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1993

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Wilson, Robert G. Jr.; Smith, John A.; and Moomaw, Russell, "G93-1146 Cover Crop Use in Crop Production Systems" (1993). *Historical Materials from University of Nebraska-Lincoln Extension*. 727.

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Cover Crop Use in Crop Production Systems

This NebGuide describes how cover crops can be integrated into various cropping systems.

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Agricultural producers are hearing more about cover crops, but many are unsure how such plants might be used in current crop production systems. Cover crops are legumes, cereals or an appropriate mixture. They are grown specifically to protect soil from erosion, protect emerging crops from blowing soil particles, improve soil structure, enhance soil fertility, reduce nutrient leaching, recycle nutrients and suppress weeds. A number of plant species could be used, but they must be successfully integrated into a diverse number of cropping systems used in Nebraska.

Nebraska has many areas where cover crops can be valuable. First, there are the sandy soils in the Sandhills. Antelope, Holt, Madison, Pierce and Stanton counties have large acreages of these sandy soils in cultivated crop production. The rolling loess hills of eastern Nebraska, alternately cropped to soybeans and corn, could benefit from use of cover crops. The low organic matter, sandy soils of southwest Nebraska are vulnerable to wind erosion. The same is true of soils in the irrigationd North Platte River Valley, where field beans, potatoes and sugarbeets leave little crop residue.

The following will describe how cover crops could be integrated into several cropping systems.

Cover Crops Seeded Late Season in Soybeans

Soybeans leave the soil more prone to wind and water erosion than does corn or grain sorghum.

Therefore, cover crops established following harvest of soybeans could be very beneficial on highly erodible land.

Time of seeding. The cover crop could be seeded by aircraft into standing soybeans. Cleaned winter rye aerially seeded at 1 to 1.5 bu/acre in sprinkler irrigated soybeans has been successful on Valentine loamy sand/Thurman sandy loam soils. Winter wheat has been less reliable than rye. Fall-seeded oats could also be used to provide a dead, winter mulch. Rye must be seeded at beginning leaf drop, from late August to September 10. Light irrigation will be necessary to keep the soil moist and promote rye development but should not be harmful to soybean yield. Successful establishment of rye in dryland soybeans will be dependent upon late summer rainfall.

Hairy vetch is an adapted legume cover crop for Nebraska but it should be planted by September 1. Winter rye plus hairy vetch could also be used if seeded by September 1. Hairy vetch will add very little nitrogen to the soil for next year's crop under these conditions.

Planting the cover crop after soybean harvest is a second option. The problem with this approach is that very little growing season remains in which to establish the cover crop. Winter rye is most often used in this system and should be planted from September 10 to October 1. Soybean harvest proceeds more rapidly on sandy soil compared to fine-textured soils, allowing earlier seeding of the rye. On fine-textured clay soil, advance planning is necessary in order to meet the rye planting date target. Select an early maturing soybean variety for a geographic area, ranging from a late Group I or early Group II in the northeast to a late Group II or early Group III in the southeast. Plant the soybeans by May 15 to 20. Soybean residue which has been chopped and spread will permit no-till planting of the cover crop immediately after harvest.

Corn planted no-till usually follows soybeans. Atrazine and crop oil (2 qt + 1 qt) applied on 2 to 3 inch rye has been successful in killing rye on loamy sand soil. On taller rye or on clay soil, combine Gramoxone at 1.5 to 2.5 pt/acre with a residual herbicide such as Atrazine, Extrazine, Bicep or Dual. Roundup at 1 pt/acre plus a nonionic surfactant and spray grade ammonium sulfate should kill 4 to 8 inch rye. Use only 3 to 10 gal/acre spray solution when using low rates of Roundup. A residual herbicide could be row-banded with the planter, leaving the killed rye as an inter-row mulch. Cultivation may be necessary later. Small rye can be destroyed by one disking or a field cultivation on sandy soil if tillage is preferred before planting corn.

Herbicide residue. A deliberate plan to plant cover crops will require a careful evaluation of herbicides used in soybeans or other row crops. Most herbicide labels give time intervals which should elapse before planting other crops. These label statements may be more restrictive than necessary to protect the manufacturer against liability. Using label statements, *Table I* contains a sensitivity score for selected cover crops to residue of commonly used herbicides. Herbicides degrade at varying rates depending upon moisture, temperature, soil pH and organic matter.

Cover Crops Seeded Early Season in Soybeans

Research has been conducted at the Northeast Research and Extension Center at Concord to determine whether cover crops of black medic or hairy vetch could be established either at soybean planting or soon after emergence. Post-emergence herbicides were identified that have selectivity to soybeans and the legumes. These herbicides controlled weeds and suppressed the cover

crops to limit their competitiveness with soybeans. In most experiments, soybean yield was not reduced by the underseeded cover crops. Spring seeded hairy vetch and black medic may not survive severe winter temperatures. Black medic produced seed under the soybean canopy. Black medic has a high percentage of hard seed so it may be possible for the legume to later reestablish itself. More research is needed to determine if this is a practical cover crop system for a soybean-corn rotation (*Figure 1*).



Winter Rye Seeded Late Season for Continuous Corn

Figure 1. Hairy vetch seeded at the time of soybean planting. Picture taken in mid-August.

On very erosive soils, aerial seeding of winter rye in continuous irrigated corn is a good soil conservation practice. Rye is seeded at 1 to 1.5 bu/acre, usually from August 1 to 15. Some producers have seeded rye during layby cultivation. Wider row spacing and shorter hybrids will allow greater light penetration through the corn canopy, which enhances survival. Normal irrigation scheduling may be sufficient to establish the rye. However, it is necessary to scout the field to be sure the soil surface stays moist. Aerial seeding of rye into dryland corn has been unreliable. Rye can be killed the next spring before planting corn, as previously described.

Winter Rye - Hairy Vetch Planted for Seed Production in irrigated Corn

There has been some farmer experimentation with aerial seeding rye plus hairy vetch in early August in irrigated corn on loamy sand soil. Rye and hairy vetch are then grown for seed production the next year under irrigation. This concept is an outgrowth of an earlier practice followed by farmers on coarse textured soils on the eastern edge of the Sandhills. Rye and vetch were strip seeded in the fall on dryland fields to protect against wind erosion. The rye and vetch seed were then separated and sold for seed. The practice declined as much of this land was developed for irrigated corn production. Irrigated seed yield of hairy vetch and rye and the economics of the system are unknown at the present time. The expectation is that vetch would add some nitrogen and organic matter to the loamy sand soil.

Cover Crops Seeded Late Season after Dry Edible Bean Harvest

There is little crop residue remaining on the soil surface following harvest of dry edible beans, leaving the soil prone to erosion from both wind and water. Spring crops which follow dry edible beans are also susceptible to damage from soil erosion.

Solid Seeded Cover Crops

Dry edible beans are harvested in early to mid-September. Cover crops of winter wheat or winter rye can be seeded immediately after bean harvest with a grain drill, or seed can be spread with a fertilizer spreader and incorporated into the soil with a shallow tillage operation. A disk drill with narrow row spacing will provide a level planting surface in the spring for the following crop. The seeding rate for either wheat or rye is usually 1 to 1.5 bu/acre. Rye will provide more top growth and better wind erosion protection early in the spring than wheat. The cover crop should be planted by September 15 to assure adequate soil protection over winter. If soil moisture is lacking at the time of seeding, sprinkler or furrow irrigation can be beneficial in improving cover crop density and growth.

A cover crop planted in this manner will provide soil

erosion protection during the fall, winter and spring. The fall seeded cover crop can also provide protection to a spring planted sugarbeet or corn crop. Allow the cover crop to grow to a 6 to 8 inch height in the spring before killing with Roundup. The spring planted crop can then be planted directly into the standing cover crop residue, or strips can be tilled through the cover crop to provide a planting area for the spring planted crop. An appropriate planter must be used for the spring crop to obtain proper seed depth, and to ensure that the cover crop residue is not punched into the seed furrow with the seed, creating inadequate seed-soil contact. A conventionally equipped, dedicated sugarbeet planter, such as a Milton or Deere 71 Flexi-Planter will have difficulty placing sugarbeet seed at the proper depth and achieving good seed-soil contact in this cover crop situation.



Figure 2. This cover crop was broadcast seeded in the fall following harvest of edible beans. Narrow strips of the cover crop were killed in the spring with Roundup when the cover crop was about 3 inches tall. Sugarbeets will be planted into the strips and the remaining cover crop killed with Roundup.

Sugarbeet growers have devised an alternative practice for controlling fall planted broadcast or narrow row cover crops while accommodating satisfactory performance of sugarbeet planters. When the cover crop reaches a height of 3-4 inches in the spring, narrow strips, approximately 12 inches wide, are sprayed and killed with Roundup. This spraying operation requires a band sprayer, straight rows and accurate "guess" rows. By sugarbeet planting time, the cover crop in these rows has died and sugarbeets can be planted in these rows without interference from the residue. The remaining cover crop in the inter-row area must be sprayed with Roundup immediately prior to sugarbeet planting or at least before any sugarbeets begin to emerge. This system provides both excellent wind erosion protection and good planter performance with traditional sugarbeet planters (*Figure 2*).

Cover Crop in Rows

An alternative to planting the cover crop with a grain drill or broadcasting the seed, is to plant the cover crop in defined rows to match the row spacing of the spring planted crop. The cover crop can be planted with a row crop planter, or with a grain drill which has appropriate openers shut off or raised. The cover crop rows must be planted straight using a marker to obtain accurate "guess row" width. Direction of the cover crop rows should be perpendicular to the prevailing wind.

Seeding the cover crop in distinct rows provides a residue-free area in which the spring row crop is planted. Conventional sugarbeet planters can be used to plant the spring crop if the area between rows of the cover crop is relatively level. An example of this technique would be to plant winter rye in rows with a row crop planter spaced 22 inches apart at the rate of 1 bu/acre in the fall after bean harvest. The following spring the cover crop should reach a height of 5 to 8 inches before being treated with Roundup at 1.5 pt/acre. Plant sugarbeets between the cover crop rows with a conventional sugarbeet planter. The cover crop provides early season protection for the developing seedlings until the sugarbeets are large enough to protect themselves. The remaining cover crop could then be



Figure 3. The cover crop was planted in the fall using a grain drill with selected seed metering units plugged, leaving bare rows to plant sugarbeets. The cover crop in this photo has been killed and the young

removed with cultivation (*Figure 3*).

sugarbeet plants are just emerging.

The timing for application of herbicides to kill the cover crop is very critical. The cover crop must be allowed to grow tall enough to provide adequate protection for both the soil and the crop to be planted. If allowed to grow too large, the cover crop can compete for soil moisture with the spring planted crop, and may be more difficult to control. Rain or wind can delay herbicide application beyond the planned date. If a non-selective herbicide is used to kill the cover crop, it must be applied before any of the spring planted crop begins to emerge.

Cover Crops Spring Seeded to Provide Protection for Sugarbeets and Selected Vegetable Crops

Spring planted sugarbeets and selected vegetable crops can be injured on coarse textured soils by blowing soil particles. A spring planted cover crop can provide early season protection for sugarbeets and vegetable crops until the crop is established. The seedbed can be prepared in a conventional manner and barley or oats seeded at the rate of 1 bu/acre with a row crop planter in March or early April. Most row crop planters can be used to seed the cover crop, in rows spaced far enough apart to facilitate the planting of sugarbeets or vegetable crops between cover crop rows in mid to late April. The hitch attachment on the cover crop planter should be moved one half row width on the planter frame so the tractor tires are in line with the rows of the cover crop and not where the sugarbeet crop rows will be (*Figures 4 and 5*).

The spring seeded cover crop could also be planted in narrow rows with a disk drill. The resulting surface must be relatively level to allow planting directly into the growing cover crop without further tillage.

The cover crop should be emerged and beginning to grow before sugarbeets or vegetables are planted. Most conventional sugarbeet or vegetable planters will perform satisfactorily in either the wide or narrow rows if the surface between cover crop rows was left relatively level after cover crop planting. When the cover crop reaches a height of 6 to 8 inches if planted in wide rows, or 3 to 5 inches if drilled in narrow rows, it should be treated with an approved gramaticide (Poast or Fusilade) appropriate for the crop being grown. The cover crop will provide early season protection for the establishing crop and can be killed before it becomes too large and begins to compete with the crop. When the sugarbeet or vegetable crop is sufficiently large, the cover crop can be removed with cultivation.



Figure 4. Sugarbeets are being planted into a spring seeded cover crop that was planted with the same planter.



Figure 5. The cover crop has been sprayed with a herbicide and is beginning to die as the sugarbeet plants develop.

Table I. Sensitivity of selected cover crops to soybean, corn and dry bean herbicides.

		Cover crop sensitivity to herbicide residue					
Cover crop planted into or following	Herbicide	Winter rye	Winter wheat	Oats	Spring barley	Hairy vetch	Black medic
		Score, 1-5 ^a					
Soybean	Canopy	2	2	3	2	3	3
	Classic	2	2	3	2	3	3
	Dual	1	1	1	1	1	1
	Lasso	1	1	1	1	1	1
	Pinnacle	2	2	2	2	2	2
	Prowl	3	3	4	3	2	2
	Pursuit	2	2	4	2	2	2
	Pursuit Plus	2	2	3	2	3	3
	Scepter	2	2	4	2	4	4
	Sencor/Lexone	1	1	1	1	1	1
	Squadron	2	2	4	2	4	4
	Treflan	3	3	4	3	2	2
Corn	Accent	3	3	4	3	4	4
	Atrazine	3	3	4	3	4	4
	Banvel	1	1	1	1	1	1
	Beacon	2	2	3	2	4	4
	Bicep	3	3	4	3	4	4
	Bladex	1	1	1	1	1	1
	Bullet	3	3	4	3	4	4
	Dual	1	1	1	1	1	1
	Eradicane	1	1	1	1	1	1
	Lasso	1	1	1	1	1	1
	Sutan	1	1	1	1	1	1
	Sutazine	3	3	4	3	4	4
Dry edible beans	Eptam	1	1	1	1	1	1
	Lasso	1	1	1	1	1	1
	Treflan	3	3	4	3	1	1
	Prowl	3	3	4	3	1	1
	Sonalan	2	2	3	2	1	1
	Pursuit	2	2	4	2	2	2

^a1 = low probability of injury; 5 = high probability of injury.

File G1146 under: FIELD CROPS

G-29, Cropping Practices

Issued April 1993; 4,000 printed.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Elbert C. Dickey, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.

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