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CROP MANAGMENT SYSTEMS AT DICKINSON, NORTH DAKOTA

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SUMMARY

An 8-year cropping systems experiment was established in the fall of 1992 to determine the effect of conventional, no-till, and sustainable systems on weed development and crop production at Dickinson, North Dakota. There are three crop production systems, and these are the results for the first year after establishment. All three crop production systems use wheat-silage corn-fallow rotation and each crop is included every year for each system for a total of nine treatments, i.e. three cropping systems and three crops each year. Conventional tillage systems relied upon preplanting tillage and postemergence herbicides for weed control, except fallow received three field cultivations. No-till system relied upon postemergence herbicides for weed control in all phases of the rotation. The sustainable system was similar to conventional system, except sweetclover was planted into the silage corn rows and was allowed to grow into the early part of the fallow year before it was disked under. Weed control for the sustainable system was limited use of postemergence herbicides in wheat and was row cultivation in silage corn.

Soil core samples were taken in the fall of 1993 for moisture and fertility (N, P, and K) analysis. Soil moisture (4-foot depth), soil nitrogen (2-foot depth), and soil phosphorus (6-inch depth) were reduced in the fallow year for the sustainable system compared to the conventional and the no-till systems (data not shown). Sweetclover grown in the silage corn and fallow years probably utilized soil water for its growth and tied up the nitrogen and phosphorus when the sampling occurred in fall 1993. However, a 75 lb N/A credit was given for the green manured sweetclover in the spring of 1994. The soil moisture or fertility characteristics were similar for the three management systems in wheat

or silage corn.

Surface residue was determined using the Soil Conservation Service string-bead method. Tillage was not done postharvest in wheat and silage corn management systems in 1993, so fall residue values are similar for those crops regardless of management system (Table 1). The sustainable fallow had more surface residue than conventional fallow system at the postharvest 1994 due to the high sweetclover residue. Wheat residue was greater than 90% in the fall and ranged from 81 to 90% in the early spring. Silage corn and fallow residue was reduced almost in half between fall and early spring to values less than 20% ground cover.

Seedbeds for wheat and silage corn in the conventional and sustainable systems were prepared with one pass of a tandem disk at the 4-inch depth, which reduced surface residue measured after planting (Table 1). The planting operation for the no-till treatment only caused a small reduction of cover. Postharvest residue results in 1994 were similar to 1993's except for two treatments, no-till silage corn and sustainable fallow. The no-till silage corn grown on 1993 wheat maintained high wheat residue plus silage corn residue from 1994 was added. The sustainable fallow had less surface residue at the postharvest 1994 sampling due to better control of the biennial sweetclover in 1994 than 1993 when sweetclover, to start the experiment, was disked under same season as planted.

Weed species present and density were determined before planting, postemergence herbicide application, and harvest (Table 2). Weeds were not detected before planting wheat in mid-April. Weed density in wheat tended to be less before herbicide treatment and was lower before harvest in no-till wheat compared to conventional or sustainable management systems. Weed densities were similar for all management systems before planting silage corn. Weed density in silage corn before herbicide treatment was less in no-till than in conventional and sustainable management systems. Preharvest weed density differences in silage corn was similar for all weed management systems. Weed density before herbicide treatment in no-till fallow was less than before the first tillage in conventional or sustainable management systems, and all management systems effectively reduced weed density in fallow by the end of season.

Weed densities tend to be lower and the weed species diversity tends to be greater in the no-till system than conventional or sustainable management systems (data not shown). The most abundant weed species were prostrate pigweed, barnyardgrass, redroot pigweed, green foxtail, and Russian thistle at time of pretreatment

counts. Volunteer wheat was present in all silage corn systems. Russian thistle appeared to respond differently than the other species to the management systems. Russian thistle in silage corn was more abundant in no-till (12/yd^2) than conventional (4/yd^2) or sustainable (1/yd^2) systems, at pretreatment and preharvest.

Wheat yields did not differ among management systems (Table 2). Corn silage yield was less in the no-till than sustainable systems, and both systems produced less silage corn than the conventional system. The low silage corn yield in the no-till system may have resulted from the high wheat residue that gave poor corn seed/soil contact that delayed corn emergence and/or cooler soil temperatures that delayed corn development. Weed density for the three management systems were similar prior to planting; however, the herbicide burndown treatment that was planned between planting and corn emergence was not able to be applied to the no-till system whereas weeds in the conventional and sustainable systems were disked under. The early season competition from weeds prior to the postemergence herbicide treatments may have caused the yield reduction, although the weed densities in the no-till silage corn were less than conventional and sustainable systems prior to postemergence herbicide treatment.

The sweetclover established weill with the silage corn in 1993 and overwintered well for a good crop in 1994. However, the sweetclover did not get established with the silage corn in 1994, prbably because of inadequate reainfall at the time of sweetclover establishment. The unpredictability of sweetclover establishment with silage corn may limit it as a major component of the sustainable system. Sweetclover established well with the silage corn in 1993 and overwintered well for a good crop in 1994. However, the sweetclover did not establish with the silage corn in 1994, probably because of inadequate rainfall after sweetclover planting. Consideration is being given to using an annual legume with larger seeds that might establish early during the fallow season for the sustainable system in the often dry environment of the Dickinson area.

Table 1. Effects of farm management practices on surface residue for three crops in Dickinson, ND in 1993 and 1994.

Time of residue sample		Conventional	No-till	Sustainable[a]	LSD 5%
1993 crop	1994 crop				
			cover %		

Postharvest 1993:					
Wheat		93	95	93	NS
Silage corn		35	35	44	NS
Fallow		7	33	53	27
Overwinter - Preplant 1994:					
Wheat stubble -	Silage corn	81	86	90	NS
Silage corn -	Fallow	14	14	13	NS
Fallow -	Wheat	2	19	18	NS
Postplant 1994:					
	Silage corn	15	86	20	14
	Fallow	3	13	-	NS
	Wheat	1	12	13	9
Postharvest 1994:					
	Silage corn	56	97	49	24
	Fallow	6	17	6	NS
	Wheat	71	82	77	NS

[a]Sustainable farm management has sweetclover interseeded in silage corn rows, and the sweetclover overwinters to be disked under as green manure in the fallow year.

Table 2. Effects of farm management practices on weed density and crop dry yield for three crops in Dickinson, ND in 1994.

Crop	Time	Conventional	No-till	Sustainable[a]	LSD 5%
Weed density (no./yd^2):					
Wheat	Preplant -	0	0	0	NS
	Pretreatment -	109	38	75	NS
	Preharvest -	23	13	34	16
Silage corn	Preplant -	77	59	60	NS
	Pretreatment -	472	184	567	164
	Preharvest -	63	88	98	NS
Fallow	Preplant -	-	-	-	-
	Pretreatment -	564	86	967	615
	Preharvest -	9	12	13	NS
Dry yield:					
	Wheat (bu/A)	45.3	43.8	40.4	NS
	Corn (ton/A)	4.3	2.6	3.3	0.9
	Clover (ton/A)	-	-	2.4	-

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