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Managing Corn and Sorghum Residues During the Ecofarming Fallow Period

This NebGuide explains how to maintain an appropriate residue cover with ecofarming in the fallow period before winter wheat to reduce soil erosion and conserve soil moisture.

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- [Managing Residues](#)
- [Weed Control with Tillage and Herbicides](#)
- [Tillage Implements](#)
- [Soil Fertility and Fertilizers](#)
- [Summary](#)

Ecofarming is a system of controlling weeds and managing crop residues throughout a crop rotation with minimum use of tillage. This will reduce soil erosion and production costs while increasing weed control, water infiltration, moisture conservation and crop yields. In the winter wheat-ecofallow corn or grain sorghum-fallow rotation, corn or grain sorghum is no-till planted into winter wheat stubble in May. During the previous summer or fall the winter wheat stubble was treated with herbicides to control weeds and increase soil water storage. This fallow period between winter wheat harvest and corn or grain sorghum planting is called ecofallow (*Figure 1*).

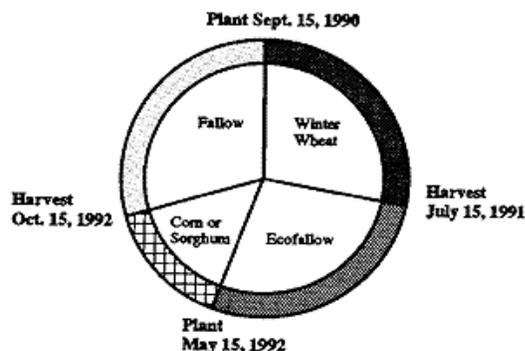


Figure 1. The ecofallow and fallow periods in the three-year ecofarming rotation.

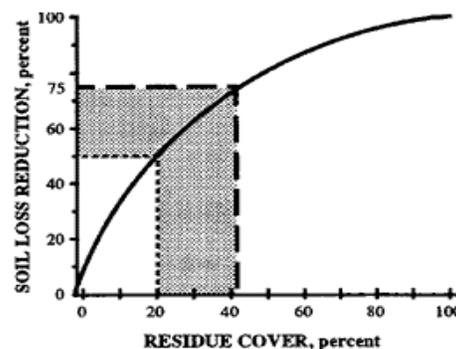


Figure 2. Relationship between soil surface residue cover and soil erosion. The example shows that a 20 percent residue cover will reduce erosion by 50 percent and a 40 percent residue cover will reduce

erosion by 75 percent of that occurring from a cleanly tilled field.

The other fallow period occurs between corn or grain sorghum harvesting in October or November and the planting of winter wheat the following September. This fallow period is addressed by this NebGuide (*Figure 2*).

During this fallow period, ecofallow corn or sorghum residues plus residue from the previous winter wheat crop should be maintained. These residues reduce wind and water erosion and conserve water. Other benefits may include trapping snow, and reducing evaporation and soil temperature. This fallow season prior to planting winter wheat is often neglected. However, if crop residues can be maintained, the results will be reduced soil erosion potential and improved success with ecofarming. If 20 percent of the soil surface is covered by crop residues, soil erosion can be reduced by 50 percent (*Figure 2*). A better goal would be to maintain 40 percent residue cover and reduce soil erosion by 75 percent.

The goal at the end of the fallow season is to have the seedbed in a condition that permits winter wheat seed to be placed in firm, moist soil. The interrow area may be loose, which will delay germination of winter annual weed seeds near the soil surface. Sufficient residues and clods should be left on the surface to retard wind and water erosion before and after the crop is planted. The amount of residue should not exceed the capabilities of the drill to be used for seeding. Modification and adjustments will make it easier for the drill to work in heavier residue.

Managing Residues

Immediately after corn or sorghum harvest, livestock can be grazed for a few days to glean sorghum heads, corn ears, loose leaves, and corn shucks. The residues should be pastured for only a short period because cattle traffic can quickly destroy winter wheat residues. Traffic also alters soil properties which then reduce growing conditions and potentially reduce grain yields. Ecofallow corn and sorghum should be pastured only when the fields are dry enough to prevent soil compaction and the burying of weed, sorghum, or corn seeds. Fields are dry enough when soil squeezed in the hand fails to hold its shape. Instead of pasturing, some farmers have used wagons to collect the shucks or heads.

Weed Control with Tillage and Herbicides

Weeds use large amounts of soil water when they are not adequately controlled during the fallow period, which may result in future stands of spotty wheat. Also, if weeds are not controlled until after they produce seed, there may be greater weed density in the growing wheat crop.

Weeds must be controlled on a timely basis while maintaining as much residue as possible. Tillage and/or herbicides may be used. Herbicide selection should be based on weeds present, length of control needed, susceptibility of succeeding crops to herbicide residual effects, and costs.

There will be fewer weeds, particularly broadleaf weeds, since the corn or sorghum has been ecofallowed or if atrazine had been applied broadcast to corn or sorghum (*Table I*). After wheat harvest the timing of the herbicide application has an effect on the amount of some weed species as shown in *Table II*. Normally, one early tillage needed in the spring in conventional rotation can be eliminated, but do not delay for too long because large weeds are difficult to kill and use moisture. The reason for this is that the sorghum or corn residues containing winter wheat residues suppress weed growth. Also, if the ecofallow corn or sorghum crops are successful, the weed control will be almost perfect.

Table I. Fallow weed growth after atrazine is applied to grain sorghum at North Platte, Ne.

| Sorghum treatment | Rate | Weed growth in fallow ^a |
|-------------------|-----------|------------------------------------|
| | (lb ai/A) | (lb/A) |
| Weedy check | – | 1440 a |
| Hand-weeded check | – | 520 bc |
| Atrazine | 1 | 960 ab |
| Atrazine | 2 | 470 bc |
| Atrazine | 4 | 60 c |

^aLetters followed by the same letter are not significantly different at the 5 percent level.

Table II. Effect of delaying herbicide applications after wheat harvest on various weed species during the fallow period after corn, 1979-1981.

| Weed Species | Days after wheat harvest atrazine was applied | | | | |
|-----------------|---|----|----|-----|-------------|
| | 5 | 20 | 35 | 50 | LSD 0.05 |
| | ----- (Plants/m ²) ----- | | | | |
| Barnyardgrass | 74 | 72 | 60 | 103 | 35 |
| Stinkgrass | 2 | 2 | 4 | 3 | NS |
| Witchgrass | 3 | 2 | 2 | 1 | NS |
| Russian thistle | 10 | 12 | 13 | 13 | NS |
| Redroot pigweed | 17 | 10 | 6 | 4 | 12 |

Weeds should be controlled by tillage and/or herbicides before they are 4 inches tall. Waiting for more weeds to emerge can be costly because the larger ones cannot be killed. Downy brome, hairy chess, Japanese chess, and jointed goatgrass must be killed before heading. Normally, these weeds are not present in the three-year ecofallow rotation. Many are using this rotation to aid in controlling these winter annuals. Several herbicides are very effective on these weeds in March and early April. These include Bladex + Cyclone, Fallow Master, Landmaster BW, and Roundup. These need to be applied before downy brome heads. At North Platte where downy brome was killed with herbicides before viable seed was produced in the fallow period, the winter wheat yielded 40 bushels per acre. When the herbicide application was delayed to control the downy brome, the grain yield was 26 bushels per acre. This reduction was due to less downy brome seed produced by the earlier application. The later herbicide treatment was too late to eliminate seed production so downy brome seedlings competed with the winter wheat.

For emerged summer annual weeds, Bladex plus Cyclone, Landmaster, Fallowmaster, Roundup RT, or Roundup can be used. If summer annual grass weeds are taller than 1 inch prior to May 1, Cyclone must be applied with Bladex. This treatment will reduce the need for early tillage. Glean alone or with Roundup or Landmaster may be used in this part of the rotation in part of southwest Nebraska. An application of Glean at this time will dissipate on most soils before recropping back to corn or sorghum. Check Glean labels for use areas and recropping intervals for your soils. Volunteer corn or sorghum may escape Bladex and Glean.

No-till winter wheat with complete reliance on herbicides for weed control has not been economical. If tillage has not been performed, a no-till drill with a 10- to 12-inch spacing or another drill modified for heavy crop residue will be needed to plant winter wheat through the stalk residue. Also, the surface soil may become so dry and hard under no-till conditions that the seeder may not be able to penetrate the soil at wheat seeding. Drilling can be accomplished if residue is well distributed (3000 pounds per acre) or rainfall has been frequent. In general, at present herbicide prices and tillage costs, herbicides are best used as fallow aids.

Tillage Implements

Tillage tools should be selected according to the amount of crop residue desired at planting. A good goal is to maintain a 40 percent residue and reduce soil erosion by 75 percent. Several types of tillage implements may be required to maintain the proper residue amounts (*Table III*). The kind, quality, quantity, and state of decomposition of the residues, kinds and sizes of weeds, soil moisture condition, soil texture, length of fallow period, and timing of tillage operations should be considered when selecting tillage equipment.

Table III can be used to determine how much residue will remain on the soil surface after specific implements are used. For example, if 90 percent of the soil surface is covered with corn residue in the ecofallow period, only 63 percent will remain after a light disking. The residue cover would be further reduced after operations with a 6-foot blade (.90), rod (.90), rod (.90), and hoe drill (.70), until 32 percent residue cover remains.

Table III. Amount of crop residue maintained by various primary and secondary tillage tools used for weed control during the fallow period. Also, the wintering effects on crop residue and the residue maintained by wheat seeders.

| Operation | Residue maintained after each tillage operation |
|---|---|
| Moldboard plow (5-7 inches deep) | 20% |
| Moldboard plow (8 inches or deeper) | 10% |
| Chisel (twisted points) | 50% |
| Chisel (straight points), 2" chisels spaced 12" apart | 75% |
| Tandem disk (regular blades) | 50-70% |
| Tandem disk (large blades) | 30-50% |
| One-way disk (24 to 26 inch disks) | 50% |
| Field cultivator (12-16 inch sweeps) | 75% |
| Field cultivator (16-18 inch sweeps) | 80% |
| Field cultivator plus rod | 75% |
| Mulch treader (spike tooth) | 70% |
| Blades (36 inches or wider) | 90% |
| Sweeps (less than 2 feet) | 80% |
| Sweeps (24 to 36 inches) | 85% |
| Rodweeder plain rod | 90% |

| | |
|--|--------|
| Rodweeder with semichisel | 85% |
| Harrow | 90% |
| Spring tooth harrow | 75% |
| Fertilizer applicator (injection) | 90% |
| Attachment to tillage equipment such as flextine harrow or mulch treader | 95% |
| Overwintering | |
| Corn and sorghum residue | 80% |
| Winter wheat residue | 90% |
| Wheat seeder | |
| Hoe openers | 50-80% |
| Disk openers | 90-95% |

Tillage should be delayed in the spring following the corn or sorghum crop until the first crop of weeds emerges. The primary purpose of tillage is to control weeds and to prepare a seedbed for winter wheat seeding. Excess tillage breaks down soil structure and destroys residue. Consequently, the soil is more susceptible to wind and water erosion, surface crusting, and soil compaction. It is important that tillage operations be performed when the weeds can be easily controlled.

With reduced-tillage, a tillage operation should be completed by July 1 even if not needed for weed control. This is to prevent the soil from getting so hard that penetration by tillage equipment or wheat seeders is difficult or impossible in the fall. Hard soil conditions occur with hot dry weather.

A light discing with a tandem disk may be used to chop the stalks and control weeds when residues are long and poorly distributed. Chisel plows, equipped with chisel and sweeps up to 18 inches wide, can be used instead of a disc in light well distributed residue. Some drills may plug with the stalks if a disc is not used. The chisel should be equipped with high clearance shanks spaced to function in heavy residues. A rotary rod, flex harrow, or mulch treader mounted behind the last row of chisel shanks will improve weed control, residue distribution, and soil leveling during the first tillage operations. The rod attachment tends to lift residues back to the surface, distribute residues, and on a level soil surface will reduce evaporation of soil water.

Subsurface sweeps, semichisels, rodweeders, and plain rotary rodweeders are the most effective tillage implements for conserving surface residue. Sweep sizes range from 30 inches to 5 to 6 feet. The blade itself is 6 to 8 inches wide, and the V-blade angles vary from 60 to 100 degrees. Wide-angle blades penetrate the soil more easily, but they do not shed weed roots and residues as easily as smaller-angle blades. A blade pitch of about 37 degrees is optimum for soil lift and weed control. A mulch treader attachment can be added to the sweep plow to improve weed control. Rolling coulters at least 20 inches in diameter mounted in front of the sweep (or V-blade) will penetrate heavy residues and weeds.

A rodweeder equipped with semichisels will penetrate firm soil and can be used as a primary or secondary tillage tool. This implement kills weeds better than a plain rod, but it destroys more residue and is more subject to plugging in heavy residues than a sweep.

Plain rotary rodweeders are used only for secondary tillage operations; they control small weeds and

firm the seedbed prior to seeding, but will not penetrate hard soils. The major disadvantage of all subsurface tillage tools is that weed control is not as good as with the stirring machines (such as the disk), especially in wet, cool soils.

Mulch treaders are used as a second tillage tool to improve weed control after initial tillage, especially when weeds are shallowly rooted. They can also be used to distribute and anchor heavy residues or to firm the seedbed. They tend to pulverize the soil.

Soil Fertility and Fertilizers

Soil sampling and tests should be done early so fertilizer can be applied with tillage. With no-till, much of the fertilizer is applied with application equipment on the drill although some nitrogen may be top dressed in spring. Soil tests are necessary to ensure proper plant nutrition, minimum fertilizer costs, optimum yields, and quality crop residues.

A good time to apply anhydrous ammonia is with a tillage operation before mid July. Late July and August applications of anhydrous ammonia, unless used with a rodweeder, may prohibit obtaining a firm seedbed by winter wheat planting. Phosphorus can be applied at the same time if needed. Concentrated bands of anhydrous ammonia and phosphorus have given good yields.

Avoid disturbing the phosphorus band with later tillage operations because phosphorus efficiency will be reduced. A band is more efficient than broadcast. The efficiency of the nitrogen is not affected by tillage; however, excessive rainfall may move the nitrogen below the root zone. In general, band (knife) and seed-applied phosphorus are equal in efficiency except in a dry year when banded (knife) is more efficient since there is a greater probability of having moisture in the area where the phosphorus is located. A nutrient must be in soil solution to be taken out by a plant.

Summary

In summary, maintain as much residue on the soil surface as possible during the fallow period between corn/sorghum harvest and before winter wheat planting. Greater residue and good weed control will contribute to a successful ecofallow system. Fallow tillage operations and herbicide treatments must be timely. Often, tillage operations are neglected until weeds are 6 to 12 inches or taller. Multiple tillage operations then are needed to kill them, and crop residues will be destroyed. Weeds remove soil moisture and make it impossible to prepare a good seedbed. Effective fallowing will mean higher winter wheat yields and fewer weeds in the winter wheat stubble to be controlled before the corn or sorghum crop is planted. The success of ecofallow corn and sorghum depends on good winter wheat stands.

Following is a suggested program for managing weeds in ecofallow corn or sorghum residue:

1. *April*: Spray Landmaster II if volunteer wheat and/or downy brome are present.
2. *May-June*: Tillage, Use tillage that maintains residue, if needed, for volunteer crops and weed control. A light discing may be needed to chop corn or sorghum stalks.
3. *Late June*: Sweep tillage with anhydrous ammonia and phosphorus placed in 12-inch bands. (If residues are heavy and/or poorly distributed or the seeder cannot plant through the residue, tillage may be needed to reduce the residue.)
4. *As necessary*: Sweep tillage or rodweed to control weeds and prepare a seedbed.
5. Final tillage with a rodweed to firm the soil for planting.

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