

# Crop Profile for Soybeans in Iowa

## General Production Information



### Major uses in Iowa:

- oil/meal processing
- feed

**Table 1.** Soybean production data for the twelve North Central states, 1997.

Rank	State	Production (billion bu)	Planted (million acres)	Harvested (million acres)	Average yield (bu. per acre)	% U.S. production	value* (billion)
1.	<i>Iowa</i>	<i>483.6</i>	<i>10.5</i>	<i>10.4</i>	<i>46.5</i>	<i>17.7</i>	<i>2.42</i>
2.	Illinois	427.9	10.0	9.95	43	15.7	2.14
3.	Minnesota	261.3	6.8	6.7	39	9.6	1.31
4.	Indiana	237.6	5.45	5.4	44	8.7	1.19
5.	Ohio	197.56	4.5	4.49	44	7.2	0.99
6.	Missouri	177.03	4.9	4.85	36.5	6.5	0.89
7.	Nebraska	141.45	3.5	3.45	41	5.1	0.71
8.	South Dakota	120.75	3.5	3.45	35	4.4	0.61
9.	Arkansas	108.3	3.6	3.55	30.5	4.0	0.54
10.	Kansas	88.8	2.45	2.4	37	3.3	0.44

11.	Michigan	72.8	1.9	1.89	38.5	2.5	0.36
15.	Wisconsin	42.2	1.0	0.96	44	1.6	0.21
18.	North Dakota	34.5	1.2	1.2	29	1.2	0.17
<b>U.S. Totals</b>		2,727	70.8	69.88	39	100	13.7

\* assuming \$5 market price per bushel

## Production Regions



**Figure 1. Soybean acreage in Iowa.** The 20 (red, or dark) counties are those where more than 40 percent of crop acreage is planted to soybean, while the 16 lighter shaded (blue) counties have fewer than 20% of acres in soybean production. The soils of north central Iowa are of low relief, and the nature of agriculture in that region is predominantly corn-soybean rotations with hog production. In southern Iowa, rolling terrain and intensive pasture and hay acreage are paired with corn instead of soybean. Northeastern Iowa is dominated by dairy and beef production, which fits the soil resource well. Steep slopes and shallow soils are favorable for pasture and corn is needed for livestock feed, leading to

considerable continuous corn or corn-alfalfa cropping patterns.

## Cultural Practices

All of Iowa benefits from a temperate climate and deep, fertile soils conducive to intense row crop production. Average annual rainfall ranges from about 25 inches in the extreme northwest corner to over 35 inches in the southeast. In general, soils are neutral to alkaline, and have relatively high water holding capacity. The bulk of Iowa row crop acreage is grown on mollisols and deep entisols in alluvial areas, with a few areas of alfisols where lower organic matter and lower pH are management factors. The combination of climate and soils in most of Iowa is ideally suited to production of both corn and soybean.

Nearly all corn and soybean acreage is planted in a 6-week period in the mid-spring. Corn planting begins in earnest when soil temperatures approach 50°F, Typically in the second week of April, and it is completed by the third week in May, if weather is favorable. Soybean planting usually lags a bit behind the corn, mostly because the growing

points of young corn plants remain below ground where it is safe from frost damage for a few weeks, in contrast to soybean which exposes its growing point upon emergence. Crop development in the southern third of Iowa typically leads the northern third by as much as a week and a half during the growing season because of warmer average temperatures experienced there.

Operation	"conventional system"	reduced till	"no-till"
Primary tillage/land preparation	Chisel plow Disk-harrow/field cultivator	Chisel plow	
Planter operations	row-crop planter	planter or grain drill	planter or grain drill
Secondary tillage	row-crop cult. (1-3 passes) rotary hoe	0-1 pass cultivation rotary hoe	rotary hoe (optional)
Harvest	combine	combine	combine

## Insect Pests

Insect pests of soybeans in Iowa are usually minor problems. The primary insect species that occur are listed below chronologically with brief narrative detailing their effects and remedies.

Pesticide classes are indicated as follows:

1. -Organophosphate
2. -Biological
3. -Carbamate
4. -Organochlorine
5. -Pyrethroid
6. -other

## GERMINATION

**Seedcorn maggot** is the larva of a small fly. The flies are attracted to fields where relatively fresh manure and other organic material is present. The larvae are maggots that seek out germinating soybean and corn seeds and eat the germ, killing the plant. There are no rescue treatments available for control of seedcorn maggot, so most treatment is made in replant situations.

**Chemical controls:**

- **1 Diazinon**; check the label

## VEGETATIVE STAGES

**Bean leaf beetles** over winter as adults and emerge and move first to perennial legumes like alfalfa. As soybeans emerge, beetles migrate to the young plants and feed readily on young leaf and cotyledon tissue.

Early season BLB is sporadic, with weather being the biggest factor in soybean infestation each year. Although the damage can appear devastating, economic losses from early season bean leaf beetle feeding are extremely unlikely.

**Chemical controls:**

None needed for early season BLB infestations. The preferred treatment is no treatment.

Late-season bean leaf beetle can occasionally be yield damaging. For late-season infestations to beans at pod-fill that reach economic threshold, treatments include:

- 5 Ambush 2EC @ 3.2 6.4 ounces per acre, 60 day PHI
- 5 Asana XL 0.66EC @ 4.8 to 9.6 ounces per acre, 21 day PHI
- 1 Cygon 400 @ 1 pint per acre, 21 day PHI
- 3 Lannate 1.8L @ 0.5 1 pint per acre, 14 day PHI (for grain)
- 1 Larvin 3.2F @ 18-30 ounces per acre, 28 day PHI
- 1 Lorsban 4E @ 1 to 2 pint per acre, 28 day PHI
- 1 Orthene 75S @ 0.67 pounds per acre, 14 day PHI
- 1 Penncap-M @ 2-3 pints, 20 day PHI
- 5 Pounce 3.2EC @ 2-4 ounces per acre, 60 day PHI
- 1 Dimethoate 4EC @ 1 pint per acre, 21 day PHI (label contains bee statement)

**Two-spotted spider mites** are controlled during most years in Iowa by a natural fungus disease. When moisture conditions lead to prolonged periods of low humidity, the fungus is suppressed, allowing the spider mite population to proliferate. Large numbers of mites feed on leaves, piercing the vascular bundles, which results in yellowing and eventual death of the leaves. Early season infestations can kill plants.

Late-season infestations can cause early maturation and increased shattering, and up to 50% yield reduction. Early detection and spot treatments are effective in limiting losses, however re-infestation is a problem as long as conditions remain favorable.

**Chemical controls:**

spot treatments are recommended; re-infestation is possible.

- 1 Lorsban 4E @ 0.5 to 1 pint per acre, PHI of 28 days. Do not use for forage or straw.
- 1 Dimethoate 4EC @ 1 pint per acre, 21 day PHI (label contains bee statement)

## **POD FILL AND MATURATION**

**Thistle caterpillar** is the larva of the painted lady butterfly. Thistle caterpillar populations are rarely large enough to cause economic damage. Damaging infestations occur when weather conditions favor spring migration into Iowa, and is characterized by severe leaf-feeding and resultant canopy loss.

### **Chemical controls:**

- 5 Ambush 2E @ 6.4 ounces per acre, 60 day PHI
- 5 Pounce 3.2EC @ 4 ounces per acre, 60 day PHI

**Green cloverworm** is the larva of a moth that migrates into Iowa. Populations usually don't reach economic levels in Iowa because of insufficient migration and the effects of a fungal disease that attacks the larvae. Occasionally, with favorable conditions for the insect, economic damage can occur. Loss of leaf area is the biggest source of damage from green cloverworm.

### **Chemical controls:**

- 5 Ambush 2EC @ 3.2 6.4 ounces per acre, 60 day PHI
- 5 Asana XL 0.66EC @ 2.4 to 4.8 ounces per acre, 20 day PHI
- 2 DIPEL, according to label, nearly all with no PHI
- 3 Lannate 1.8L @ 0.5 1 pint per acre, 14 day PHI
- 1 Lorsban 4E @ 0.5 to 1 pint per acre, 28 day PHI
- 1 Malathion 57%EC @ 3 pints per acre, 3 day PHI
- 1 Orthene 75S @ 0.67 pounds per acre, 14 day PHI
- 1 PennCap-M @ 2-3 pints, 20 day PHI
- 5 Pounce 3.2EC @ 2-4 ounces per acre, 60 day PHI

**Bean leaf beetle** (late season) see BLB early season

**Grasshopper** (predominantly 3 species: differential, two-striped, red-legged) can cause significant damage to maturing soybeans, with the insects eating through the pod and into the beans themselves. Grasshopper populations are extremely dependent on two factors. These are the presence of undisturbed grassy oviposition areas near fields that allow egg masses to overwinter and hatch without disruption and relatively dry weather during early and middle summer.

### **Chemical treatments recommended:**

- 5 Asana XL 0.66EC @ 4.8 to 9.6 ounces per acre, 20 day PHI
- 3 Furadan 4F @ 0.25 to 0.5 pints per acre, 21 day PHI
- 1 Lorsban 4E @ 0.5 to 1 pint per acre, 28 day PHI
- 1 Orthene 75S @ 0.67 pounds per acre, 14 day PHI
- 1 PennCap-M @ 2-3 pints, 20 day PHI

## **Diseases**

### **Pythium Damping-off**

Pythium is a common early season root pathogen of soybean caused by 5 species of *Pythium*. This disease is found wherever soybeans are grown. Wet, cool (50-59 F optimal) soils are preferred for spread and infection by Pythium. Pythium symptoms appear as seedling decay before emergence, and root rot of seedlings. No major resistance genes are known to Pythium species. Some species have been known to cause root swelling similar to some herbicide damage.

### **Phytophthora Damping-off**

Phytophthora is a common seedling disease root pathogen of soybean. Wet, warm (70-77) soils are preferred for spread and infection by Pythium. Pythium symptoms appear as seedling decay before emergence, and root rot of seedlings. After V2 stage, Phytophthora can be differentiated from Pythium based on a brown discoloration extending from the root up the stem. There is single gene resistance available for most Phytophthora races, although field populations usually include a range of races. Race shifts within the Phytophthora population are common.

### **Rhizoctonia**

Rhizoctonia root rot is an early season root rot caused by *Rhizoctonia solani*. This disease can reduce stands by as much as 50% and can cause yield losses of up to 40% have been recorded in Brazil and the United States. This fungus is common in most agricultural soils. Diseased seedlings are often shrivel and die after emergence, or remain stunted. The most distinctive symptom of Rhizoctonia root rot is red or reddish brown streaks or lesions on the hypocotyl or lower stem

### **Anthracnose**

Soybean anthracnose is caused by a number of species of *Colletotrichum*. It occurs wherever soybeans are grown. The disease can reduce stand, seed quality, and yield by 16-26% or more in the United States. This disease can occur at any stage of soybean development. Symptoms typically appear in the early reproductive stages on stems, pods, and petioles as irregularly shaped brown areas and may resemble pod and stem blight. In advanced stages of anthracnose, infected tissues are covered with black fruiting bodies, which produce minute black spines that can be seen with the unaided eye. Free water on plant surfaces promoted infection.

### **Stem canker**

Stem canker is a soil borne disease caused by *Diaporthe phaseolorum*. It can be found in all North American soybean production regions. The use of resistant varieties has reduced the significance of stem canker. Stem canker starts with the appearance of small, reddish brown lesions, usually near leaf node three or four, around the beginning of flowering. As lesions enlarge, they become sunken. During pod set, the soybean leaves just above the canker become yellow. Infected plants have interveinal chlorosis and necrosis, but leaf drop is minimal. Plants become brittle with time, and the upper portion of the plant dies after the canker girdles the stem. The fungus does not invade the roots, so no root rot is observed. Excessive rainfall and high humidity with warm temperatures (70-80 F optimal) early in the growing season are conducive to disease development.

### **Septoria leaf spot**

Septoria leaf spot, also known as brown spot, is caused by the fungus *Septoria glycines*. This disease has been found in all North Central states, and most Southern and mid-Atlantic states in the United States. Normally, the disease causes no significant yield losses, but up to 15% yield loss has been attributed to this disease. The fungus normally infects aged leaves in the lower portion of the canopy. Brown spot lesions are chocolate brown to blackish brown in color. Frequent rainfall is the primary condition for the occurrence of an epidemic. In a wet summer, the disease progresses from lower to upper leaves rapidly.

### **Purple seed stain**

Purple seed stain is caused by the fungus *Cercospora kikuchii*. This disease is found world wide, and is associated with reduction in quality of yield and it can delay germination of infected seeds. The disease is most conspicuous on seeds, although pods, stems and leaves can be infected. Seed discoloration varies from pink or pale purple to dark purple. Discolored areas range from specks to large irregular blotches that may cover the entire seed coat. Warm, humid conditions favor the growth of this pathogen.

### **Sudden death syndrome**

Sudden death syndrome is a soil borne disease caused by *Fusarium solani*. This disease has recently become prevalent in soybean production regions in the North Central United States. Sudden death syndrome has been reported to cause up to 50% yield losses. Symptoms appear during the early reproductive growth stages, generally in high yielding fields. Root infection causes intervenal chlorosis and necrosis of the leaves, which culminates in leaf drop with the petioles still attached to the stem. The fungus causes root rot and a general browning of the tap root and secondary roots. Sudden death syndrome is prevalent during cool, wet growing seasons.

### **White mold**

White mold is caused by a soil borne fungus *Sclerotinia sclerotiorum*. The disease has emerged as a major production problem in the north central region recently with outbreaks occurring in areas where maturity groups I to III are grown. Infection usually begins after canopy closure. The most typical sign of white mold is a mass of cottony, white, fungal mycelium growing on lesions of infected stems. Black irregularly shaped sclerotia, ranging from pinhead-size to pebble-size, form in the dense mycelium on the exterior and interior of infected stems and pods.

### **Brown Stem Rot**

Brown stem rot is a late-season, cool-temperature, soil borne disease caused by the fungus *Phialophora gregata*. Brown stem rot is widespread in Midwestern and some southeastern states of the United States and Canada, and can cause yield reductions of 17-25%. *P. gregata* causes two types of symptoms: stem symptoms and foliar symptoms. Foliar symptoms are often confused with plant maturity. Soybean leaves turn brown instead of yellow at maturity. Stem symptoms include increased lodging, and browning of the pith from the soil line up the stem.

## **Fungicide information**

### **captan**

- **Trade name and formulation:** various
- **Use rates:** 0.62 - 1.18 oz/100 lbs. seed
- **Application timing:** seed treatment
- **REI:**
- **Primary use:** seed rots and seedling blights (*Pythium*, *Phytophthora*, *Rhizoctonia*)

### **metalaxyl**

- **Trade name and formulation:** Apron 50W, Ridomil
- **Use rates:** 0.032 - 0.5 oz a.i./100 lbs seed
- **Application timing:** seed treatment
- **REI:** 12 hours
- **Primary use:** seed rots and seedling blights (*Pythium*, *Phytophthora*), *Phytophthora* root rot

## carboxin

- **Trade name and formulation:** Vitavax 34
- **Use rates:** 0.8 - 0.16 oz a.i./100 lbs seed
- **Application timing:** seed treatment
- **REI:**
- **Primary use:** seed rots and seedling blights (*Pythium*, *Phytophthora*, *Rhizoctonia*)

## benomyl

- **Trade name and formulation:** Benlate
- **Use rates:** 0.5 lb a.i./A
- **Application timing:** postemergence, after early pod-set. Repeat 14-21 days later (as needed.)
- **Pre-harvest interval:** 35 days. Do not graze or feed treated vines to livestock.
- **REI:** 24 hours
- **Primary use:** pod and stem blight, anthracnose, stem canker, Septoria brown spot, purple seed stain.

## chlorothalonil

- **Trade name and formulation:** Bravo 500
- **Use rates:** 0.78-1.82 lb a.i./A per application
- **Application timing:** postemergence. 2 or 3 applications at 7 day intervals.
- **Pre-harvest interval:** Do not apply within 6 weeks of harvest. Do not feed soybean hay or threshings to livestock.
- **REI:** 48 hours
- **Component of other products:**
- **Primary use:** pod and stem blight, anthracnose, stem canker, Septoria brown spot, purple seed stain.

## thiophanate-methyl

- **Trade name and formulation:** Topsin-M
- **Use rates:** 0.35 - 0.7 lb a.i./A per application - two applications maximum per season.
- **Application timing:**
- **Pre-harvest interval:** Do not apply after beans begin to form in pods. Do not graze or feed treated vines or hay to livestock.
- **REI:** 12 hours
- **Component of other products:**
- **Primary use:** pod and stem blight, anthracnose, stem canker, Septoria brown spot, purple seed stain.

## Nematodes

### Soybean Cyst Nematode (*Heterodera glycines*).

**Soybean cyst nematodes (SCN)** are small worms that infect soybean roots and, when present in large numbers, can seriously damage soybean yield. Recent surveys by researchers at Iowa State University show that approximately 70 percent of randomly selected Iowa soybean fields are infested with SCN.

Although Temik, Vydate and Telone are labeled for SCN control, few, if any, producers use them. Crop rotation and the use of SCN-resistant soybean cultivars are the two biggest tools in managing SCN.

1. Scouting for early detection. In Iowa, there often will be no obvious symptoms of SCN infection in the above-ground parts of plants for years until SCN population densities increase to extremely high levels. By then, however, the problem is most difficult to manage. The key to successful management of SCN is early detection of infestations. Scouting for SCN can be done by digging roots and looking for white SCN females, which are visible on soybean roots with the naked eye. Digging roots should be done no earlier than 5 or 6 weeks after planting and can continue through the month of August.
2. Growing non-host crops. Soybean cyst nematode population densities decline during any year that non-host crops are grown. Alfalfa, corn, and oats are common non-host crops grown in Iowa, and SCN densities decline similarly when these three crops are grown in infested fields. Soybean cyst nematode population densities generally decline from 10 to 50% during a year that a nonhost crop is grown.
3. Use of SCN-resistant soybean cultivars. Resistant soybean cultivars are the most effective tool available for management of SCN. By planting resistant soybeans in infested soil, reproduction of the nematode is suppressed. Most SCN juveniles will be unable to feed and complete their life cycle on the roots of resistant varieties, but a few nematodes will survive and reproduce. Most any SCN-resistant soybean variety will yield significantly better than a susceptible variety in a field infested with the nematode. SCN-resistant soybean varieties keep SCN population densities from increasing and may even decrease the densities through the course of a growing season.

## Weeds

Annual weed species comprise a majority of the weed control problems in Iowa soybean production. Many of the primary weed species are introduced rather than native. The most troublesome weeds are those adapted to the two-crop rotation system primarily used in Iowa. Weeds that are able to germinate in the spring following primary tillage, compete with the crop, and produce seed before frost or harvest are the most common. However, as the amount of tillage in Iowa row-crop production decreases, there has been an increase in the frequency of perennial and biennial weed problems.

Weeds reduce corn yield primarily by competing for water, sunlight and nutrients, thus diminishing total soybean yield potential. Heavy weed infestations can also affect harvest efficiency by increasing grain moisture content at harvest and increasing foreign material levels in harvested grain, both resulting in added cost to the producer.

Current information regarding weed management in Iowa can be found at <http://www.weeds.iastate.edu>

### Annual grasses

Annual grasses infest approximately 98% of all soybean acres in Iowa. Many of these are controlled with preemergence herbicide applications and tillage. While not as competitive as broadleaf weed species, annual grasses can reduce crop yields when significant populations are present. In most weed management programs, control of

grasses is of secondary concern to control of broadleaf weed species. Of the many species present, three of the most prevalent are discussed below.

### **Foxtails**

There are three important foxtail species in Iowa: giant foxtail (*Setaria faberi*), yellow foxtail (*Setaria glauca*), and green foxtail (*Setaria viridis*). At least one of these species infest nearly 100 percent of the corn acres in Iowa. While low populations cause little crop competition, because of seed production an unchecked population can quickly become a severe problem. None of these species is native to Iowa.

Foxtail species in soybeans are controlled through a combination of preemergence herbicides, tillage (seedbed preparation and inter-row cultivation) and postemergence herbicides. Unlike corn, there are more herbicide options for postemergence control of grass species in soybeans.

### **Woolly cupgrass**

Woolly cupgrass (*Eriochloa villosa* [Thunb.] Kunth.) is a relatively new and potentially serious weed problem in Iowa. Woolly cupgrass was first collected in 1957 from one county in Southwest Iowa and it is currently distributed throughout most Iowa counties. The spread has increased rapidly in the last 10 to 15 years and is currently estimated to infest over 20% of Iowa cropland. Woolly cupgrass populations have increased rapidly in the last decade and the distribution has spread widely.

This annual grass weed demonstrates biological, biochemical, and morphological characteristics that make it economically damaging and adds to the difficulty in developing effective management strategies. Woolly cupgrass is a prolific seed producer. This seed tends to germinate earlier and at higher populations than other annual grass weeds. Woolly cupgrass has demonstrated tolerance to most herbicides commonly used for control of annual grasses in corn.

### **Shattercane**

Shattercane (*Sorghum bicolor*) is an annual grass that is found only in cultivated fields where it reseeds itself. Shattercane is commonly found in areas where forage sorghum has been grown. All sorghums are members of the same species and can hybridize. It may develop if seeds from hybrid grain or forage sorghums are allowed to grow and flower through several generations. Therefore, it is highly variable. While found in areas throughout the state, it is more prevalent in the southern and western regions of Iowa.

### **Other annual grasses of economic importance in soybean:**

- barnyardgrass (*Echinochloa crusgalli*)
- fall panicum (*Panicum dichotomiflorum*)
- wild proso millet (*Panicum miliaceum*)

### **Perennial grasses**

#### **Quackgrass**

Quackgrass (*Agropyron repens*) is a perennial grass that spreads by rhizomes. These rhizomes are effectively spread

by tillage, increasing the scope of the population in a field. While quackgrass can be found in nearly every county in Iowa, it is more common in small grains and lawn areas than in corn production. Tillage is an effective control by depleting food reserves and bringing rhizomes to the surface. Atrazine is also provides excellent control.

### **Wirestem muhly**

Wirestem muhly (*Muhlenbergia frondosa*) is a perennial grass that reproduces by seeds and underground rhizomes. It is native to Iowa. It was not considered a common row crop weed until the 1950's when serious infestations developed in cultivated fields. Wirestem muhly is most common as a weed of cultivated fields in southeast and east central Iowa. Delayed seedbed preparation will help control wirestem muhly in corn by bringing rhizomes to the soil surface to dry out.

## **Annual broadleaves**

Annual broadleaf weed species are the main weed management target in Iowa soybean production. Velvetleaf (*Abutilon theophrasti*) is one of the most common broadleaf weeds found in Iowa, infesting nearly 90 percent of all soybean acres. Common cocklebur (*Xanthium strumarium*) is found on approximately 60 percent of the acres. Common sunflower (*Helianthus annuus*) infests 50 percent of Iowa soybean acres. These three weeds can provide significant crop yield reduction because of their aggressive growth habit, canopy structure, and competitiveness.

### **Waterhemp**

Common waterhemp is a relatively new weed problem in Iowa. However, common waterhemp is a native species that has been identified by botanists in the historic taxonomic records. Currently, common waterhemp is a serious weed problem throughout Iowa. There have been changes in agricultural practices that have favored this weed. These changes include reductions in tillage, herbicide selection, simplified crop rotations, and recent weather patterns that have resulted in the relatively rapid rise in importance of common waterhemp to Iowa agriculture. Because waterhemp is a relatively new weed problem, there has been little research conducted. Most of the research has focused on the relationship of this weed complex with herbicides. Specifically, there have been many studies documenting difficulties in controlling common waterhemp with herbicides that inhibit acetolactate synthase (ALS) activity.

There are many factors that have contributed to the increase in common waterhemp populations in Iowa. Studies have shown the common waterhemp emerges late in the growing season when compared to other annual broadleaves such as velvetleaf (*Abutilon theophrasti*). Over the past few years, a common pattern of waterhemp emergence has been emergence approximately two weeks after velvetleaf and continuing for two months. Velvetleaf demonstrated a relatively short germination period of three weeks. In many weeds, late emergence is not a major management issue because the crop canopy effectively competes with the weed. However, common waterhemp is able to emergence late and grow through the crop canopy. The survival of emerged waterhemp is highly dependent on environmental conditions. Abundant rainfall during the growing season will promote high waterhemp populations.

Other biological characteristics that contribute to the rapid increase in common waterhemp populations are high seed production and an ability to germinate from shallow soil depths. Small-seeded annual weeds like common waterhemp must be near the soil surface to successfully germinate and emerge. Reduced and no tillage systems which have increased in the Midwest favor the establishment and success of common waterhemp populations.

Control of common waterhemp has become increasingly difficult due to resistance to ALS-inhibiting herbicides. Waterhemp has demonstrated cross-resistance to all herbicides with this mode of action.

### **Other broadleaf weeds of economic significance in Iowa soybean production:**

- redroot pigweed (*Amaranthus retroflexus*)
- lambsquarter (*Chenopodium album*)
- Pennsylvania smartweed (*Polygonum pensylvanicum*)
- common ragweed (*Ambrosia artemisiifolia*) and giant ragweed (*Ambrosia trifida*)

### **Perennial broadleaves**

The occurrence of perennial broadleaf weeds is highly dependent on the tillage regime used in soybean production. Since most perennial broadleaf weeds do not tolerate tillage, these weeds are more of a problem in reduced tillage and no-till operations.

Swamp smartweed (*Polygonum coccineum*) is commonly found in low, wet areas of fields. Because of an extensive root system it is a strong competitor with soybean and difficult to eradicate. Because of its similarity to Pennsylvania smartweed, an annual, many producers incorrectly identify this weed.

### **Herbicide Control**

Herbicides continue to be the primary strategy used for soybean weed management in Iowa. Ninety-nine percent of Iowa soybean acres were treated with at least one herbicide in 1995.

Weed management systems in soybeans rely heavily on postemergence products, and herbicides in the ALS-inhibitor class continued to dominate the Iowa soybean market in 1995. The imidazolinone herbicides imazethapyr and imazaquin were used on 76 percent and 4.4 percent of the soybean acres, respectively. Chlorimuron and thifensulfuron, both sulfonyleurea herbicides, were used on 10.4 percent and 18.6 percent, respectively, of the soybean acres in 1995. Bentazon, a herbicide in the diphenyl-ether class, was used on 10.3 percent of the soybean acres.

Major changes in herbicides used for grass control in soybeans also were observed between 1990 and 1995. The acres treated with trifluralin declined from 55 percent in 1990 to 30.3 percent in 1995, whereas the acres treated with pendimethalin increased from 8.9 percent to 27.9 percent in 1995. The number of acres treated postemergence for grass control increased from approximately 20 percent in 1990 to 44 percent in 1995.

The following is a review of the primary herbicide active ingredients currently used in Iowa soybean production. Herbicides are grouped according to primary mode of action. Many times herbicides within a mode of action will control a similar spectrum of weeds and have similar use properties. Products that are package mixes are listed under the primary active ingredient with other ingredients noted. Information on acreage treated, if available, is from the [1995 Survey of Pesticide Use in Iowa](#). For products or active ingredients introduced since the 1995 survey, no use data is provided.

[ALS-inhibitors and amino acid derivatives](#)

[PSII inhibitors \(non-mobile\)](#)

[Shoot inhibitors](#)

[Cell-membrane disruptors \(PPO\)](#)

[Unclassified](#)

[ACC-ase inhibitors](#)

[Growth regulator](#)

[Pigment synthesis inhibitor](#)

[Root inhibitors](#)

## ALS-inhibitors and amino acid derivatives

### chloransulam

- **Trade name and formulation:** FirstRate 84WDS
- **Percent crop treated:** not available
- **Use rates:** 0.5 - 0.63 oz a.i./A
- **Application timing:** postemergence
- **Pre-harvest interval:** 65 days. May harvest for forage or hay after 14 days.
- **REI:** 12 hours
- **Component of other products:**

### chlorimuron

- **Trade name and formulation:** Classic 25DF
- **Percent crop treated:** 10.4%
- **Use rates:** 0.0625 - 0.1875 oz a.i./A
- **Application timing:** postemergence (Classic, Concert, Synchrony, Reliance) or preemergence (Canopy formulations)
- **Pre-harvest interval:** 60 days. Do no graze or feed treated forage.
- **REI:** 12 hours
- **Component of other products:** Canopy 75DF, Canopy XL 56.3DF, Concert 25DF, Synchrony STS 42DF, Reliance STS 25DF

### flumetsulam

- **Trade name and formulation:** Python 80WDG
- **Percent crop treated:** 0.6%
- **Use rates:** 0.04 - 0.07 lb a.i./A
- **Application timing:** preplant incorporated, preemergence (apply 30 days prior to planting until before the soybean cracking stage.)
- **Pre-harvest interval:** 85 days
- **REI:** 12 hours
- **Component of other products:** Broadstrike+Dual, Broadstrike+Treflan, FrontRow

### imazamox

- **Trade name and formulation:** Raptor 1AS

- **Percent crop treated:** not available
- **Use rates:** 0.03-0.04 lb a.i./A
- **Application timing:** postemergence up to 5 inch weed height but prior to soybean bloom)
- **Pre-harvest interval:** 85 days. Do not graze or feed treated soybean forage, hay, or straw to livestock.
- **REI:** 4 hours
- **Component of other products:**

### imazaquin

- **Trade name and formulation:** Scepter 70DG, Scepter 1.5AS
- **Percent crop treated:**4.4%
- **Use rates:** 0.06 - 0.123 lb a.i./A
- **Application timing:** preplant incorporated, preemergence (up to 45 days before planting), postemergence
- **Pre-harvest interval:** none. Do not graze or feed treated soybean forage, hay or straw to livestock.
- **REI:** 12 hours
- **Component of other products:** Squadron, Detail, Scepter OT, Tri-Scept, Steel

### imazethapyr

- **Trade name and formulation:** Pursuit 2AS, Pursuit 70DG
- **Percent crop treated:** 76%
- **Use rates:** 0.0625 lb a.i./A
- **Application timing:** postemergence - apply to weeds less than 3 inches in height
- **Pre-harvest interval:** 85 days. Do not graze or feed treated soybean forage, hay or straw to livestock.
- **REI:** 4 hours
- **Component of other products:** Pursuit Plus, Steel

### thifensulfuron

- **Trade name and formulation:** Pinnacle 25DF
- **Percent crop treated:** 18.6%
- **Use rates:** 0.0625 oz a.i./A
- **Application timing:** postemergence after 1st trifoliolate has expanded
- **Pre-harvest interval:** 60 days. Do not graze or feed treated forage.
- **REI:** 12 hours
- **Component of other products:** Concert 25DF, Synchrony STS 42DF, Reliance STS 25DF

## ACC-ase inhibitors

### clethodim

- **Trade name and formulation:** Select 2EC, Prism
- **Percent crop treated:** 11.5%
- **Use rates:** 0.09 - 0.25 lb a.i./A
- **Application timing:** postemergence

- **Pre-harvest interval:** 60 days. Do not graze or feed treated forage or hay to livestock.
- **REI:** 12 hours
- **Component of other products:**

### fenoxaprop

- **Trade name and formulation:** Option II
- **Percent crop treated:** 15.9%
- **Use rates:** 0.031 - 0.07 lb a.i./A
- **Application timing:** postemergence prior to soybean bloom
- **Pre-harvest interval:** 90 days. Do not graze or feed treated forage or hay to livestock.
- **REI:** 24 hours
- **Component of other products:** Fusion 2.66EC

### fluazifop

- **Trade name and formulation:** Fusilade DX 2EC
- **Percent crop treated:** 17.5%
- **Use rates:** 0.09 - 0.188 lb a.i./A
- **Application timing:** postemergence until soybean bloom
- **Pre-harvest interval:** none. Do not graze field or harvest for forage or hay.
- **REI:** 12 hours
- **Component of other products:** Tornado, Typhoon, Fusion 2.66EC

### quizalofop

- **Trade name and formulation:** Assure II 0.8EC
- **Percent crop treated:** 6%
- **Use rates:** 0.03 - 0.06 lb a.i./A
- **Application timing:** postemergence until pod set
- **Pre-harvest interval:** 80 days. Do not graze field or harvest for forage or hay.
- **REI:** 12 hours
- **Component of other products:**

### sethoxydim

- **Trade name and formulation:** Poast Plus 1EC, Prestige 1EC, Poast 1.5EC
- **Percent crop treated:** 9.5%
- **Use rates:** 0.14 - 0.28 lb a.i./A
- **Application timing:** postemergence
- **Pre-harvest interval:** 75 days. Do not graze treated fields. Do not feed treated forage (green/succulent) or silage to livestock. Treated hay may be fed.
- **REI:** 12 hours
- **Component of other products:** Conclude G, Rezult G

## PSII inhibitors (non-mobile)

### bentazon

- **Trade name and formulation:** Basagran 4S
- **Percent crop treated:** 10.3%
- **Use rates:** 0.5 - 1.0 lb a.i./A
- **Application timing:** postemergence
- **Pre-harvest interval:** no restriction. Do not graze or cut for forage or hay for at least 30 days after last treatment.
- **REI:** 48 hours
- **Component of other products:** Galaxy, Rezult B

## PSII inhibitors (mobile)

### linuron

- **Trade name and formulation:** Lorox 50DF, Lorox 4L
- **Percent crop treated:** 0.2%
- **Use rates:** 0.5 - 2.5 lb a.i./A
- **Application timing:** preemergence (after planting, before emergence)
- **Pre-harvest interval:** none. Do not feed treated forage to livestock.
- **REI:** 24 hours
- **Component of other products:**

### metribuzin

- **Trade name and formulation:** Sencor 75DF, Lexone 75DF, Sencor 4F
- **Percent crop treated:** 2.2%
- **Use rates:** 0.05 - 0.14 lb a.i./A
- **Application timing:** preplant incorporated, preemergence (prior to soybean emergence)
- **Pre-harvest interval:** none. Do not use for forage.
- **REI:** 12 hours
- **Component of other products:** Axiom 68DF, Turbo 8EC, Canopy 75DF

## Shoot inhibitors

### alachlor

- **Trade name and formulation:** Lasso 4EC, Lasso II 15G, Partner 65DF, CropStar 20G
- **Percent crop treated:** 1.1%
- **Use rates:** 2 - 3 lb a.i./A

- **Application timing:** early preplant (up to 30 days prior to planting), preplant incorporated, preemergence
- **Pre-harvest interval:** none
- **REI:** 12 hours
- **Component of other products:** Freedom 3EC

### dimethenamid

- **Trade name and formulation:** Frontier 6EC
- **Percent crop treated:** 0.1 %
- **Use rates:** 0.75-1.5 lb a.i./A
- **Application timing:** early preplant, preplant incorporated, preemergence, early postemergence (up to 3rd trifoliolate stage of soybeans)
- **Pre-harvest interval:** none
- **REI:** 12 hours
- **Component of other products:** Detail 4.1EC

### flufenacet

- **Trade name and formulation:** Axiom 68DF (a premix with metribuzin)
- **Percent crop treated:** registered for use in 1998
- **Use rates:** 0.24 - 0.44 lb a.i./A
- **Application timing:** preplant, preplant incorporated, preemergence
- **Pre-harvest interval:** none. Do not graze or harvest for forage.
- **REI:** 12 hours
- **Component of other products:**

### metolachlor and S-metolachlor

- **Trade name and formulation:** Dual II 7.8EC, Dual II Magnum 7.64EC
- **Percent crop treated:** 1%
- **Use rates:** 1.46 - 2.9 lb a.i./A of metolachlor
- **Application timing:** fall applied, early preplant (up to 30 days prior to planting), preplant incorporated, preemergence
- **Pre-harvest interval:** none
- **REI:** 24 hours
- **Component of other products:** Broadstrike+Dual, Turbo 8EC

## Root inhibitors

### ethalfluralin

- **Trade name and formulation:** Sonalan 3HFP
- **Percent crop treated:** 1.7%
- **Use rates:** 0.56 - 1.31 lb a.i./A
- **Application timing:** preplant incorporated (within 2 days after applications)

- **Pre-harvest interval:** none. Do not graze or feed treated forage.
- **REI:** 12 hours
- **Component of other products:**

### pendimethalin

- **Trade name and formulation:** Prowl 3.3EC, Pentagon 60DG
- **Percent crop treated:** 27.9%
- **Use rates:** 0.5 - 1.5 lb a.i./A
- **Application timing:** preplant incorporated, preplant surface, preemergence
- **Pre-harvest interval:** none. Do not graze or harvest for forage or hay.
- **REI:** 12 hours
- **Component of other products:** Pursuit Plus EC, Squadron, Steel

### trifluralin

- **Trade name and formulation:** Treflan 4EC, many generics
- **Percent crop treated:** 30.3%
- **Use rates:** 0.5 - 1.0 lb a.i./A
- **Application timing:** preplant incorporated (incorporation required within 24 hours)
- **Pre-harvest interval:** none
- **REI:** 12 hours
- **Component of other products:** Broadstrike+Treflan, Freedom 3EC, TriScept, Commence EC,

## Growth regulator

### 2,4-D

- **Trade name and formulation:** 2,4-D LV ester 4EC (several products)
- **Percent crop treated:** 13.4%
- **Use rates:** 0.375 - 1.0 lb a.i./A
- **Application timing:** burndown (prior to planting. Allow at least 7 days before planting for 0.5 lb applications, and 30 days for application up to 1 lb a.i./A)
- **Pre-harvest interval:** none
- **REI:** 48 hours
- **Component of other products:**

## Pigment synthesis inhibitor

### clomazone

- **Trade name and formulation:** Command 4EC, Command 3ME
- **Percent crop treated:** 3.4%

- **Use rates:** 0.5-1.0 lb a.i./A
- **Application timing:** early preplant (no later than April 1 south of I-80 and April 10 north of I-80), preplant incorporated, preemergence
- **Pre-harvest interval:** none. Do not graze or feed treated soybean forage.
- **REI:** 12 hours
- **Component of other products:** Commence

(PPO)

### acifluorfen

- **Trade name and formulation:** Blazer 2L, Status 2L
- **Percent crop treated:** 2.3%
- **Use rates:** 0.125-0.375 lb a.i./A
- **Application timing:** postemergence
- **Pre-harvest interval:** 50 days. Do not use treated plants for forage.
- **REI:** 48 hours
- **Component of other products:** Galaxy, Storm, Conclude B, Scepter OT

### flumiclorac

- **Trade name and formulation:** Resource 0.86EC
- **Percent crop treated:** not available
- **Use rates:** 0.027-0.08 lb a.i./A
- **Application timing:** postemergence
- **Pre-harvest interval:** 60 days. Do not graze treated areas or harvest for forage or hay.
- **REI:** 12 hours
- **Component of other products:** Stellar 3.1EC

### fomesafen

- **Trade name and formulation:** Flexstar 1.88ME, Reflex 2LC
- **Percent crop treated:** 1.9%
- **Use rates:** 0.19-0.31 lb a.i./A
- **Application timing:** postemergence (before soybean blooming)
- **Pre-harvest interval:** none. Do not graze or feed treated forage.
- **REI:** 24 hours
- **Component of other products:** Tornado, Typhoon

### lactofen

- **Trade name and formulation:** Cobra 2EC
- **Percent crop treated:** 1.4%
- **Use rates:** 0.2 lb a.i./A
- **Application timing:** postemergence

- **Pre-harvest interval:** 45 days. Do not use straw or hay for animal feed or bedding.
- **REI:** 12 hours
- **Component of other products:** Stellar 3.1EC

### sulfentrazone

- **Trade name and formulation:** Authority 75DG
- **Percent crop treated:** not available. Registered in 1998.
- **Use rates:** 0.1875 - 0.25 lb a.i./A
- **Application timing:** early preplant (up to 30 days), preplant incorporated, preemergence
- **Pre-harvest interval:** none. Do not graze or feed treated soybean forage.
- **REI:** 12 hours
- **Component of other products:** Canopy XL

## Unclassified

### glufosinate

- **Trade name and formulation:** Liberty 1.67S
- **Percent crop treated:** not available
- **Use rates:** 0.2-0.36 lb a.i./A
- **Application timing:** postemergence from emergence to bloom (use only on soybeans designated as "LibertyLink")
- **Pre-harvest interval:** 70 days. Do not feed green, immature soybeans to livestock
- **REI:** 12 hours
- **Component of other products:**

### glyphosate

- **Trade name and formulation:** Roundup Ultra 4SL
- **Percent crop treated:** prior to introduction of Roundup Ready soybeans 19.9%. Current data unavailable.
- **Use rates:** 0.75 - 1.5 lb a.i./A
- **Application timing:** emergence to 30 inches or V8 growth stage. For applications after 24 inches use drop nozzles.
- **Pre-harvest interval:** 7 days. Do not feed or graze treated forage.
- **REI:** 4 hours
- **Component of other products:**

## Contacts

### Iowa State University

1. Richard O. Pope, extension program specialist
2. Brent A. Pringnitz, extension program specialist

3. Robert G. Hartzler, extension weed management specialist
4. Greg Tylka, extension nematologist
5. X.B. Yang, extension plant pathologist
6. Keith Whigham, extension agronomist
7. Marlin Rice, extension entomologist
8. Joyce Hornstein, extension program specialist
9. Sorrel Brown, PIAP state liaison for Iowa

### **Iowa Soybean Association**

### **Iowa Independent Crop Consultants Association**

### **Agribusiness Association of Iowa**

### **Iowa Farm Bureau Federation**

### **Iowa Agricultural Statistics Service**

### **Iowa Certified Crop Advisor Board**

Produced by the Iowa State University [Pest Management and the Environment Program](#).

Last update: Thursday, February 18, 1999 07:37 AM

---

Database and web development by the [NSF Center for Integrated Pest Management](#) located at North Carolina State University. All materials may be used freely with credit to the USDA.