Crop Profile for Oats in Kansas

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General Production Information

The Northern and Central Plains contribute significantly to oat production, making up almost one quarter (23.5 million bu in year 2002 and 48.0 million bu in year 2003) of the total U. S. production. North Dakota led this region in oat production during 2002 and 2003, contributing 12.6 million bu in 2002 and 21.2 million bu in 2003, followed by SD, NE, and KS. Pesticides play a significant role against pests in oat production in the region. The following table summarizes oat area, yield, production, price per unit, ranking in terms of value of production in Northern and Central Plains for 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	140	60	52	3120	1.89	5897	14
2002	NE	175	55	43	2365	2	4730	16
2002	ND	670	300	42	12600	1.68	21437	4
2002	SD	470	120	45	5400	1.99	8955	7
2003	Total	1455	535		23485		41019	
2004	Proportion	29.13%	26.00%		20.25%		18.98%	
2002	US Total	4995	2058	56.4	116002	1.81	216127	
2003	KS	140	70	65	4550	1.45	6598	13
2003	NE	220	90	73	6570	1.5	9855	8
2003	ND	620	360	59	21240	1.3	27612	1
2003	SD	420	230	68	15640	1.3	20332	4
2004	Total	1400	750		48000		64397	
2005	Proportion	30.43%	33.72%		33.18%		29.55%	
2003	US Total	4601	2224	65	144649	1.45	217962	

In 2003, North Dakota ranked 1st, and contributed 14.7% to total U.S. oat production. Over 21.2 million bushels were produced on 1.4 million planted acres. An average yield of 59 bushels per acre was realized with a total value of $27.6 million.

Pesticide Usage on Oats for Year 2003

Oats is one of the major crops in this region. The pesticide usage survey on oats in the region for 2003 was conducted by the Kansas Agricultural Statistics Service (KASS) and Kansas State University from October to December 2003. Questionnaires were mailed directly to all sampled growers, identified by KASS based on previous survey data. A total of 443 questionnaires were distributed. Overall, valid responses were very low (18.06%) in the 2003 survey. Although up to 90% of the surveys were returned, only 80 of the responses from four states and 45 counties contained valid data and most sampled growers replied that they did not grow Oats in 2003. 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	68	56	82.35	34	20.90
NE	117	7	5.98	5	2.61
ND	113	9	7.96	2	3.36
SD	145	8	5.52	4	2.99
Total	443	80	18.06	45	29.85

Approximately 11% of the pesticides were applied directly by growers/producers against various pests and 89% of the pesticides were applied by commercial entities in this region.

Cultural Practices

Oats is a significant crop in the Northern and Central Plains, especially in North Dakota. It can produce high quality forage, be used as a feed grain, and can be used for human consumption in hot and ready-to-eat cereals and granola bars. Oats also are planted as a companion crop for establishment of various grasses and legumes. Oats can grow on many soil types, however, medium-textured soils, with good water-holding capacity are preferred over light or poorly drained soils. Spring oats are well adapted to cool and adequate moisture conditions of this region. Seeds generally germinate at 44-45 ^{o}F. Spring oats are planted in late February through April across the Northern and Central Plains.

Spring oats is drilled in shallow or no-tillage planting system. Seeds are planted at 3/4 to 1/2 inches deep, depending on soil texture, moisture conditions, and condition of the seedbed. Generally, row spacing ranges from 6-8" wide, but 10-14" is used in the western areas of the region. Oat seeding rates range from 32 to 96 lb/a. Generally, only certified seed for quality and purity are planted. Seeds are usually treated with fungicide against various seedling diseases and smut. Spring oats are grown in rotation with row crops such as corn, soybean, sorghum, and sunflower to control weeds, insects, and diseases. Frequently, it is planted between a fall-harvest crop and wheat that is to be planted the next fall. It is essential to harvest oats at the proper stages. Oat for forage should be harvested from the boot to early milk stage. Best silage is produced when oats are harvested at the late-milk to late-dough stages. Oats are harvested for grain when kernels reach 15% moisture.

Worker Activities

Oats production in the Northern and Central Plains is primarily mechanized. Worker activities for oats 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 farming tools. The primary worker activities in the early season involve irrigation and herbicide application against weeds such as Kochia, Canada thistle, Field bindweed, Pigweeds, Tansy mustard, Wild buckwheat, Russian thistle, Quackgrass, and Sunflower. The major activities during the summer involve pest monitoring and fungicide applications against several primary plant diseases including Crown rust, Stem rust, and Oat Red Leaf, barley yellow dwarf Virus (BYDV)**.** Activities that bring workers in direct contact with oats during the growing season are very limited in this region.

Insect Pests

There was no insecticide application reported on oats based upon the 2003 survey. However, certain non-chemical approaches may be applied against insect pests on oat production. For instance, resistant barley varieties may be chosen against cereal leaf beetle (*Oulema melanopus*) and control of volunteer grains in field areas to eliminate alternate hosts may be adopted against Russian wheat aphid.

Diseases


Several plant diseases may attack leaves and leaf sheaths, such as **Crown Rust (***Puccinia coronata*), while **Stem Rust** (*Puccinia graminis*) attacks leaves and stems. *P. coronata* produces oblong, yellow –orange pustules in contrast to the darker red-brown and more elongated pustules of *P. graminis.* Both rust diseases overwinter in host and volunteer plants. Spores of the fungus may blow in from southern states. The disease can be damaging if the infection gets an early start. Although certain smuts may attack young plants, such as **Loose Smut** (*Ustilago avenae*) and **Covered Smut** (*Ustilago segetum*), symptoms are not visible until heading. The fungus destroys all of the flower parts, producing black powdery spore masses that are dispersed by the wind. The fungus survives only in seed. (Left Image, crown rust on oats, courtesy of http://www.cdl.umn.edu/introduction/ocr.html, right image, loose Smut on oats, courtesy of http://www.hannafords.com/disease.php?id=13).

Additionally, **Oat Red Leaf, barley yellow dwarf Virus (BYDV)** can also infect many annual and perennial grasses. The virus can be transmitted by several species of aphids, such as greenbug, bird cherry oat, corn leaf and English grain aphids. Initial symptoms are yellowish-green spots near the tips of older leaves. The spots enlarge and turn into different shades of yellow, brown, and red. Stunting and colored plants, scattered in the field, are characteristic symptoms of severely infected young plants. As infected plants mature, lower test weight and blasting of florets are the more obvious symptoms of BYDV infection. Certain soilborne or seed-carrying fungi such as *Rhizoctonia* spp., *Penicillium* spp., *Fusarium* spp., and *Pythium* spp. may cause **Damping Off and Seedling Blight** in wet conditions under too low or too high soil temperatures for adequate germination favors seedling blight. The pathogens attack seeds during germination causing them to rot in the soil or they attack young seedlings. Infected seedlings develop dark brown lesions on the sub-crown inter-node and leaves wilt. Oat fields show symptoms of poor germination, stunting or weak seedlings, or death of young plants after emergence. Management practices include selecting resistant varieties, planting early, using clean certified seed, and using fungicides. (Image, symptom of BYDV on oats, http://www.gov.on.ca/OMAFRA/english/crops/pub811/6bydv.htm).

However, there was no report regarding fungicide usage on oats based on the 2003 survey, even though certain cultural practices may be adopted against these diseases on oats.

Weeds

Oats are generally planted before summer annual weed seeds germinate. No-till fields should be weed-free before planting. Generally, well-established, uniform stands of oats are relatively competitive with weeds and need less herbicide treatment than thin fields. The following are problematic weeds experienced by oat farmers/producers during 2003, which were treated with herbicides.

Kochia (*Kochia scoparia* L.), **(summer cypress, fireweed, mock cypress, Mexican firebush)** is an early germinating summer annual weed, native of Eurasia Flowering season is through summer to early fall. Seeds are the only source of reproduction. Found on rangeland, pastures, fields and disturbed sites. This species has confirmed resistance to triazine and ALS inhibiting herbicides. Herbicide treatments on this weed were reported in Kansas and North Dakota based on 2003 survey. (Image courtesy of http://el.erdc.usace.army.mil/pmis/plants/html/kochia_0.html).

Canada Thistle (*Cirsium arvense*), **(field thistle)** is a native of Eurasia and North Africa, and flowers from June to August. Seeds and rhizomes are the source of reproduction. Found on cropland, ditch banks, roadsides, mud flats, stream and lake bank, and in moist soils. Treatments on this weed using herbicides were reported across the region based on the survey. (Image courtesy of http://www.funet.fi/pub/sci/bio/life/plants/magnoliophyta/magnoliophytina/magnoliopsida/asteraceae/cirsium/vulgare-5.jpg).

Field bindweed (*Convolvulus arvensis* L.), **(creeping Jenny)** is a native of Eurasia. Summer is flowering season. Seeds, spreading roots and rhizomes are the source of reproduction. Found on both cultivated and uncultivated land. It is most common in small grain and summer crop fields, in waste places, gardens, and roadsides. Treatments on this weed using herbicides were reported across the region based on the survey. (Image courtesy of http://tncweeds.ucdavis.edu/photos/conar02.jpg).

Pigweeds (*Amaranthus spp*.), members of the Amaranth family are a problem in several cropping systems. *A. hybridus*, smooth pigweed, was the first triazine resistant plant documented. *A. retroflexus*, redroot pigweed is probably the most common species in this region. *A. lividus*, is a prostrate species with a notch in the tip of the leaf. *A. spinosus*, spiny amaranth, has sharp, strong spines on the stem. *A. graecizans*, breaks off at the ground line and being round is blown around by the wind. Treatments on this weed using herbicides were reported in Kansas based on the survey. (*A. retroflexus*, image courtesy of http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=AMARET).

Tansy Mustard (*Descurainia pinnata*), a member of the Mustard family, is a native winter annual, 4 - 32" tall. The plant is covered with fine hairs. The stem is erect and

branched. The flowers are small, pale yellow, and occur in small clusters at the tips of elongating racemes. Leaves are alternate and pinnately dissected, 2 - 4" long. Tansy mustard has stellate pubescence and racemic inflorescences. Petals are yellow, yellowish-green to cream. Pods are linear with two rows of seed in each seed pod. Tansy mustard spreads by seed from early to late summer. Treatments on this weed using herbicides were reported in North Dakota based on the survey. (Image courtesy of http://www.calflora.net/bloomingplants/tansymustard.html).

Wild Buckwheat (*Polygonum convolvulus)*, a member of the Buckwheat family, is an annual weed with arrowhead-shaped leaves. It has trailing stems that wind around other plants and is often mistaken for field bindweed. Its leaves are heart shaped, alternate and more pointed than those of field bindweed. The leaves have an inconspicuous papery sheath that encircles the stem at the base of each petiole. Stems can be 8 - 40" long. In contrast to field bindweed, wild buckwheat has small, green flowers in the leaf axils. Seeds are triangular, black and slightly roughened. Seeds are the sole source of reproduction. Treatments on this weed using herbicides were reported in North Dakota based on the survey. (Image courtesy of http://oregonstate.edu/dept/nursery-weeds/weedspeciespage/wild_buckwheat/habit_750.jpg).

Russian thistle (*Salsola iberica*), **(tumbleweed, tumbling thistle)** is native of Europe. Flowering can be seen during summer and early fall. Seeds are the only source of reproduction. Found on small grain fields, cultivated dryland fields, and waste areas. There is confirmed resistance to triazine and ALS inhibiting herbicides. Treatments on this weed using herbicides were reported in Kansas based on the survey. (Image courtesy of http://extension.usu.edu/rangeplants/forbs/russianthistle.htm) .

Common sunflower (*Helianthus annuus* L.), **(annual sunflower)** is a native weed. Summer is flowering season. Seeds are the only source of reproduction. Found in cultivated fields, pastures, gardens, roadsides, waste ground, and disturbed sites. There is confirmed resistance to ALS inhibiting herbicides. Treatments on common sunflower using herbicides were reported in South Dakota based on the survey. (Image courtesy of http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=HEAN3&photoID=hean3_005_avp.tif).

Quackgrass (*Elytrigia repens*), a member of the Grass family, is an aggressive perennial reproducing by seed or spreading by a shallow mass of long, slender, branching rhizomes. Rhizomes are usually yellowish-white, sharp-pointed, somewhat fleshy. These rhizomes are effectively spread by tillage, increasing the distribution of the population in a field. They are able to penetrate hard soil or even tubers and roots of other plants. Stems are erect and usually 1 - 3' tall. Leaf blades are 0.25 - 0.5" wide, flat pointed and have small auricles at the junction of blade and sheath. Leaf sheaths and upper leaf blade surfaces are thinly covered with soft hairs. Spikelets are arranged in two long rows, lengthwise against the

stem. Florets are either awnless or have short, straight awns. Tillage is an effective control by depleting food reserves and bringing rhizomes to the surface. Treatments on quackgrass using herbicides were reported in South Dakota based on the survey. (Image courtesy of http://www.invasive.org/images/768x512/1357002.jpg).

Herbicide Usage in 2003

Various weeds compete for resources with oats, and several were problematic and were treated with herbicides during 2003. Based upon the 2003 survey, approximately 37% of the oats planting acreage was treated with herbicides, indicating weed control is one of the critical practices for oat production in the Northern and Central Plains. The survey shows at least four herbicides (active ingredients) were applied in attempts to control 10 different weeds affecting oat production. The following table lists the herbicides used and weeds controlled. Other non-chemical methods (such as oat growers may adopt the deep plowing followed by tillage of re-growth for weed control.) may also be applied in weed control.

Herbicides and Targeted Weeds

Herbicide (Ingredients)	Weeds Targeted
2,4-D	Canada Thistle, Field bindweed, Kochia, Pigweed, Tansy Mustard, Wild Buckwheat, Others
dicamba	Canada Thistle, Kochia, Russian thistle, Common sunflower, Quackgrass, Others
fluroxypyr	Canada Thistle, Common sunflower, Kochia, Quackgrass, Russian thistle
thifensulfuron	Canada Thistle

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

Herbicide usage survey on oats

Herbicide (Ingredient)	Trade name	Mode of Action[b]	Acres Treated	Percent Treated*	Rate (lb a.i./ a)
2,4-D	2,4-D amine	GR	226	12	2.3
dicamba	Sterling, Clarity	GR	800	42	0.32
fluroxypyr	MCPA	GR	750	40	0.17
thifensulfuron	Harmony	GR	110	6	0.14

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

[b]: GR = Growth regulators.

Dicamba and fluroxypyr were the most frequently used herbicides for weed control on oats in the Northern and Central Plains, up to 82% of the sampled treated areas did so at a rate of 0.32 lb/a for dicamba, and 0.17 lb/a for fluroxypyr.

Pesticide Application methods

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

Application Methods

Control Method	Weed (%)	Insect (%)	Disease (%)
1 Broadcast (ground)	0.67	#	#
2 Broadcast (by air)	0.11	#	#
3 Spot Treatment	0.00	#	#
4 In irrigation	0.00	#	#
5 Banded in or over row	0.00	#	#
6 Foliar or directed spray	0.22	#	#
7 In seed furrow	#	#	#

Unspecified.

Broadcast (ground) is the most common method of application of herbicides for weed control in oats.

Non-chemical Control Practices

Non-chemical (cultural) control is one of the important practices for pest control in oats production in the Northern and Central Plains. The following table '**Cultural Control Practices'** lists 12 possible cultural approaches used by farmers for controlling oats pests (weeds, insects, and diseases).

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	5	10.64	6.25
Cultivating during growing season	1	2.13	1.25
Adjusting planting/harvesting dates	3	6.38	3.75
Alternating chemical usage to minimize resistance	2	4.26	2.50
Rotating crops planted	21	44.68	26.25
Utilizing and water management practices	0	0.00	0.00
Cleaning field equipment between uses	3	6.38	3.75
Utilizing treated seed	3	6.38	3.75
Utilizing soil analysis	8	17.02	10.00
Adjusting row spacing or plant density	1	2.13	1.25
Others***	0	0.00	0.00

[#] Without specified targeted pests (weeds, insect pests, or diseases) in this survey.

* The proportion of growers (among the 47 sampled growers) who adopted a given cultural approach for pest control. e. g., over 44% 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 alfalfa production. e. g., there is a 26.25% chance that the approach 'rotating crops planted' was applied by farmers to control various pest. Please note that one farmer may use more than two approaches in pest control.

*** Unspecified cultural approaches.

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