High Plains Sunflower Production Handbook

Colorado State University • Kansas State University • University of Nebraska • University of Wyoming
USDA-ARS—Central Great Plains Research Station, Akron, Colorado

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High Plains Sunflower Production Handbook was published at Kansas State University in cooperation with Kansas Sunflower Commission, National Sunflower Association - High Plains Committee, Colorado Sunflower Administrative Committee, and the following groups.

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Check the seed. Sunflowers should be sampled weekly the first 6 weeks after harvest or until seed temperatures are below 60 degrees Fahrenheit. Then sample the sunflowers every 3 to 4 weeks during winter and weekly through the spring and summer. Do not bring the stored grain temperature below freezing with aeration during the winter months. Many storage problems will appear during the first 6 weeks of storage or in the spring and summer as weather conditions begin to change.

Check the sunflowers, not the bin! When sampling, probe the sunflower seed pile and be observant for temperature, moisture, insect, fungi, and odor differences from the previous inspection. If the probe is hot, immediate action is necessary. Remember to feel, smell, or walk around the bin and probe the sunflowers and not just peer through a roof opening and assume there is no storage problem. Always write down the results of your inspection for future reference.

Act quickly to stabilize problems. If a problem is detected, try to stabilize it with aeration. If this fails, move the sunflowers to market immediately as the problems will only increases.

Although some cooperators experience problems when storing sunflowers, most are able to store seed successfully with good management. Growers who adequately dry seeds (8 to 9 percent), use aeration wisely and periodically inspect their product do not have problems. Generally, High Plains sunflower fields are harvested near 5 percent because of our arid climate. However, with proper management, seeds harvested at high moisture can be dried and stored easily.

Drying

In cases where sunflowers have been harvested at higher moisture (greater than 10 percent), they can be dried using any drying system. There is a tendency by operators accustomed to drying other grains to overdry sunflowers. Removing 10 points of moisture from corn requires evaporating approximately 6 pounds of water, whereas with sunflowers, only 3 pounds has to be removed when drying from 20 to 10 percent. The sunflower seed flow rate through nonbatch dryers must be increased in comparison to corn to avoid overdrying.

Temperatures in the plenum of a dryer should be 160 degrees Fahrenheit or lower in continuous-flow and recirculating-batch dryers with non-oil seeds. Excess heat will cause nutmeats to be steam wrinkled, or even scorched. Plenum temperatures for confectionary sunflowers in batch and bin dryers should be less than 140 degrees Fahrenheit and 110 degrees Fahrenheit, respectively. Plenum temperatures for oil-type sunflowers are 180 degrees Fahrenheit in column dryers and 120 degrees Fahrenheit for bin dryers.

Operators should recognize the fire potential when drying sunflowers. Hair or fibers on the seeds rub loose during handling and tend to float in the air. These fibers will ignite rapidly when drawn through a drying fan and open burner. Dryers should never be left unattended when drying sunflowers. Daily cleaning around and inside the dryer, uniform flow of seeds through a dryer, and providing clean intake air by attaching an extra length of duct to the fan inlet or facing the fan into the wind will reduce fire hazards when drying. The duct must be large enough to not restrict the air flow. Collected trash is a major fire hazard and should be disposed of properly.

If a fire occurs, stop the fan immediately. Many times this will extinguish a small fire in a dryer.

Moisture Meters

Moisture meters should be calibrated following the manufacturers' guidelines. The meter should be checked against an elevator or processor meter to make sure your meter is consistent with the buyer's meter. Seeds that are dried tend to "fool" a moisture meter if taken straight from a drier and tested. False readings (too low) after drying are common and can lead to storage problems if an accurate measurement is not known. Samples should be placed in an airtight bag and held for 12 hours at room temperature. Then recheck the moisture content to obtain a second reading. Compensation may be needed for sunflowers with high oil content.

Crop Rotation and Residue Management

Crop Rotations

As with any other crop, sunflowers respond to good management practices, including desirable placement within the crop rotation. While sunflowers grow well on summer-fallowed land, their deep root system allows them to perform well when planted in rotation following shallower-rooted cereals such as winter wheat or proso millet. The deep-rooted, full-season nature of sunflowers often results in significant soil water depletion. Therefore, it may be necessary to use summer fallow, or several years of shallow-rooted crops, to refill the soil water profile.

Research conducted by the USDA-Agricultural Research Service at Akron, Colo., showed that available soil water at winter wheat and proso millet planting was significantly affected by the presence of sunflowers in a crop rotation.

At Colby, Kan., research suggests that a winter wheat-corn-sunflowers-grain sorghum-fallow rotation is worth considering. Corn has shown more year-to-year yield variation than either sunflowers or grain sorghum – mostly because of variation in rainfall received. Since there is a greater probability for soil moisture to accumulate after wheat harvest than after a summer crop, the additional moisture stored favors corn following wheat. With soil moisture likely to be somewhat depleted after corn, sunflowers have shown the potential to extract water that is positionally unavailable to either corn or grain sorghum, which favors sunflowers after corn. Grain sorghum requires the least amount of available soil moisture to maintain small year-to-year yield variation and produced high amounts of crop residue. This suggests that grain sorghum, where the season allows its production, follow sunflowers as the last crop before seeding wheat, not only to provide another cash crop, but also to provide additional crop residue cover during the extended fallow period. This rotation potentially offers a combination of no-till and conventional-tillage options. With available herbicides for no-till, corn is easily planted into wheat stubble, grain sorghum into sunflower stubble, and wheat into sorghum stubble.

If the winter annual grasses, for example, downy brome, jointed goatgrass, or rye, are a problem in winter wheat fields, sunflowers in the rotation provide the producer with additional opportunities to exercise control. The control may be provided by additional tillage opportunities and/or the use of effective grass herbicides not available for use in a wheat-fallow or wheat-proso-fallow rotation. Clearfield™ sunflowers are now an option for controlling annual grasses. Volunteer sunflowers, and other broadleaf weeds, that can be problematic in sunflowers are easily controlled in the alternate small grain crop.

Sunflowers are susceptible to triazine, Aatrex, and sulfonylurea (Ally, Amber, Peak), herbicide residues in the soil. Oats, wheat, proso, barley, and soybeans all exhibit greater tolerance to these herbicides than sunflowers. Therefore, sunflowers should not be planted where chemical carryover may be a problem. Rotation restrictions for sunflowers with some sulfonylurea herbicides may be as long 36 months.

Sunflower diseases and insect and weed pests also are minimized through the use of proper crop rotation. Sclerotinia stalk and head rot (white mold), Verticillium wilt, Phoma and premature ripening are the primary diseases resulting from a failure to rotate crops. Rotations of 4-year spacings between sunflower crops, two of which must be cereals, are recommended to help prevent and control these diseases. Sunflowers are also a host for diseases found in other crops. Verticillium wilt is found in potatoes, safflowers, and sunflowers. White mold is a disease found in dry edible beans, flax, rapeseed, soybeans, mustard, sugarbeets and sunflowers. No more than one of these crops should be grown in the same rotation cycle in fields infested with these diseases. (Refer to the Diseases section in this publication for a more thorough discussion.)

Crop rotations help reduce populations of insects that overwinter in the soil or in sunflower residue. Insects that migrate into an area from other geographic regions, or from fields planted to sunflowers the previous year that are in close proximity to current season fields, are not effectively controlled by crop rotation. If possible, avoid planting sunflowers next to a sunflower field from the previous year since most overwintering sunflower insects can easily migrate to adjoining fields. Rotation spacings recommended above for disease prevention should minimize the potential for insect populations. (This is discussed in the Insect Pest identification and Control section of this publication.)

Suggested sunflower rotations for the High Plains include:

- winter wheat-sunflowers-fallow
- winter wheat-proso-sunflowers-fallow
- winter wheat-corn-sunflowers-fallow
- winter wheat-corn-sunflowers-grain sorghum-fallow

It may be desirable from a pest management and soil water storage standpoint to alternate the winter wheat-sunflowers-fallow rotation with a winter wheat-proso or corn-fallow rotation.

Residue Management

Standing sunflower residue is effective at reducing wind speeds at the soil surface, reducing soil erosion potential, and in capturing windblown snow. However, sunflower residue is fragile and decomposes rapidly after tillage. Research conducted for 3 years by the University of Nebraska at Sidney, Neb. found sunflower residue to decline during summer fallow from 3,900 pounds per acre and 39 percent ground cover after harvest to just 510 pounds per acre and 4 percent ground cover after winter wheat planting (Table 24). Tillage operations included a late May sweep tillage operation followed by a late June chisel operation with 9-inch sweeps and two operations with a rodweeder.

Research conducted at the USDA-ARS, Central Great Plains Research Station, Akron, Colo., indicated an advantage in surface residue amounts when sunflowers are managed with no-till. Two experimental sites, each with a different stalk harvest height of 18 or 25 inches, were used to study the disappearance of sunflower residues under no-till and reduce-till fallow. Weeds were controlled using a sweep-plow (32-inch V-blade) in the tilled plots. Glyphosate

Table 24. *Sunflower residue weights and ground cover at five sampling times between sunflower harvest and winter wheat seeding the following year at Sidney, Neb. from 1993 through 1995.*

Sampling time [1]	Residue weight	Ground cover
	lbs/acre	%
After harvest	3,900	39
Early spring	3,020	26
Late spring	1,290	11
Summer	1,160	9
Wheat seeding	510	4

[1] *After harvest = fall within 2 weeks after mechanical harvest; early spring = within 2 weeks of winter wheat green-up and prior to first tillage operation; Late spring = within 2 weeks after sweep tillage operation; Summer = prior to the first rodweeding operation; and Wheat seeding = within 2 weeks after planting winter wheat.*

Table 25. *Sunflower residue cover and residue mass at sunflower harvest and approximately one year later at wheat planting time. Average values for a two year study at Akron, Colo.*

Fallow system	Initially at sunflower harvest		A year later at wheat planting time	
	Residue weight	Ground cover	Residue weight	Ground cover
	lbs/acre	%	lbs/acre	%
Sweep-till	2,730	46	1,710	15
No-till	2,440	45	980	29

(Roundup) was used to control weeds in no-till plots. In no-till, the taller-stalk-harvest height (25 inch) lost 75 percent of the initial number of standing-stalks by that fall. Whereas, with shorter stalks (18 inch), only 27 percent of the initial amount was lost. In 1996, better durability of shorter stalks was again observed, but the advantage of the shorter stalk height in maintaining standing stubble was not as great. By wheat planting time both the tall and the short stalks had less than 50 percent of the initial stalk amount still standing. By late September, only 11 percent of the taller stalks were standing with nearly 43 percent of the shorter still standing that year. Part of the reason for the increased loss with taller stalks is mechanical damage from spray booms and tractor axles, which don't always clear the taller stalks. Also, a taller stalk has greater surface area exposed to the wind, hence greater force is available to blow it down.

No-till resulted in 1,700 pounds per acre of residue on the soil surface at wheat planting time (mid September) and maintained 29 percent residue cover during summer fallow season (Table 25). Sweep-plow managed summer fallow contained only 980 pounds per acre of surface residue at wheat planting time and only 15 percent residue cover.

Over two seasons at Colby, Kan., an average of 30 percent of sunflower residue was lost by spring time. With two sweep tillage operations during the summer, 80 percent of the original crop residue had been lost by wheat seeding time. With no-till, initial wheat and sunflower crop residue amounts at sunflower harvest were increased by approximately 30 percent and, at wheat seeding, three times as much crop residue remained compared to conventional tillage.

Residue management can begin as early as selecting the summer crop and row spacing for an intensified rotation. Average crop residue amounts over a 3-year period for 30-inch rows and conventional tillage at Colby, Kan., were 5,812 pounds per acre for corn, 5,350 pounds per acre for grain sorghum and 3,823 pounds per acre for sunflowers. For the first 2 years of the study, when 30-inch rows were compared to 15-inch rows, the narrower row spacing increased corn residue amounts by 933 pounds per acre, grain sorghum by 250 pounds per acre, and sunflowers by 621 pounds per acre. In another study under conventional tillage, 15-inch rows increased sunflower crop residue only an average of 240 pounds per acre over a 4-year period and increased oilseed yield an average of 327 pounds per acre.

Other practical solutions to incorporating sunflowers into High Plains while minimizing the risk of soil erosion cropping systems include strip cropping, or following sunflowers with a shallow-rooted summer crop such as proso millet.