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G91-1009 Getting Started in Ecofarming: Growing the Winter Wheat Crop

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Getting Started in Ecofarming: Growing the Winter Wheat Crop

Cultural practices can improve the weed competitiveness of winter wheat in an ecofallow program, thus increasing the effectiveness of herbicides.

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Ecofarming is a popular conservation tillage practice used in Nebraska areas where winter wheat is produced. It requires a high degree of management, but the rewards through higher crop yields and erosion protection are worth the effort. In Nebraska the winter wheat-fallow rotation is the common rotation used in areas of less than 17 inches of rainfall, while in areas that receive 17 to 22 inches the winter wheat-corn or sorghum fallow rotation is most common. In 1988, 41 percent of the available wheat stubble fields in west central and southwest Nebraska and 11 percent in the Panhandle were sprayed with a herbicide after wheat harvest.

In 1986 a field survey was taken one to two months after herbicides were applied after winter wheat harvest. Results indicated that many cultural practices greatly influenced weed control in the winter wheat stubble. The purpose of this NebGuide is to explain how some of these cultural practices can be used by farmers to improve the weed competitiveness of their winter wheat. Hence, when herbicides are used their effectiveness is increased.

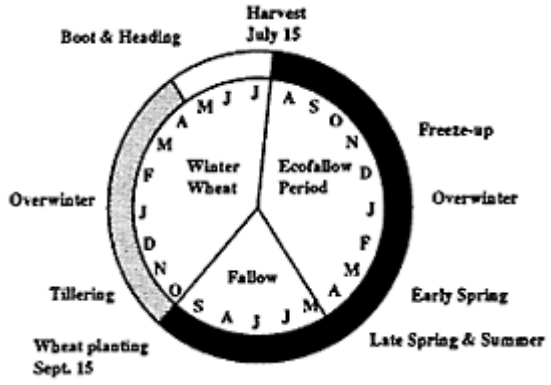

Figure 1. Sequence of events in a winter wheat-fallow rotation over a 24-month cycle.

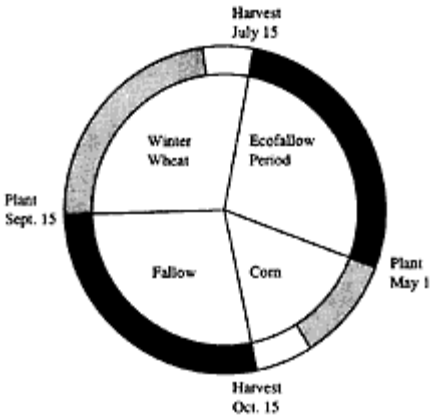

Figure 2. Sequence of events in a winter wheat-corn-fallow rotation over a 36-month cycle.

Ecofarming is defined as a system of controlling weeds and managing crop residues throughout a crop rotation with a minimum of tillage so as to reduce soil erosion and production costs while increasing weed control, water infiltration, moisture conservation, and crop yields. Energy requirements are much lower with ecofallow than with normal fallow systems. The ecofallow period in the two-year rotation occurs between winter wheat harvest and the planting of winter wheat 14 months later (*Figure 1*). In the three-year rotation it is between winter wheat harvest and corn, sorghum, millet, or soybean planting (*Figure 2*).

Ecofallow means controlling weeds during the fallow period by using herbicides or herbicides plus tillage with minimum disturbance of crop residues and soils. In the winter wheat-fallow rotation this has also been referred to as chemical fallow or chem-fallow. The ecofallow concept has been successful in the winter wheat-sorghum or corn-fallow rotation because of improved weed control, soil erosion protection and the potential to store more soil water, thus increasing yields more than in fields where tillage was used to control weeds and prepare a seedbed for corn or sorghum. The advantage in the winter wheat-fallow rotation is achieved largely through improved soil erosion protection from winter and water and improved weed control.

The use of ecofallow in the winter wheat-fallow rotation has not always increased winter wheat yields. The grain filling period is usually during the period of timely rainfall, so the extra stored soil water may not be needed by the winter wheat plant.

The cost of the herbicides and application can not exceed the cost of tillage if profitability is to be maintained. Water stored during the fallow period will be beneficial at planting time to help establish a good stand of winter wheat. Some years winter wheat yields may be higher on ecofallow land that has been in corn or sorghum.

The threat of wheat streak mosaic and the Russian wheat aphid has increased emphasis on controlling volunteer winter wheat, downy brome, and jointed goatgrass by 14 days prior to winter wheat seeding. The leaf curl mite is the vector for the wheat streak mosaic. The big source of leaf curl mite and aphid infestation is from volunteer winter wheat found in adjacent winter wheat stubble fields. These insects can be controlled by killing the volunteer grain and other hosts by cultivating the fallow ground or use of herbicides prior to planting winter wheat.

How to Develop an Ecofallow System

An effective fallow weed control program begins with the winter wheat crop. Planting winter wheat following an 11- or 14-month fallow period allows for the most competitive winter wheat. When winter wheat is planted after oats, sunflower, or soybeans without a long fallow period, expect more weeds and poorer weed control with herbicides applied post harvest (*Table I*).

Table I. Effect of rotation on weed control when averaged over herbicides sprayed after winter wheat harvest in Nebraska in 1986. [a,b]

Rotation	Fields surveyed	Field rating[c]	Barn-yard-grass	Green fox-tail	Witch-grass	Stink-grass	Sand-bur	Kochia
	(%)	(%)	---------(%)----------					
Wheat-fallow	7	83	86	80	88	72	---	100
Wheat-wheat-corn-fallow	4	80	75	92	85	93	100	98
Wheat-wheat-sorghum-fallow	9	72	63	50*	0**	50*	0*	---
Wheat-corn-fallow	39	86	78	84	94	92	83	93
Wheat-sorghum-fallow	34	65**	57*	70	83	71	36	60**
Wheat-corn-sorghum or wheat-sorghum-sorghum-fallow	2	83	66	60	100	100	---	100
Wheat-soybean, sunflower corn silage or oats	4	52**	0**	51*	50*	42*	---	99
CV (%)		39	55	39	30	35	59	44
PR>F (%)		3	4	28	6	21	2	20

[a]Adapted from Weed Tech. 3:244-254.
[b]**=Different from winter wheat-corn-fallow (w-c-f) rotation at the 1% level, and *=different from w-c-f rotation at the 5% level.
[c]Field rating refers to overall post-harvest weed control and stubble quality throughout the field.

A good stand of vigorously growing winter wheat reduces the chance of weeds becoming a problem after harvest. Thin wheat stands have more weeds which are usually larger and harder to kill. Winter wheat planted in seven-inch rows has fewer weeds than wheat in 14-inch rows. However, 12- to 14-inch row spacings and drills equipped with furrow openers are preferred in areas that receive 17 inches or less of rainfall. Barnyardgrass, foxtail species, and longspine or field sandbur are especially troublesome in wider spaced plantings in the higher rainfall areas. Stand and vigor of winter wheat can be improved by:

- Using tillage methods during the summer fallow period that maintain plant residue on the soil surface to control erosion and conserve soil water.
- Killing weeds before they remove soil water during the summer fallow period.
- Using a rodweeder to kill weeds and firm up the seedbed on the last two tillage operations before planting.
- Using a hoe drill instead of a disk drill if surface soil (top two to four inches) is dry, so that the

seed can be placed into firm, moist soil.

- Placing seed one inch deep into firm, moist, fine textured soils, and 1.5 to 2 inches deep in coarse textured soils. This is especially critical in the tractor tire area.
- Planting by seeds per acre rather than pounds per acre. The suggested rate is 18 seeds per row foot in any row spacing.
- Planting clean and weed-free seed; trashy seed inhibits seed placement.
- Checking the winter wheat in early March through April for broadleaf weeds. Broadleaf weed problems encountered after winter wheat harvest can be partly or completely eliminated by a timely herbicide spraying in spring.

Fertilizer

Proper fertilizer application is essential for profitable winter wheat yields. Fertilizer should be applied according to soil tests. Phosphorus makes the winter wheat more competitive (*Table II*). Successful applications include using anhydrous ammonia, solutions, and dry fertilizers. Anhydrous ammonia can be applied in June with or without phosphorus with a sweep blade. Dual injection of anhydrous ammonia and phosphorus in 12-inch bands has worked well. July and August application of anhydrous ammonia should be done with a rod weeder. If sufficient rainfall does not occur after application with a sweep plow, the seedbed will not be firm. Avoid fertilizing when the soil is too wet because heavy loads compact the soil. Wheel tracks can be a problem, particularly when driving on wet soil.

Table II. Influence of phosphorus on weed control when banded at wheat seeding time in western Nebraska.[a]

Item	Phosphorus		
	No	Yes	PR>F
Winter wheat yield, bu/A	48	58	-
Wheat stems, m^2	600	730	0.15
Witchgrass, m^2	2.0	0	0.07
Stinkgrass, m^2	4.3	0.3	0.12
Pigweed, m^2	2.7	0	0.09
Russian thistle, m^2	0.3	0.3	n.s.
Common purslane, m^2	1.0	0	0.22
Total weeds, m^2	10.3	0.6	0.06

[a]Adapted from Wicks, G.A., D.H. Popken, and S.R. Lowry. 1989. Weed Tech. 3:244-254.

A 1986 survey of winter wheat stubble fields that had been sprayed with herbicides in west central and southwest Nebraska indicated that timing of fertilizer application to winter wheat was related to weed control. Fertilizing prior to planting winter wheat improved weed control after winter wheat harvest when compared to top dressing winter wheat with nitrogen in the spring (*Table III*). Fertilizing in the fall made the winter wheat more competitive with the weeds. Apparently the winter wheat did not use all the spring applied nitrogen so the weeds used the remainder.

Table III. Influence of fertilizing winter wheat on weed control after herbicides were applied following winter wheat harvest in 1986 in Nebraska .[a,b]

Fertilizer practice	Field surveyed	Field rating[c]	Barn-yard-grass	Green fox-tail	Witch grass	Prickly lettuce
	(%)	(%)	----------(%)----------			
N band or broadcast in fall + P in row	10	87**	76#	99*	98*	100**
P and/or N + P broadcast in fall	17	79**	82*	92*	98*	100**
N broadcast in fall only	23	75**	52	65	95*	99**
N + P in row in fall + N in spring	12	85**	60	78*	60	---
N + P broadcast in fall + N in spring	12	81**	89*	86*	83	100**
N broadcast in spring only	10	45	46	48	60	56
No fertilizer applied	15	75**	58	69	96*	100**
CV (%)		39	7	37	32	21
PR>F (%)		1	10	5	12	0.4

[a]Adapted from Weed Tech. 3:244-254.

[b]** = different from nitrogen applied in spring at 1% level, * = different from nitrogen applied in spring at 5% level, and # = different from nitrogen applied in spring at 15% level.

[c]Field rating refers to overall post-harvest weed control and stubble quality throughout the field.

Variety Selection

Winter wheat varieties for ecofallow should be selected on adaptability, grain yield, weed competitiveness, insect and disease resistance, and amount of stubble provided. Some winter wheat varieties do not produce sufficient crop residue to gain maximum effectiveness of the stubble if corn or sorghum is the following crop. Fields with more than 4500 pounds of straw per acre store the most soil water. Tall growing varieties, such as Siouxland are more competitive with weeds than most semidwarf varieties (*Table IV*).

Table IV. Effect of winter wheat varieties on post-harvest weed control averaged across herbicides applied after wheat harvest in 1986 in Nebraska.[a,b]

Variety	Frequency	Field rating[c]	Barnyard-grass	Green foxtail	Witch-grass	Stink-grass	Sandbur
	(%)	(%)	----------(%Control)----------				
Bounty 310	2	100	---	100	---	---	---
Siouxland	4	98	100	100	48**	100	---
Vona	2	89	100	80	---	---	---
Centura	9	87	98	92	99	98	40
Centurk 78	15	81	67	96	97	97	100
Brule	32	81	53**	71+	96	87	75
Colt	12	78	76	48	100	---	46
Mustang	2	63	---	49*	100	70	0
Hawk	17	59*	54*	77	67+	56*	56
Pioneer 2656	2	47*	50+	50	---	---	---
Wings	3	2**	---	---	0**	0**	0

[a]Adapted from Weed Tech. 3:244-254.
[b] ** = different from Centura at the 1% level, * = different from Centura at the 5% level, and + = different from Centura at the 10% level.
[c]Field rating refers to overall post-harvest weed control and stubble quality throughout the field.

Residue Management

Volunteer wheat can be reduced with a timely harvest with a properly adjusted combine operated so grain is put in the bin instead of out of the back of the combine. Uniformly spreading the long straw and chaff will save time and frustration when planting the next crop. Use good spreaders on the combine or remove excess straw as soon as possible. Straw choppers are usually useful on conventional combines if equipped with deflectors. Rotary combines do not need straw choppers, but most need improvements to spread the straw. Unload grain while moving; if you have to stop, pull out and let the combine clear before stopping. Piles of straw are difficult to plant through and require extra tillage operations to destroy or spread the crop residue. Volunteer wheat is easier to control if the chaff is distributed. If residues are extremely heavy, remove the loose straw behind the combine. Eliminate excess traffic.

Surveys of winter wheat fields in the winter wheat-fallow rotation were conducted as part of the Agricultural Energy Project. Most winter wheat fields had residue levels of about 2 percent compared to 18 to 80 percent residue cover in ecofallow fields when measurements were taken in March 1988. It takes excellent management to maintain sufficient residue during the fallow period for erosion protection.

The producer's goal should be to obtain a suitable seedbed that winter wheat can be planted into satisfactorily for germination and emergence with existing hoe drills. Therefore, some tillage will be

necessary to destroy residue and prepared a seedbed. Do not control weeds throughout the 14-month fallow period in the two-year rotation with herbicides alone (chemical fallow). It is too costly and if the soil is not tilled before dry hot weather it may get so hard that penetration with most drills is impossible. If sweep tillage is started in June, a good seedbed can be prepared with one or more additional tillages.

In the three-year rotation the corn and sorghum residue needs to be disked in order to prevent stalks from plugging the hoe drills at winter wheat planting. This operation usually should occur by mid-May if no herbicides are used in the spring. One may have to cultivate sooner if downy brome or jointed goatgrass is present to stop seed development. More effort needs to be made in keeping more crop residue on the soil surface. Most fields have less than 2 percent residue cover when sown back to winter wheat. Crop residues are important to the system because:

1. Standing stubble traps snow. This may mean an additional one to three inches of water available for crop production compared to fields where residue was destroyed.
2. Winter wheat stubble reduces soil temperature and evaporation, thus increasing moisture for crop growth.
3. Residues reduce wind and water erosion. At least 750 pounds of winter wheat residue is needed per acre to control wind erosion on medium textured soils. Sandy soils, which are more susceptible to wind erosion, require 1,250 pounds per acre. Additional residues will improve water erosion control. Conventional hoe drills will seed through about 2,500 pounds per acre of winter wheat residues. The amount of straw left at winter wheat planting should match the clearance capacity of the drill. Straw can be redistributed by using a mulch treader or by pulling a rotary hoe backward with the teeth interlocking. *Table V* shows how various tillage operations maintain residues.

Table V.Wheat residue maintained with each tillage operation

V sweeps - 3 to 6 feet in width	90%
Chisel plows	75%
Disk, one-way, tandem offset	40 to 60%
Mulch treaders	75%
Rodweeders with semichisels	85%
Rodweeder	90%

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