

SUNFLOWER

A Native Oilseed with Growing Markets

Overview

Sunflowers have a long history in Missouri, dating back at least a thousand years to when they were cultivated in fields by Native Americans. Although modern sunflower cultivars were not grown widely in the U.S. until the 1970s, there were tests of sunflower oilseed processing by the Southeast Missouri Sunflower Growers' Association in Missouri in 1926. Sunflowers are well adapted to Missouri conditions, even though their primary production has lately been in the Northern and Western Plains. Sunflower acreage has been increasing over the last few years in Missouri, with several thousand acres now produced.

New government policies are making it more economically favorable for sunflowers, primarily the availability of oilseed loan deficiency payments (LDPs) for sunflower. The growing size of the sunflower market, both for oilseed and birdseed uses, is creating new opportunity to add sunflowers to crop rotations in Missouri. Sunflowers can be planted from April through July, including as a double crop after wheat.

By adding sunflower to an existing crop rotation, pest problems such as corn borer or soybean cyst nematode can be reduced. Sunflower is shorter season than most crops, so can be planted later or harvested earlier, helping spread out work load. Sunflowers are efficient at extracting water from the soil profile, especially in sandy loam soils, and can often tolerate drier conditions better than other crops.

Growth and Development

Sunflower (*Helianthus annuus* L.) is a broadleaf plant that emerges from the soil with two large cotyledons. Emergence will take four to five days when planted an inch deep in warm soil, but will



take a few days longer in cooler soils or when planted deeper. Soil crusting can make it difficult for the large seedlings to push out of the soil. Sunflowers grow rapidly, producing large, rough leaves. If planted in early June, sunflowers in Missouri will be in full bloom after about two months in early August, and be mature by late September. Current sunflower varieties in Missouri reach an average of six feet in height, varying between five and seven feet depending on planting date and soil conditions. After reaching their full height and blooming, heads on commercial cultivars turn downwards, designed to make it harder for birds to eat the seed.

A field of sunflowers in bloom is a striking sight, and many farmers remark about the pleasure they, and people passing by, get from seeing the flowers. Each sunflower head, or inflorescence, is actually composed of two types of flowers. What appears to be yellow petals around the edge of the head are actually individual ray flowers. The face of the head is comprised of hundreds of disk flowers, that each form into a seed (achene). Commercial sunflowers have flowers that are self-compatible for pollination, meaning they do not require a pollinating insect, although some studies have shown bee pollinators providing a slight yield boost. Sunflower heads turn with, or track, the sun early in their development, but later stay east-facing before facing downwards. Some farmers like to plant their rows north and south so that the heads can lean into the row space, rather than bumping against an adjacent plant, causing some seed to fall.

How to Grow Sunflower

Sunflowers work well as a full season crop in rotation with corn, soybeans and/or sorghum. As a double crop after wheat, sunflowers are an equally good choice with soybeans for the southern half of Missouri, and are a very good choice for the northern part of the state. Regardless of whether they are grown as a single crop or double crop, sunflowers should not be planted in the same field more than once every three to four years. Sunflowers, like soybeans, do not leave very much residue, so on erosive fields consider seeding a fall cover crop after sunflowers. Sunflowers generally grow best on well drained soils, are tolerant of clay loam or silty clay loam soils and perform comparatively well on sandy loam soils. They should not be grown on wet soils, but may be a good choice for bottom ground that doesn't dry out until early summer, since the sunflowers can be planted relatively late.

Variety Selection

Most major seed companies have several varieties of sunflower available. Almost all commercial varieties of sunflowers are hybrids, so new seed should be purchased each year. Companies have been actively developing new hybrids of sunflowers with better disease resistance and higher yields. Special types with unique seed oil characteristics have been developed through conventional plant breeding (not biotech), including "NuSun" sunflowers, that are higher in oleic acid in their seed oil than conventional oilseed sunflowers. Reflecting market demands, many companies are releasing NuSun varieties, that are considered mid-level in their oleic acid content (there are also "high-oleic" varieties available that are desired for certain food and industrial uses). Variety test comparisons in Missouri have shown a considerable difference in yield of available varieties, but similarity in height and maturity. For the birdseed market, oil percentage does not matter, but selecting a variety with high oil content may be worthwhile for a vegetable oil market. To get the latest information on variety performance in Missouri, and for a list of seed sources, refer to the Jefferson Institute publication on sunflower varieties (phone 573-449-3518).

Planting

Sunflowers should be planted 1 to 1 1/2 inches deep. Row spacing studies have shown that sunflowers do not yield better in narrow rows, whereas wide rows are preferable to allow cultivating for weeds or use a row crop header. Sunflowers are not particularly sensitive to seeding rate, since head size (and seed number) per plant will increase in a thinner stand. Seeding rates can be from 15,000 to 25,000 plants per acre. Sunflower seeds vary in size, so seeding rate based on weight must take into account seed size, but will be roughly 3 to 4 pounds per acre. Number 2 sunflower seeds are largest, while number 5 are smallest. Most sunflower seed available is sized as a 3 or 4. Size of the seed can affect what type of planter modifications are necessary, such as buying new seed plates or finger pickups.

Planting sunflower can begin anytime after soils have warmed to 50°F. (April) through mid-July. It's not a bad idea to plant sunflower on a couple of different dates to reduce risk and spread out labor load. Planting early can allow sunflower to be harvested before corn and soybeans, and will help avoid bird damage. Planting late can allow planting after other crops are done, and is less likely to have damage from sunflower moth. Double crop planting after wheat works well with sunflower and can be done in the northern part of Missouri since sunflower is more frost tolerant than soybeans in the fall.

Fertility

Sunflower has modest fertility needs, but does respond to nitrogen. When following soybeans in the rotation, roughly 50 to 70 lbs. N/acre is appropriate. Following a non-legume, about 80 to 100 lbs. N/acre is suitable. Animal manure or a legume cover crop can reduce or eliminate need for N fertilizer. One option is to spring plant a legume cover, such as Austrian winter peas in early April, let the legume grow for 2 months, then incorporate the legume and plant the sunflower in early June. This approach can eliminate the need for N fertilizer if good legume growth occurs. For sunflower planted double crop after wheat, apply about 60 lbs. N/acre if the wheat stubble is tillage incorporated, or about 80 lbs. N/acre if the sunflower is grown no-till in the residue. P and K should be applied based on soil test recom

mendation: for double cropping, extra P and K for the sunflower can be applied to the wheat the previous fall. On sandy soils, sunflower is often responsive to extra potassium fertilizer. Sunflower appears tolerant of soils with a pH down to 5.5, but consider liming if the pH is below 6.0, to improve nutrient availability in the soil. Starter fertilizer for sunflower will usually be beneficial only in cool soils of early spring, and should not be placed in direct contact with the seed.

Weed Control

One of the real advantages of sunflower is that its vigorous growth and robust size make it very competitive with most weeds. However, weeds must not be allowed to get a head start on sunflower. Weeds can be controlled either through herbicides or tillage, but most sunflower producers in Missouri make use of both, applying a preplant herbicide and then row cultivating at least once after the sunflower seedlings are established. Some of the preemergence herbicides* available for sunflower are Treflan, Prowl, Sonalan, and Eptam, all of which are primarily grass herbicides with control of some broadleaves. For 2002, a broadleaf herbicide called Spartan was given a temporary Section 18 registration for conservation or minimum tillage use in Missouri. A section 18 application has been submitted for Spartan for use on sunflowers again in 2003. For grass control after sunflowers have emerged, Poast and Select are available, but no post-emerge broadleaf herbicides are available. Prior to planting, Roundup or paraquat can be used as a burn-down, and in the rare situation where a harvest aide (dessicant) is needed, paraquat or sodium chlorate can be used. Instead of herbicides, two alternative methods of weed control are to use cover crops (such as rye or winter annual legumes), or to use a stale seedbed technique (till the soil 7-10 days prior to planting to stimulate weed seed germination, then till again just before planting to kill those weed seeds).

Insects

Sunflower is similar to corn in that a lot of insects like to eat it. Some insects are occasionally a problem, and a few are worth scouting for, possibly needing treatment once in awhile. At the seedling

stage, there is rarely a problem unless a heavy infestation of cutworms are present. As the plant grows, many insects feed on sunflower foliage, including grasshoppers and caterpillars, but seldom do they cause economic damage. The real stage to be scouting for insect pests is once the flower bud has begun to develop. Head clipper insects which attack the stem right below the head can cause the whole head to fall off, but are not too common. The main threat to sunflower in Missouri is sunflower moth or banded sunflower moth. Ideally, the adult moths should be identified through scouting, and if present in sufficient numbers, should be sprayed before larvae become established. Once the eggs have hatched and larvae have moved inside the head and seeds, insecticide control is very difficult. Later planting (June or July) can help avoid sunflower moth in most years. A number of broad spectrum insecticides are labeled* for sunflower, including Asana, Baythroid, Furadan, Endosulfan, Lorsban, Parathion, Permethrin, Stryker, and Warrior. Certain organic insecticides may also be used, including Bt products and pyrethrin. It is best to avoid spraying an insecticide when honey bee pollinators are present.

Diseases

Although a number of diseases have been identified for sunflowers, just as with other crops, relatively few diseases have been seen in Missouri. In cool wet soils, seeds or seedlings may be attacked by fungi, so seeds are typically treated with fungicide. Various leaf and foliar diseases will cause surface spots or yellow patches, but do not impact yield. Probably the greatest disease threat to sunflower is sclerotinia (white mold), which is also found in soybeans, canola, and certain other broadleaf plants. Using good rotation practices, including not planting sunflower in a field more than every three to four years, can reduce likelihood of disease.

**Pesticide products are mentioned in this guide only as a starting reference point for product use, and are not a guarantee that a label for the product is applicable to Missouri. For latest information on use of a pesticide, consult the product label or a company representative.*

Harvest

Sunflower seeds are generally physiologically mature when the back of the flower head is yellow. When the head turns brown on the back, seeds are usually ready for harvest. In some cases, harvesting at high moisture may be useful to avoid bird damage or reduce loss from lodging or seed shatter. Platform (wheat), row-crop, and corn heads have all been used successfully with sunflower. Row-crop heads are perhaps the best choice because they can be used without modification. Corn heads need to be modified with a stationary cutting knife before use with sunflower. Platform heads can be used without modification, but often have a higher amount of seed and head loss than a row head. Adding pans to the front of the platform and/or modifying the reel can improve efficiency.

Combine settings must be adjusted for sunflower versus other crops. Airspeed should be lower, due to the lighter weight of sunflowers. The concave should generally be run wide open (on a rotary combine, a rotor-to-concave setting of 3/4 to 1 inch is appropriate). A bottom screen of 3/8 inch, and a top screen of 1/2 to 5/8 inch is typical. Cylinder speed should usually be in the range of 250 to 400 rpm. The overall goal of the threshing process should be passing the head through nearly intact through the combine, or in a few large pieces, with all developed seed removed from the head. If the head is being ground up into small pieces, there will be excessive trash in the grain.

Storage

During colder periods, sunflower can be safely stored at 10% moisture or less, but during warmer months the storage moisture should be at 8% or less. When taking a moisture reading on sunflower seeds that are being dried in a bin, keep in mind that the hull dries faster than the kernel. Thus, a moisture reading taken on sunflower being dried may be artificially low; to get a more accurate reading, place some seed in an airtight jar overnight and take moisture reading the next day, after the hull and kernel moisture have equalized.

Bins with perforated floors work better for drying sunflower than those with ducts. If aeration is not available, sunflower should be rotated between bins

to avoid hot spots developing in the stored grain. When excessive trash is present in the harvested grain, cleaning before storage can greatly reduce incidence of storage problems. Ambient air can be used to cool and dry sunflower. If heated air is used, generally a 10°F. increase in temperature over ambient is sufficient to increase rate of drying. Be aware that sunflower dries more rapidly than corn or soybeans, and should be monitored to avoid overdrying.

Sunflower drying has a higher risk of fire hazard than some crops. The primary problem is that small fibers rub off the sunflower hulls and float in the air, and these fibers readily burn. A few tiny fibers burning will not necessarily start a fire, but if combined with overdried grain, may lead to a bin fire. Avoiding use of propane heat with an open flame will eliminate this risk, but if heat must be used certain precautions can be taken. The air intake for the dryer blower can be turned into the wind, allowing clean air to pass over the burner rather than air with sunflower fibers. Monitoring the bin during hot air drying, and avoiding overdrying, can greatly reduce the risk of a bin fire.

Other key steps in storage include cleaning the bin and grain handling equipment before storage, and monitoring the bin for insects. Avoid creating a peak or cone of grain at the top of the bin, since moisture and possibly insects, will tend to congregate in that spot. Sunflower grown for the snack food (confectionery) market must be handled with extra care, cleaned well, and be free of insect damage to meet food grade standards.

Test weight (pounds of seed per bushel) of sunflower will vary because of different seed sizes, but typical test weights for oilseed sunflowers are 28-32 lbs./bu. (U.S. grade standard is only 25 lbs./bu.). Due to the low test weight, high sided semi-trailers are often used when sunflower is hauled long distance in order to carry more grain and reduce transportation cost.

Uses

Of the roughly 3 million acres of sunflowers that are grown each year in the U.S., up to 90% are the oilseed type. A significant fraction of the oilseed harvest goes for birdseed production, but most of the seeds are processed into vegetable oil. Of the seeds processed for oil, about equal thirds are dehulled, partially dehulled or left with hulls on for processing. When hulls are removed, they become a very low value byproduct, most often burned for fuel.

Vegetable oil use. Use of the oil from sunflower for cooking first occurred in Russia in the 1800s. Though sunflower is native to the U.S., it was not seen as a vegetable oil source here until the last 50 years, and really only began to be significantly grown for this purpose about 25 years ago. Sunflower is lower in saturated fats than most vegetable oils. The development of NuSun varieties that are mid-level in oleic acid has spurred further interest in using sunflower oil in food preparation. NuSun oil has the primary advantage of being more stable than most vegetable oils and not needing to be hydrogenated to improve shelf life.

Livestock use. After the oil is extracted from the sunflower seed (the oil is about 40 to 45% of the seed by weight), the remaining seed material (meal) is fed to livestock. The nutrient value of sunflower meal depends primarily on the type of processing it has gone through: (1) whether the oil was mechanically pressed (expelled) from the seed, or solvent extracted (which removes more of the oil), and (2) the degree to which the hulls were removed prior to oil processing. If part or all of the hulls remained on the seed prior to oil extraction, then the meal will have higher fiber content but lower protein and fat. Solvent extracted sunflower meal will have a protein percentage around 41% if dehulled, and around 28% if hulls are left on the seed. Fat content of solvent extracted meal is roughly 1%, and roughly 9% in mechanically pressed seed meal. A good source of information on the various types of sunflower meal and their feed values for various animals is the publication "Sunflower Meal Use in Livestock Rations," available from the National Sunflower Association (phone 888-718-7033). Regardless of the method of sunflower meal manufacture, the meal can serve as the sole source of supplemental protein in diets for beef or dairy cattle.

Snack food use. Although whole seed, or confectionery, use of sunflower in the U.S. is only about 10-20% of the crop each year, it is a premium market. Prices for confectionery sunflower run significantly higher than oilseed sunflower. Most of the confectionery sunflower is sold for snack food. Reportedly in Russia, sunflower seeds are such a popular snack food that people carry packets of them around in their pockets, making them even more popular than peanuts are in the U.S. Some confectionery sunflower finds its way into processed foods, such as granola bars, multigrain breads or other baking uses. Confectionery sunflower varieties have seeds that are larger, easier to dehull, lower in fat and are typically striped or white (oilseed types are almost always black, but can be white or striped).

Birdseed use. No nationwide statistics are kept on sunflower birdseed usage, but it is certain that hundreds of thousands of acres are used for this purpose. Sunflower is considered the premium component in most birdseed mixes, and is priced higher than other typical birdseed components such as sorghum, millet, or cracked corn. Although confectionery sunflower that doesn't meet food grade standards is usually sold into the birdseed market, most of what is used for birdseed is the oilseed type. From a packagers perspective, the oilseed type is used because it is cheaper than confectionery. However, the reason birdseed feeding books recommend use of the oilseed type is due to its thinner hulls and smaller seed size, making it easier for small songbirds to eat. Birds do not care if the sunflower seed is striped or black, but most buyers want black seed for uniformity in what they package.

Markets and Economics

In Missouri, the easiest way to market sunflower is to the birdseed market. Most sunflower producers sell to a regional birdseed packager, but some sell to a local retail store, or sell directly off their farm already packaged for consumers. Three of the bigger sunflower birdseed buyers are Pennington Seed in southwest Missouri (phone 417-637-5979), Buchheit Corp. in southeast Missouri (phone 573-547-4569) and Keller and Sons near northeast Missouri (Quincy, IL, phone 217-228-6700). In theory, birdseed prices should be unaffected by what happens in the vegetable oil market, but unfortunately they are, at least at the

wholesale level. Sunflower oilseed prices, including birdseed, follow soybean prices. Farmers that directly sell their own packaged birdseed obviously have more control over their pricing, but still have to keep an eye on competitors' prices.

Confectionery sunflower prices do not track soybean prices quite as closely, but will generally follow broad swings in the price of vegetable oils. Many current or potential sunflower producers are interested in confectionery sunflower prices because of their higher price. Unfortunately, with this higher price comes more demanding production and handling requirements to get a high quality, undamaged seed suitable for the human food market. Although there is not currently an established buyer's network for confectionery sunflowers in Missouri, this is a product that lends itself to direct marketing. Whether selling wholesale or direct, sunflower growers should get experience by growing the oilseed type before even considering growing the confectionery type. Most Missouri sunflower producers should plan to grow the oilseed varieties.

With the emergence of NuSun and high oleic types of sunflowers, opportunity exists to grow one of these speciality oil sunflowers and receive a price premium, typically 10-20% over regular oilseed prices. Until markets develop further for these speciality oil types, Missouri growers will be required to ship them to out-of-state markets, but in a few cases there may be a price advantage to growing one of these types. Contact the Jefferson Institute for information on buyers (phone 573-449-3518).

The economics of growing sunflowers for birdseed are fairly similar to growing soybeans. Seed cost is about \$15 per acre and weed control costs should be similar to soybeans. Fertilizer will cost more than soybeans, mainly because some form of nitrogen is needed with sunflowers. Most years, an insecticide will not be needed, so the other production cost is harvest, which is similar to soybeans or corn. An extra cost with sunflowers is created by the distance of transporting them to market. In some cases this can cost a penny a pound or more, depending on distance to market.

Recent Missouri sunflower prices have been \$10-12/cwt., but prices can vary considerably. Prices from some birdseed buyers in Missouri have been 10 to 20% higher than in the Plains states, since they have to normally pay to bring the sunflower from several hundred miles away. With the loan deficiency payment, total income from 1999 to 2002 was about \$12/cwt. in Missouri. Past production studies have shown average yields of around 2000 pounds per acre for full season sunflower, and 1500 pounds per acre for double crop sunflower. Yield potential for both types of production is as much as 25-35% higher than these averages, when soils and rainfall are not limiting. Net income from full season sunflower appears to be comparable to corn or soybeans in Missouri. Double crop sunflowers often provide better income than double crop soybeans in northern Missouri. Reasons to grow sunflowers include:

- (1) to have a double crop option in north Missouri;
- (2) to have a drought tolerant option, especially on sandy loam soils;
- (3) to reduce pest pressures through rotations;
- (4) to spread out labor or risk;
- (5) to have a crop that can be direct marketed.

For Further Information

A number of print and web-based materials are available for free or at low cost from various extension and non-profit organization offices. For Missouri producers, the Jefferson Institute has a free sunflower information kit that goes into detail on several aspects of producing and marketing sunflowers (call 573-449-3518). The National Sunflower Association has good information on their website (www.sunflowerusa.com) as well as print bulletins and brochures. There is additional information at www.jeffersoninstitute.org.



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