popular method in weed control, followed by foliar or directed spray in weed control. Fungicides were more likely to be applied in seed furrow during barley planting.

Non-chemical Control Practices

Non-chemical (cultural) control may be one of the important approaches for pest control in barley production in the Northern and Central Plains. The following table '**Cultural Control Practices'** lists 12 possible cultural approaches that may be adopted by farmers/producers for barley pest (weeds, insects, and diseases) control.

Cultural Control Practices#

Control approaches	Practice Case	Rate1 (%)*	Rate2 (%)**
Releasing any beneficial organisms	0	0.00	0.00
Mowing, burning, or tilling around the fields	0	0.00	0.00
Cultivating during growing season	0	0.00	0.00
Adjusting planting/harvesting dates	0	0.00	0.00
Alternating chemical usage to minimize resistance	0	0.00	0.00
Rotating crops planted	6	60.00	42.86
Utilizing and water management practices	0	0.00	0.00
Cleaning field equipment between uses	1	10.00	7.14
Utilizing treated seed	2	20.00	14.29
Utilizing soil analysis	1	10.00	7.14
Adjusting row spacing or plant density	0	0.00	0.00
Others***	0	0.00	0.00

Unspecified targeted pests (weeds, insect pests, or diseases) in this survey.

* The proportion of growers who adopted a given cultural approach to pest control. e. g., over 60% farmers used the 'rotating crops planted' approach to control pests (weeds, insect pests, or diseases).

** The likelihood that a given cultural approach was used by farmers for pest control in barley production. e. g., there is a 43% possibility that the approach 'rotating crops planted' was applied by farmers to control various pest. Please note that farmers may use more than two approaches in pest control.

*** Unspecified cultural approaches.

Contacts

Fengyou Jia, Crop Profile, Coordinator
(785) 532-5588
jia@ksu.edu

Sonny Ramaswamy, Crop Profile, Project Leader
(785) 532-6154
sonny@ksu.edu

Jeff Whitworth, Extension Entomologist
mailto:jwhitwor@oznet.ksu.edu

Dallas Peterson, Extension Weed Science
mailto:dpeterso@oznet.ksu.edu

James P. Shroyer, Extension Agronomy
jshroyer@oznet.ksu.edu

References

1. Agricultural Research. 1993. Northwest Research and Extension Center, Kansas State University, SRP-762.
2. Dumler, T., C. R. Thompson, and D. M. O'Brien. 2000. Spring Barley cost-return budget (W-B-F rotation) in western Kansas. Kansas State University Agricultural Experiment Station and Cooperative Extension Service, MF- 2097.
3. Fjell, D., C. Thompson, and S. Duncan.1998. Small grain cereals as forage: crop selection. Kansas State University Agricultural Experiment Station and Cooperative Extension Service, For a-25.
4. Glogoza. P., M. McMullen, and R. Zollinger. 2000. Crop Profile for Barley in North Dakota. http://pestdata.ncsu.edu/cropprofiles/docs/NDbarley.html.
5. Gunsolus, J. L. and W. S. Curran. 1994. Herbicide mode of action and injury symptoms. University of Minnesota College of Agriculture, Minnesota Extension Service, BU-3832-F.
6. Gunsolus, J. L., R. L Becker, B.R Durgan, P.M. Porter, and A.G. Dexter. 2001. Cultural and chemical weed control in field crops. University of Minnesota, Extension Service, BU-3157-S.
7. Kadir, S. 2001. Crop Profile for Pecans Barley in Kansas. (http://www.ipmcenters.org/cropprofiles/docs/ksbarley.html).
8. Regehr, D. L, D. E. Peterson, W. H. Fick, P. W. Stahlman, and R. E. Wolf. 2004 Chemicals Weed Control for Field Crops, Pastures, Rangeland, and Noncropland, Kansas State University, Agricultural Experiment Station and Cooperative Extension Service (http://www.oznet.ksu.edu/library/crpsl2/srp917.pdf).
9. Roozenboom, K., R. C. Rife, and R. Sears. 1993. Winter barley varieties in Kansas. Agricultural Experiment Station, Kansas State University, SRP-686 (http://www.oznet.ksu.edu/library/crpsl2/SRP686.pdf.).
10. Shroyer J., D.L. Devlin, R.E. Lamond, and L.C. Bonczkowski. 1986. Spring barley in Kansas. Kansas State University Cooperative Extension Service, MF-877.
11. Shroyer J.P., R.E. Lamond, E.B. Nilson, W.B. Willis, H.L. Brooks, M.E. Mikesell, and J.K. Brotemarkle. 1986. Winter barley in Kansas. Kansas State University Cooperative Extension Service, C-677.
12. U.S. Department of Agriculture (USDA)/National Agricultural Statistics Service (NASS). 1998-19992003-2004. Barley: all. http://www.nass.usda.gov:81/ipedb/grains.htm.
13. Watkins, J.E. and L.C. Lane. 1989. Barley yellow dwarf disease of barley, oats, and wheat. University of Nebraska Cooperative Extension, G89-906-A.
14. Watson, S., D. Fjell, J. Fritz, and D. Blasi. 1993. Emergency and supplemental forages. Kansas State University Cooperative Extension Service, MF-1073 (http://www.oznet.ksu.edu/library/crpsl2/MF1073.pdf).
15. Watson, S., D. Fjell, J. Shroyer, K. Bolsen, and S. Duncan. 1993. Small grain cereal for forage. Kansas State University Cooperative Extension Service, MF-1072 (http://www.oznet.ksu.edu/library/crpsl2/MF1072.pdf).
16. White, S.C. and G.A. Salsbury. 2000. Insects in Kansas. Kansas Department of Agriculture.