Chapter 4.
Small Grains

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Winter Wheat

Although both soft red and hard red winter wheat can be grown in Illinois, improved soft wheat varieties are widely adapted in the state; nearly all of Illinois wheat is the soft type. The primary reasons for this are the better yields of soft wheat and the sometimes poor bread-making quality of hard wheat produced in our warm and humid climate. Because it may be difficult to find a market for hard wheat in many parts of the state, it is advisable to line up a market before planting the crop.

Wheat in the Cropping System

During the 1990s, wheat acreage in Illinois averaged about 1.4 million acres planted, with an average of about 1.2 million acres harvested. In the past two years, however, Illinois farmers have annually produced less than a million acres of wheat. This is due to low wheat prices, but also to the high corn yields in southern Illinois. Most of the wheat acreage is in the southern half of the state, and a majority of the acreage south of I-70 is double-cropped with soybeans each year. Much of the crop in the northern part of the state is planted by livestock producers, who may value the straw as much as the grain, and who often spread manure on the fields after wheat harvest. For those considering producing wheat, these points may help in making the decision:

1. State average yields have ranged from 32 to 61 bushels per acre over the past 15 years, with county average yields often correlated with average corn yields. Under very favorable spring weather conditions (i.e., dry weather in May and June), yields on some farms have exceeded 100 bushels per acre. As a rule of thumb, wheat yields average about one-third those of corn, but they can be about one-half those of corn when weather is favorable for both crops. Because its weather requirements differ from those of corn and soybeans, wheat helps spread weather risks.
2. Wheat costs less to produce than corn, but gross and net incomes from wheat are likely to be less than for corn or soybeans. Added income from double-crop soybeans or from straw, however, improves the economic return from wheat. Wheat also provides income in midsummer, several months before corn and soybean income.
3. Wheat is one of the best annual crops in Illinois for erosion control because it is in the field for some 8½ to 9 months of the year and is well established during heavy spring rainfall. Wheat can also serve to break crop rotations that would otherwise lead to buildups in diseases or insects.
4. Wheat crop abandonment is higher than for other crops, but wheat acres not harvested can be planted to spring-seeded crops, usually at their optimal planting times.

Dates of Seeding

The Hessian fly-free dates for each county in Illinois are given in Table 4.01. Wheat planted on or after the fly-free date is much less likely to be damaged by the insect than wheat planted earlier. It also will be less severely damaged in the fall by diseases such as Septoria leaf spot, which are favored by the excessive fall growth usually associated with early planting. Because the aphids that carry the barley yellow dwarf (BYD) virus and the mites that carry the wheat streak mosaic virus are killed by freezing temperatures, the effects of these viruses will be less severe if wheat is planted shortly before the first killing freeze. Finally, wheat planted on or after the fly-free date will probably suffer less from soilborne mosaic; most varieties of soft red winter wheat carry resistance to this disease, but some show symptoms if severely infested.

The decreases in yield as planting is delayed past the fly-free date vary considerably, depending on the year and the location within Illinois. In general, studies have shown that yields decline little with planting delays for the first 10 days after the fly-free date.

Table 4.01. Hessian Fly-Free Dates for Seeding Wheat

County	Average date of seeding wheat for highest yield	County	Average date of seeding wheat for highest yield	County	Average date of seeding wheat for highest yield	County	Average date of seeding wheat for highest yield
Adams	Sept. 30–Oct. 3	Ford	Sept. 23–29	Livingston	Sept. 23–25	Randolph	Oct. 9–11
Alexander	Oct. 12	Franklin	Oct. 10–12	Logan	Sept. 29–Oct. 3	Richland	Oct. 8–10
Bond	Oct. 7–9	Fulton	Sept. 27–30	Macon	Oct. 1–3	Rock Island	Sept. 20–22
Boone	Sept. 17–19	Gallatin	Oct. 11–12	Macoupin	Oct. 4–7	St. Clair	Oct. 9–11
Brown	Sept. 30–Oct. 2	Greene	Oct. 4–7	Madison	Oct. 7–9	Saline	Oct. 11–12
Bureau	Sept. 21–24	Grundy	Sept. 22–24	Marion	Oct. 8–10	Sangamon	Oct. 1–5
Calhoun	Oct. 4–8	Hamilton	Oct. 10–11	Marshall-		Schuyler	Sept. 29–Oct. 1
Carroll	Sept. 19–21	Hancock	Sept. 27–30	Putnam	Sept. 23–26	Scott	Oct. 2–4
Cass	Sept. 30–Oct. 2	Hardin	Oct. 11–12	Mason	Sept. 29–Oct. 1	Shelby	Oct. 3–5
Champaign	Sept. 29–Oct. 2	Henderson	Sept. 23–28	Massac	Oct. 11–12	Stark	Sept. 23–25
Christian	Oct. 2–4	Henry	Sept. 21–23	McDonough	Sept. 29–Oct. 1	Stephenson	Sept. 17–20
Clark	Oct. 4–6	Iroquois	Sept. 24–29	McHenry	Sept. 17–20	Tazewell	Sept. 27–Oct. 1
Clay	Oct. 7–10	Jackson	Oct. 11–12	McLean	Sept. 27–Oct. 1	Union	Oct. 11–12
Clinton	Oct. 8–10	Jasper	Oct. 6–8	Menard	Sept. 30–Oct. 2	Vermilion	Sept. 28–Oct. 2
Coles	Oct. 3–5	Jefferson	Oct. 9–11	Mercer	Sept. 22–25	Wabash	Oct. 9–11
Cook	Sept. 19–22	Jersey	Oct. 6–8	Monroe	Oct. 9–11	Warren	Sept. 23–27
Crawford	Oct. 6–8	Jo Daviess	Sept. 17–20	Montgomery	Oct. 4–7	Washington	Oct. 9–11
Cumberland	Oct. 4–5	Johnson	Oct. 10–12	Morgan	Oct. 2–4	Wayne	Oct. 9–11
DeKalb	Sept. 19–21	Kane	Sept. 19–21	Moultrie	Oct. 2–4	White	Oct. 9–11
DeWitt	Sept. 29–Oct. 1	Kankakee	Sept. 22–25	Ogle	Sept. 19–21	Whiteside	Sept. 20–22
Douglas	Oct. 2–3	Kendall	Sept. 20–22	Peoria	Sept. 23–28	Will	Sept. 21–24
DuPage	Sept. 19–21	Knox	Sept. 23–27	Perry	Oct. 10–11	Williamson	Oct. 11–12
Edgar	Oct. 2–4	Lake	Sept. 17–20	Piatt	Sept. 29–Oct. 2	Winnebago	Sept. 17–20
Edwards	Oct. 9–10	LaSalle	Sept. 19–24	Pike	Oct. 2–4	Woodford	Sept. 26–28
Effingham	Oct. 5–8	Lawrence	Oct. 8–10	Pope	Oct. 11–12		
Fayette	Oct. 4–8	Lee	Sept. 19–21	Pulaski	Oct. 11–12		

From 10 to 20 days late, yields decline at the rate of a bushel or so per day. This yield loss accelerates to as much as 2 bushels per day from 20 to 30 days late, with sharper declines in the northern part of the state. By one month after the fly-free date, yield potential is probably only 60 to 70 percent of normal, making this about the latest practical date to plant wheat. Wheat may survive even if planted so late that it fails to emerge in the fall, but reduced tillering and marginal winterhardiness often result in large yield decreases.

The planting date has a major effect on the winter survivability of the wheat plant. It is best if the plant can grow to about the 3-leaf stage, usually forming two or more tillers. By the time the plant reaches this growth stage, it has stored some sugars in the crown (lower stem) of the plant. These sugars act as anti-freeze, allowing the crown and new buds to survive soil temperatures down to 15°F or so. Late-planted wheat does not have time to produce and store such sugars before soils freeze, while early planting tends to result in rapid plant growth with less storage of sugars. Freeze–thaw cycles during the winter tend to use up stored sugars, thereby decreasing winterhardiness. Varieties also differ in their ability to survive low temperatures, but many of the higher-yielding varieties begin growth early in the spring, and this trait tends to be associated with less winterhardiness.

Rates of Seeding

While seeding rate recommendations for wheat have usually been expressed as pounds of seed per acre, differences in seed size can mean that the number of seeds per acre or per square foot may not be very precisely specified. Research in Illinois has measured yields in response to varying the number of seeds from 24 to 48 per square foot. Results given in Table 4.02 indicate that seed rates within this range affect yields very little, though in northern Illinois,

Table 4.02. Effect of Seed Rates on Wheat Yield

Seeds per square foot	Wheat yield (bu/A) Southern Illinois[a]	Northern Illinois[b]
24	77.2	71.8
36	77.6	74.0
48	77.8	75.9

[a]Average of four trials conducted at Belleville and Brownstown.
[b]Average of four trials conducted at Urbana and DeKalb.

Table 4.03. Conversion Chart for Number of Wheat Seeds or Plants per Square Foot, per Acre, and per Linear Foot of Drilled Row

Seeds or plants per square foot	Seeds or plants per acre (millions)	Seeds or plants per foot of row at row spacing of: 6 in.	7 in.	8 in.	10 in.
20	0.87	10	12	13	17
24	1.05	12	14	16	20
28	1.22	14	16	19	23
32	1.39	16	19	21	27
36	1.57	18	21	24	30
40	1.74	20	23	27	33

Table 4.04. Conversion Chart for Pounds of Wheat Seeds of Different Sizes Needed per Square Foot and per Acre

Seeds per square foot	Seeds per acre (millions)	Lb of seed needed per acre when seed size (in seeds per pound) is: 11,000	13,000	15,000	17,000
24	1.05	95	80	70	61
28	1.22	111	94	81	72
32	1.39	127	107	93	82
36	1.57	143	121	105	92
40	1.74	158	134	116	102

where there was some cold injury in the spring, the extra plants gave a slight yield advantage. On average, though, it appears that a seeding rate of about 30 to 35 seeds per square foot is adequate for top yields when planting is done on time.

Seed size in wheat varies by variety and by weather during seed production but usually ranges from 11,000 to 17,000 seeds per pound. Table 4.03 converts seed rates per square foot to those per acre and per linear foot. These numbers are useful for calibrating a drill. Some seed bags list the number of seeds per pound. If not, a simple estimate may be needed. Large seed has 11,000 to 13,000 per pound; medium 14,000 to 16,000 per pound; and small 17,000 to 18,000 per pound. Table 4.04 gives the pounds of seed per acre needed for various seed sizes.

A stand of 25 to 30 plants per square foot is generally considered the optimum, and a minimum of 15 to 20 plants per square foot is needed to justify keeping a field in the spring. If plants are weakened by winter weather and tiller numbers are low, then even 20 plants per square foot might not maximize yield. If in doubt, wait and count tillers. By jointing, wheat needs 40 to 50 tillers per square foot to ensure high yield potential. Such tillers should be capable of producing heads.

If planting is delayed much past the fly-free date, then fall growth and spring tillering are likely to be reduced. To compensate, the seeding rate should be increased by 10 percent for each week of delay in planting after the fly-free date.

Seed Treatment

Treating wheat seeds with the proper fungicide or mixture of fungicides is an inexpensive way to help ensure improved stands and better seed quality. Under conditions that favor the development of seedling diseases, the yield from treated seed may be 3 to 5 bushels higher than that from untreated seed. See Chapter 19, "Disease Management for Field Crops," for more information.

Seedbed Preparation

Wheat requires good seed–soil contact and moderate soil moisture for germination and emergence. Generally, one or two trips with a disk harrow or field cultivator will produce an adequate seedbed if the soil is not too wet. It is better to wait until the soil dries sufficiently before preparing it for wheat, even if planting is delayed.

No-Tilling

While some producers prefer to do some tillage to improve seed–soil contact for wheat, others have had good success drilling wheat without tillage. This approach requires adequate weight and covering mechanisms on the drill. Other considerations for no-tilling wheat include these:

1. Residue from the previous crop must be spread uniformly to prevent seed placement problems.

2. Without tillage to destroy emerging weeds, herbicides may need to be considered in the fall.
3. Seed rates should be equal to or slightly higher than those used for tilled fields.
4. Corn residue should be allowed to dry in the morning before drilling to prevent its being pushed down into the seed furrow.

There has also been concern about residue from the previous crop providing a place for diseases (such as Fusarium head scab) to build up. While this may well be a factor, fields that are tilled also have suffered heavy damage when conditions are favorable for disease development; tillage is not the deciding factor in most cases. Wet soils and compaction from harvest equipment have also been found to reduce no-till stands more than when soils are tilled.

Depth of Seeding

Wheat should not be planted deeper than 1 to 1½ inches. Deeper planting may result in poor emergence. Drilling is the best way to ensure proper depth of placement.

Though a drill is best for placing seed at the right depth, a number of growers use fertilizer spreaders to seed wheat. This practice is somewhat risky but can work well, especially if rain falls after planting. An airflow fertilizer spreader usually gives better distribution than a spinner type. If seed is broadcast, the seeding rate should be increased by 20 to 30 percent to compensate for uneven placement. After broadcast seeding, the field may be rolled with a cultipacker or cultimulcher (with the tines set shallow), or it may be tilled very lightly with a disk or tine harrow to improve seed–soil contact. In general, broadcast-seeded wheat has some shallow placed seeds, and plants that grow from these do not have as much winter hardiness as deeper-placed plants.

Row Spacing

Research on row spacing generally shows little advantage for planting wheat in rows that are less than 7 or 8 inches apart. Yield is usually reduced by wider rows, with a reduction of about 1 to 2 bushels in 10-inch rows. Wisconsin data show greater yield reductions in 10-inch rows, probably due to slower early growth than is common in Illinois.

Varieties

The genetic improvement of wheat has continued with the involvement of both the private sector and public institutions. As a result, there are now some 50 varieties sold in Illinois, with more than 70 percent provided by private companies.

Both public and private varieties are tested at six locations in Illinois each year, and the results are assembled in a report titled *Wheat Performance in Illinois Trials*. The report also describes varieties, including both agronomic characteristics and resistance to diseases. Copies of this report are available in Extension offices by mid-August to allow use of the information before planting. Results are also available on the World Wide Web at http://vt.cropsci.uiuc.edu.

Intensive Management

Close examination of the methods used to produce very high wheat yields in Europe has increased interest in application of similar "intensive" management practice in the United States. Such practices have included narrow row spacing (4 to 5 inches); high seeding rates (40 to 50 seeds per square foot); high nitrogen rates, split into three or more applications; and routine use of foliar fungicides for disease control and plant growth regulators to reduce height and lodging.

From research conducted in Illinois, it has become apparent that responses to these inputs are much less predictable in Illinois than in Europe, primarily because of the very different climatic conditions. Following is a summary of research findings to date:

1. Research in Indiana and other states shows that the response to rows narrower than 7 or 8 inches is quite erratic, with little evidence to suggest that the narrow rows will pay added equipment costs.
2. Seeding rates of 30 to 35 seeds per square foot generally produce maximum yields.
3. Increasing nitrogen beyond the recommended rates of up to 110 pounds per acre has not routinely increased yields. Splitting spring nitrogen into two or more applications has not increased yields in most cases, but it may do so if very wet weather after nitrogen application results in loss of nitrogen.
4. Although foliar fungicides are useful if diseases are found, routine use has resulted in yield increases of only 3 to 5 bushels per acre (Table 4.05) and is probably not economically justified, unless disease levels are high.
5. Growth regulators are not needed to prevent lodging.

More recently, less intensive management packages have been promoted for higher and better grain quality. Some of these use tiller counting in the spring, and tie nitrogen management to tiller counts. Foliar fungicides may also be used. While they are more likely to "work" than the European system described above, these practices do not always increase yield or grain quality.

Table 4.05. Response of Caldwell Wheat to Tilt Fungicide

	Yield (bu/A)	
Treatment	Southern Illinois[a]	Northern Illinois[b]
–Tilt	55.2	64.3
+Tilt	57.7	69.5

[a]Average of four trials at Brownstown and Belleville.
[b]Average of four trials at Urbana and DeKalb.

Wheat Management for Best Yields

Despite our best efforts at managing wheat, harsh winter weather or wet weather in May and June can spell disaster for the crop, and there may be little that can be done to maintain good yields. To help ensure good yields when the weather is favorable, follow these steps:

1. Choose several top varieties.
2. Apply some nitrogen and necessary phosphorus fertilizer before planting: 18-46-0 provides both nutrients.
3. Drill the seed on or near the fly-free date, using 30 to 35 seeds per square foot of good-quality seed.
4. Topdress additional nitrogen at the appropriate rate in late winter or early spring, at about the time that the crop breaks dormancy and begins to green up. Application to frozen soil is acceptable, but some nitrogen may run off if rain falls on sloping soil before it thaws.
5. Scout for weeds, insects, and diseases beginning in early April and treat for control only if necessary.
6. Hope for dry weather during and after heading.

Double-Cropping and Intercropping

Much of the wheat in Illinois is double-cropped with soybeans, and a small portion of wheat acreage is double-cropped with other crops, such as sunflower and grain sorghum. The following are a few management considerations for this cropping sequence:

1. To ensure that wheat will be harvestable as early as possible, choose a midseason or earlier wheat variety. There is not as much range in wheat maturity among available varieties as many people believe; the different varieties in the University of Illinois variety trials generally reach combine ripeness within a space of about 3 to 4 days. Ironically, some of the more disease-resistant varieties stay green longer, thus mature later, due to healthy leaves rather than to bred-in late maturity. Variety developers usually designate maturity according to time of flowering, which does not correspond exactly to time of harvest. We have also observed that varieties that flower 3 or 4 days earlier than average tend to yield less. It seems, therefore, that the best varieties should be chosen based on yield, only making sure that they do not mature later than average.
2. Plant wheat on time. A common rule of thumb is that for every 3 days of delay in planting time, harvest is delayed by 1 day. Do not, however, plant earlier than the fly-free date.
3. Avoid excessive nitrogen application. Too much nitrogen can delay maturity and contribute to lodging, both of which make double-cropping more difficult.
4. Harvest as soon after combine-ripeness as the weather permits. Some producers successfully harvest at grain moisture contents up to 20 percent, taking care not to damage kernels. If the weather is dry and warm, this probably means harvesting only a day or two earlier than usual, but this can sometimes provide enough time to plant the double crop before wet weather sets in. Wheat at these moisture contents can usually be dried using unheated air, but watch stored grain carefully to make sure it is drying. If the weather is wet, it may be necessary to raise the air temperature by 10 or 15 degrees to get the crop to dry without the grain heating up.
5. If straw is not harvested it should be chopped and spread evenly to minimize interference with planting.

Recently, interest in a system called **relay intercropping** has been renewed. In this system, wheat is typically planted in rows 14 or 15 inches apart, then soybean seed is planted between these rows before the wheat crop is harvested. Relay intercropping was developed during the 1970s but was never used on many acres in Illinois. Part of the renewed interest is due to availability of polymer-coated soybean seed. The coating delays water uptake and germination of seeds, thus allowing soybean to be planted between wheat rows earlier than uncoated seed could be. Soybeans planted too early in this system grow up through the wheat, and they both interfere with wheat harvest and yield less if their tops are cut off when wheat is combined.

Relay intercropping is not in wide use, and the fact that most of the wheat in Illinois is grown where double-cropping is common will probably limit its

adoption. Some considerations regarding this system include

1. Planting wheat in rows twice as far apart as normal reduces wheat yield by about 15 percent, on average. This reduction needs to be considered as a direct cost.
2. Weed control in wheat is more critical when using this system, both because wide wheat rows will allow more weed growth and because weeds will interfere with soybean planting. It may also be difficult to find herbicides that can be used on both crops or that have a short enough time interval before soybean can be planted.
3. Harvesting straw from intercropped fields usually causes considerable damage to the soybean crop. Also, manure cannot easily be applied after wheat harvest when using this system. Both of these factors will tend to limit adoption of the intercropping system by livestock producers.
4. Polymer-coated seed delays emergence by 2 weeks or so; thus, soybeans can be planted into wheat at about the boot stage of wheat. Uncoated soybean seed costs less, but it should not be planted before the wheat has headed out. In fact, delaying planting until after flowering is completed is probably safer than planting earlier. Another factor to consider is that wheat plants dry out the soil; therefore, soybean seed may not have enough moisture to germinate, regardless of when it is planted between wheat rows.
5. Wheat needs to be harvested as early as possible and with the cutter bar set high enough to keep from clipping off soybean plants. At least some of the soybean plants injured by combine tires should recover to produce yield, but using wide equipment will help to minimize the proportion of soybean plants injured.
6. While we have some work under way in Illinois on this system, it is not known whether it will provide better yields and net income than the double-cropping system provides in southern Illinois.

In summary, Illinois producers probably need to be cautious when considering the relay-intercropping system. Some producers in Indiana and Ohio have begun to use this system, either with the coated seed or with uncoated seed planted later. Unlike Illinois, however, both Indiana and Ohio have considerable acreages of wheat on heavier soils in the northern areas of the states, where double-cropping cannot normally be done successfully.

Spring Wheat

Spring wheat is not well adapted to Illinois. Because it matures more than 2 weeks later than winter wheat, it is in the process of filling kernels during the hot weather typical of late June and the first half of July. Consequently, yields average only about 50 to 60 percent of those of winter wheat.

With the exception of planting time, production practices for spring wheat are similar to those for winter wheat. Because of the lower yield potential, nitrogen rates should be 20 to 30 pounds less than those for winter wheat. Spring wheat should be planted in early spring, as soon as a seedbed can be prepared. If planting is delayed beyond April 10, yields are likely to be low, and another crop should be considered.

Very little spring wheat is grown in Illinois, and there has been little testing of spring wheat varieties. Most spring wheat varieties that may grow reasonably well in Illinois were bred in Minnesota or other northern states, and so there is a risk when they are grown here. Some of the varieties that have been tested in the past include Wheaton, Sharp, Grandin, Marshall, and Guard, all of which produced similar yields (around 40 bushels per acre) in Illinois trials. There are no clearly superior varieties for either yield or quality.

Rye

Both winter and spring varieties of rye are available, but only the winter type is suitable for use in Illinois. Winter rye is often used as a cover crop to prevent wind erosion of sandy soils. The crop is very winter-hardy, grows late into the fall, and is quite tolerant of drought. Rye generally matures 1 or 2 weeks before wheat. The major drawbacks to raising rye are the low yield potential and the very limited market for the crop. It is less desirable than other small grains as a feed grain.

The cultural practices for rye are similar to those for wheat. Planting can be somewhat earlier, and the nitrogen rate should be 20 to 30 pounds less than that for wheat because of lower yield potential. Watch for shattering as grain nears maturity. Watch also for the ergot fungus, which replaces grains in the head and is poisonous to livestock. Ergot may develop when the weather is wet at heading.

There has been very little development of varieties specifically for the Corn Belt, and little yield testing has been done recently in Illinois. Much of the rye seed available in Illinois is simply called common rye; some of this probably descended from Balbo, a variety released in 1933 and widely grown many years ago in

Illinois. More recently developed varieties that may do reasonably well in Illinois include **Hancock**, released by Wisconsin in 1979, and **Rymin**, released by Minnesota in 1973. **Spooner** is another Wisconsin variety that may be suitable.

Triticale

Triticale is a crop that resulted from the crossing of wheat and rye in the 1800s. The varieties currently available are not well adapted to Illinois and are usually deficient in some characteristic such as winterhardiness, seed set, or seed quality. In addition, they are of feed quality only. They do not possess the milling and baking qualities needed for use in human food.

Cultural practices for triticale are much the same as those for wheat and rye. The crop should be planted on time to help winter survival. As with rye, the nitrogen rate should be reduced to reflect the lower yield potential. With essentially no commercial market for triticale, growers should make certain they have a use for the crop before growing it. Generally when triticale is fed to livestock, it must be blended with other feed grains. Triticale is also used as a forage crop. The crop should be cut in the milk stage when it is harvested for forage.

A limited testing program at Urbana indicates that the crop is generally lower yielding than winter wheat and spring oats. Both spring and winter types of triticale are available, but only the winter type is suitable for Illinois. Caution must be used in selecting a variety because most winter varieties available are adapted to the South and may not be winterhardy in Illinois. Yields of breeding lines tested at Urbana have generally ranged from 30 to 70 bushels per acre.

Spring Oats

To obtain high yields of spring oats, plant the crop as soon as you can prepare a seedbed. Yield reductions become quite severe if planting is delayed beyond April 1 in central Illinois and beyond April 15 in northern Illinois. After May 1, another crop should be considered unless the oats are being used as a companion crop for forage crop establishment and yield of the oats is not important.

When planting oats after corn, it will probably be desirable to disk the stalks; plowing may produce higher yields but is usually impractical. When planting oats after soybeans, disking is usually the only preparation needed, and it may be unnecessary if the soybean residue is evenly distributed. Make certain that the labels of the herbicides used on the previous crop allow oats to be planted; oats are quite sensitive to a number of common herbicides.

Before planting, treat the seed with a fungicide or a combination of fungicides. Seed treatment protects the seed during the germination process from seed- and soilborne fungi. See Chapter 19, "Disease Management for Field Crops."

Oats may be broadcast and disked in but will yield 7 to 10 bushels more per acre if drilled. When drilling, plant at a rate of 2 to 3 bushels per acre. If the oats are broadcast and disked in, increase the rate by ½ to 1 bushel per acre. As a companion seeding with forage legumes, use only 1 to 1½ bushels per acre.

For suggestions on fertilizing oats, see Chapter 11, "Soil Testing and Fertility."

Varieties

Illinois has for years been a leading state in the development of oat varieties. Excellent progress has been made in selecting varieties with high yield, good standability, and resistance to barley yellow dwarf mosaic virus (also called redleaf disease), which is the most serious disease of oats in Illinois.

Some of the newer spring oat varieties include Blaze, Chaps, Ogle, and Rodeo, all developed in Illinois; Dane and Prairie from Wisconsin; and Jay from Indiana. Yield and test weight data and descriptions of these varieties are published by the Illinois Crop Improvement Association in their annual *Oat Decision Maker*.

Winter Oats

Winter oats are not nearly as winterhardy as wheat and are adapted to only the southern third or quarter of the state; U.S. Highway 50 is about the northern limit for winter oats. Because winter oats are not attacked by Hessian fly, planting in early September is highly desirable. Experience has shown that oats planted before September 15 are more likely to survive the winter than those planted after September 15. Barley yellow dwarf virus may infect early planted winter oats, however, since the crop will attract BYDV-carrying aphids.

The same type of seedbed is needed for winter oats as for winter wheat. The fertility program should be similar to that for spring oats. Seeding rate is 2 to 3 bushels per acre when drilled.

Development of winter oat varieties has virtually stopped in the Midwest because of the frequent winter kill. Of the older varieties, **Norline**, **Compact**, and **Walken** are sufficiently winterhardy to survive some winters in the southern third of the state. All of these varieties were released more than 20 years ago. Walken has the best lodging resistance of the three.

Spring Barley

Spring barley is damaged by hot, dry weather and therefore is adapted only to the northern part of Illinois. Good yields are possible, especially if the crop is planted in March or early April, but yields tend to be erratic. Markets for malting barley are not established in Illinois, and malting quality may be a problem. Barley can, however, be fed to livestock.

Plant spring barley early—about the same time as spring oats. Drill 2 bushels of seed per acre. To avoid excessive lodging, harvest the crop as soon as it is ripe. Fertility requirements for spring barley are essentially the same as for spring oats.

The situation with spring barley varieties is similar to that for spring wheat: most varieties originate in Minnesota or North Dakota and have not been widely tested or grown for seed in Illinois. Some of these varieties are Azure, Hazen, Manker, Morex, Norbert, Robust, and Excel. Seed for any of these will likely need to be brought in from Minnesota or the Dakotas.

Winter Barley

Winter barley is not as winterhardy as the commonly grown varieties of winter wheat and should be planted 1 to 2 weeks earlier than winter wheat. Sow with a drill and plant 2 bushels of seed per acre.

The fertility requirements for winter barley are similar to those for winter wheat except that less nitrogen is required. Most winter barley varieties are less resistant to lodging than are winter wheat varieties. Winter barley cannot stand "wet feet"; it should not be planted on land that tends to stay wet. The barley yellow dwarf virus is a serious threat to winter barley production.

Varieties

The acreage of winter barley is very small in Illinois, and variety testing has not been extensive. Based on limited testing, the varieties described below appear to have the best chance of producing a good crop under Illinois conditions. There has been little or no certified seed of these varieties produced in Illinois, but the higher yields may make it worthwhile to find seed in another state.

Pennco, released in 1985 by Pennsylvania, is a high-yielding variety with good disease resistance and standability. It is a few days earlier and slightly more winterhardy than Wysor and is considerably more winterhardy (though later in maturity) than **Barsoy**, an old variety that was once common in Illinois.

Wysor, released in 1985 by Virginia, is a high-yielding variety with good disease resistance and winterhardiness.