THE AGRONOMICS AND ECONOMICS OF DIRECT SEEDING OF ROW CROPS INTO ALFALFA STUBBLE

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Abstract: Cotton, corn and blackeyes were successfully direct-seeded into alfalfa stubble in four different field scale trials during 1988. There are many potential benefits to be gained from this practice, including: increased alfalfa production, reduced tillage costs, increased water infiltration and reduced particulate air pollution. There are two primary agronomic challenges to overcome -- minimum tillage stand establishment and weed control. A rough economic analysis shows from $150.00 to $200.00 per acre increased net income compared to traditional practices. This economic advantage depends on normal yields and normal weed control costs which need to be determined in future trials.

Keywords: Minimum tillage, no-till, rotational crops, stand life, and water infiltration

INTRODUCTION

Direct seeding of row crops into alfalfa stubble has many potential benefits. The greatest benefit is increased alfalfa production. Instead of taking alfalfa out in the fall to prepare the ground for spring planting of the next crop, alfalfa can be left in through the first or second cutting. Within two or three days after the alfalfa is baled or green-chopped in the spring, the next crop is planted and growing. This results in essentially continuous farming. The increased income from winter sheeping and the first one or two cuttings is substantial.

There are savings from reduced tillage. Approximately 5 to 10 passes through the field are eliminated by minimum tillage planting. Research at the Shafter USDA Cotton Research Station indicates very high water infiltration occurs after several years of alfalfa production. This has occurred on soils with historical mid-season sealing problems. Minimum tillage planting may maintain these high water infiltration rates for the succeeding crop. Direct seeding resulting in continuous farming may also greatly reduce particulate air pollution from open worked ground.

To obtain these benefits, there are several agronomic challenges to overcome. Most obvious, is just getting a good stand with a one-pass-through planting operation. Secondly, once you have a good stand, which we did in all four of our trials, maintaining good weed control is a challenge.

Soil compaction, particularly with a tap-rooted plant like cotton, may have to be overcome with aggressive precision ripping at planting. However, soil compaction may not be as much of a problem as expected because of extensive undisturbed root channels left by decaying alfalfa roots.

PLANTING

As soon as the hay was out of the field, the crop was irrigated and then sprayed the next day to burn down all existing vegetation. Within two or three days after irrigation, the plots were planted in a single pass operation. These soils were mostly sandy loams with crop residue and alfalfa crowns on the soil surface, so planting soon after an irrigation was no problem.

All four trials were planted with a two-row planter sled with four bars for equipment attachment. All plantings were one-pass-through planting operations. Several different combinations of tillage were tried, with the following combination the most successful.

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Fertilizer knives were attached to the front of the planter sled and run six to eight inches deep. No fertilizer was applied through the knives this year. They were used as lightweight rippers. The second bar had fluted coulters (3" flutes on a 22" diameter) attached to it. The coulters further broke up the soil and filled back in the slot created by the fertilizer knives. The third bar on the sled pulled 22 inch sweeps, running completely flat. The sweeps sheared off alfalfa crowns one to two inches below the surface and still left the ground flat. Finally, John Deere 71 planters, with disk openers, planted the seed.

In the cotton plots, SJ2 was used in the first and GC510 in the second. The corn variety was a grain variety NK6321 and the blackeye variety was Blackeye #5.

WEED CONTROL

Just after the irrigation, but before planting, the plots were sprayed with Roundup. In the first plot planted to cotton, Roundup was sprayed before the irrigation, when the alfalfa was water-stressed and thus the alfalfa grew back rapidly. Both the second cotton plot and the blackeye plot were sprayed after an irrigation with the hay actively growing. The blackeye plot had 99 percent control of the hay, but there was only about 75 percent control in the cotton plot.

The corn silage plot was sprayed with Roundup the day after green-chopping. Since there was little alfalfa for absorption of the herbicide, the hay was only burned down and the regrowth slightly suppressed. The corn silage plot being the last plot was all planted using a 22 inch sweep down the row at planting. The sweep resulted in 100 percent control of alfalfa in the row.

Residual herbicides were included with the Roundup sprays on the cotton plots and blackeye plot. The cotton plots were uncultivated after planting. The blackeyes were cultivated four times and the corn twice. Crescents and rolling disks were used to cultivate close to the row and sweeps were run flat to shear off the alfalfa left in the furrow. The corn was kept flat for irrigation between existing borders. Small furrows were formed in the blackeyes to aid in harvesting.

Cotton Weed Control

On the first cotton plot, Roundup 4 S (glyphosate) at 0.75 or 1.5 lb ai/A (1.5 or 3pt/A) was applied at three dates after the first spring cutting of alfalfa on 3/17/88. Treatments and dates are given in Table 1 below. Goal 1.6 EC(oxyfluorfen) was added at 1 oz ai/A in one plot to assess if additive effects occurred. Plot size was 8.3 x 15 feet, replicated three times. Border irrigation was applied 3/28/88. Cotton was planted into the stubble, using only a fluted coulter on 3/31/88. Daily maximum temperatures reached 75°F during germination.

Table 1: HERBICIDE RATINGS FOR 4/18 and 4/22/88

Date	Height		Alfalfa			F. Barley	Overall
	Alfa	F. Barley	Inches	Injury	Control	Control	Control
On 3/23	3"-6"	4"-6"		+19	+19	+23 days	+19
+23							
Untreated			17.0	0.0	0.0	0.0	0.0
Roundup @ 0.75 lb ai/A			9.7	5.3	6.0	9.7	5.7
Roundup @ 1.50 lb ai/A			6.0	6.8	8.0	9.0	8.0
Field Treatment*(remainder of check)			8.0	8.0	7.0	10.0	7.0
On 3/30	8"	5"					
Roundup @ 0.75 lb ai/A			9.7	4.7	5.7	8.3	5.3
Roundup @ 1.50 lb ai/A			9.0	6.7	7.7	9.7	7.0
On 4/04	13"	5"-8"					
Roundup @ 0.75 lb ai/A			12.0	4.3	5.7	9.3	6.7
Roundup @ 1.50 lb ai/A			9.8	7.7	7.7	9.7	7.0
Roundup @ 0.75 + Goal @ 1/16			10.0	7.0	6.0	1.3	5.3

**(Caparol @ 1.6 + Roundup @ 3 + Prowl @ 0.75)

The results of using Roundup at three different dates, at equal rates, were little affected by either irrigation or date of application. Adding Goal did not markedly change results. Nor did going to 3 lb ai, as was done in the field treatment. Suppression did occur with all treatments, but once regrowth started, recovery was rapid. By May 1, control was no longer evident, alfalfa was 16", and the cotton underneath was shaded. No ill effects were noted on cotton at either date or when observed prior or after these dates, except from alfalfa competition.

When the field treatment was rated on 4/22/88, there was 100% control of: Prickly lettuce, Annual bluegrass, Foxtail barley, London rocket, Knotweed and Sowthistle. There was 80% to 90% control of: Purple nutsedge, Cheeseweed (Malva), and Horseweed (marestail). Alfalfa control varied considerably. This was probably due to variations in dormancy in individual plants when plants were sprayed. Overall, control was 70% on 4/22/88.

In the second cotton trial, the alfalfa field had been treated with a dormant application of Direx 4F (diuron) @ 2 lb/A + Treflan TR-10 (trifluralin) @ 2 lb ai/A. In this field on a loam soil, no injury to cotton occurred nor were weeds a factor after planting.

Blackeye Weed Control

Seven herbicide treatments were made on 4/13/88, one day after planting blackeyes into alfalfa stubble. The entire test area had been treated with Roundup 4S (glyphosate) on 4/08/88. Sprinkler irrigation of 0.5-1" was applied on 4/10/88. On 4/14/88, another irrigation of 0.5" was made.

Plots were 8.33 x 19 feet, replicated three times. Treatments are shown below in Table 2. Considerable plant residue remained, but in the drill row, different planting procedures removed or disturbed residues. Maximum temperatures were at 78°F when treatments were made, but fell to much lower temperatures in mid-May.

Table 2. EFFECTS OF RESIDUAL HERBICIDES ON WEEDS AND ALFALFA IN BLACKEYES PLANTED INTO ALFALFA STUBBLE TREATED WITH ROUNDUP

Treatment	Rate ai/A	Alfalfa	Bermudagrass	Nettle	Russian Thistle
1. Check		9.3	6.0	4.0	6.7
2. Dual 8 EC	1.5	9.3	10.0	8.0	8.0
3. Dual	3.0	9.0	10.0	7.3	10.0
4. Dual + Prowl	1.5 + 0.75	8.7	9.3	10.0	10.0
5. Dual + Prowl	3.0 + 1.5	9.0	10.0	8.3	10.0
6. Dual + Roundup	1.5 + 1.5	8.7	10.0	10.0	9.0
7. Dual + Roundup	3.0 + 3.0	9.0	10.0	7.7	10.0

Table 2. (cont)

Treatment	Rate ai/A	Lambsquarters	Pigweed	Barnyard Grass	G foxtail
1. Check		0.0	0.0	0.0	0.7
2. Dual 8 EC	1.5	3.7	2.0	6.7	7.7
3. Dual	3.0	5.7	6.7	9.7	10.0
4. Dual + Prowl	1.5 + 0.75	8.7	7.3	6.7	8.0
5. Dual + Prowl	3.0 + 1.5	9.7	9.0	10.0	7.0
6. Dual + Roundup	1.5 + 1.5	4.0	6.7	8.3	7.3
7. Dual + Roundup	3.0 + 3.0	10.0	8.0	10.0	10.0

A total of four cultivations were done. The third cultivation successfully threw dirt to the blackeye row to cover emerging weeds along the row. Where no cultivation was made in one area, weeds overtook the crop.

These results suggest that one Roundup application prior to planting blackeyes would permit planting using a large sweep to cut off alfalfa crowns in the row at planting. This could be followed by further sweep-tillage in the furrow prior to recovery of the suppressed alfalfa. The usefulness of residual herbicides was not fully demonstrated. Further studies are needed to determine their utility. The limited results from these trials suggest they are effective, but not good enough to eliminate tillage.

Table 3: AGRONOMIC INFORMATION AND YIELD RESULTS FOR MINIMUM TILLAGE DIRECT SEEDING OF ROW CROPS INTO ALFALFA STUBBLE

CROP	SOIL TYPE	PLOT SIZE	PLANTED/HARVESTED		YIELD
Cotton	Milham loam	6 rows x 800'	3/31/88		NOT HARVESTED
Cotton	Merced clay loam	14 rows x 400'	5/15/88	11/01/88	0.5 bales/acre
Blackeyes	Cajon fine sandy loam	6 rows x 600'	4/12/88	9/12/88	22 cwt/acre
Corn	Cajon fine sandy loam	14 rows x 400'	5/18/88	8/02/88	20-25 ton/acre

YIELDS

The yield results and background agronomic information are shown in Table 3

The second cotton plot was planted on a slightly saline-sodic clay loam soil which made planting very difficult. The stand was about 60 percent of normal with a 25 percent alfalfa stand still growing. The plot was allowed to water-stress severely on several occasions. Even with these limitations, a yield of 0.5 bales per acre is pathetic.

The blackeye plot was in a hand line sprinkler irrigated alfalfa field. The blackeyes were irrigated on the same schedule as the alfalfa, twice per cutting. This irrigation schedule was very hard on the blackeyes. Since the field was lease ground, it wasn't discovered till after planting that this 1988 crop of blackeyes was the third crop of blackeyes in the last ten years. This resulted in severe "early cutout" of the blackeyes. Also, no insect control treatments were used on the blackeyes. The extended hot periods this summer were also limiting blackeye yields. Twenty-two sacks per acre is a very encouraging yield considering these yield limitations.

The corn silage plot was harvested early. The yield was weighed, but no moisture samples were taken at harvest. The experienced silage grower who harvested the silage estimated the moisture to be between 75 to 80 percent. Thus, the yield adjusted to 70 percent moisture is somewhere between 20 to 25 tons per acre. This is a good silage yield, considering the early harvest and the variety planted is primarily a grain corn variety.

ECONOMICS

Following in Table 4 are some estimates of the income and expenses associated with direct seeding of row crops into alfalfa stubble.

Table 4: THE ECONOMICS OF DIRECT SEEDING ROW CROPS INTO ALFALFA STUBBLE

	ONE CUTTING ($/Acre)	TWO CUTTINGS ($/Acre)
Income--Winter Sheeping Off	25.00	25.00
Income--Hay Cuttings(1 1/4 & 1 ton/Acre)	125.00	225.00
Tillage Savings	50.00	50.00
TOTAL INCOME AND SAVINGS	200.00	300.00
Alfalfa Production Costs:		
Insect Control	5.00	10.00
Irrigation (6"/Irrigation & One Irrigation/Cutting)	15.00	30.00
Harvest	30.00	60.00
TOTAL COSTS	50.00	100.00
INCOME ABOVE COSTS	150.00	200.00

The income above costs is estimated to be $150.00 and $200.00 per acre for one and two cuttings, respectively. If the yield of the direct-seeded crop is normal and there are no additional costs as a result of direct seeding, then a grower is approximately $150.00 or $200.00 per acre ahead in profit. This is compared to taking the alfalfa out in the fall and leaving the ground open during the winter and early spring.

Some dairy farmers might want to compare the economics of direct-seeding to taking the alfalfa out in the fall, planting winter forage, and then planting corn silage in May after the winter forage is harvested. The profit, the cost of buying forage from another grower minus the cost of producing the winter forage, would have to exceed $200.00 per acre in order to make winter forage more profitable than direct-seeding corn silage into alfalfa stubble after the second cutting.

There may very well be some additional weed control costs in the direct-seeded crop. There may also be slight yield reductions from minimum tillage planting. The cost of any additional weed control and the value of any reduced yield must be subtracted from the $150.00 and $200.00 per acre for one and two cuttings respectively.

The practice of direct-seeding cotton, corn and blackeyes into alfalfa stubble has the potential to increase alfalfa production and grower income. The additional two cuttings could add from one to two- and one-half tons per acre to the production of an alfalfa stand. The direct-seeding of row crops into alfalfa stubble has a number of potential benefits in addition to increased alfalfa production: savings from greatly reduced tillage, increased water infiltration, and reduced particulate air pollution. Trials need to be conducted in a variety of locations to determine the best planting and weed control practices, and yields need to be carefully compared to conventionally planted row crops.

ACKNOWLEDGEMENTS

The original idea for these trials resulted from a discussion between Kater Hake, Kern County Farm Advisor, and Berle Meek, Shafter USDA Cotton Research Station researcher, on how to maintain high water infiltration rates. The authors thank growers Marino Riccomini, Larry Frey, Steve Brunni, Herschel Moore, Willie Bennett, and Bob Hale for their help in doing these trials. Kern County Agricultural Technician, John Fritz, is appreciated for his "Nebraska Farming" "know-how" and "can do" spirit.