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Winter Wheat Production on Former CRP Lands in the Southern Great Plains

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INTRODUCTION

As the bulk of the 1.2 million acres of land under CRP contracts in Oklahoma begins expiring in 1996 and 1997, contract holders will have to choose a future use of their CRP acres. Much of this land was cropped annually to winter wheat and cotton. Sediments, airborne dust, and particulate-associated nutrient discharges are significant problems in the production of both crops. In 1994, a collaborative multi-agency project was developed and implemented on two CRP fields under contract since 1987 to evaluate environmentally-sound production options for using highly-erodible CRP lands in the post-contract era. The project objectives were to (1) identify sustainable dryland production systems for converting CRP lands to the production of wheat that preserve the benefits to the soil under the CRP, (2) evaluate economics of production options, and (3) deliver project information to producers, action agencies, and the general public.

METHODS AND MATERIALS

I. Field-scale evaluation of conservation tillage production systems for future CRP land use

A. FORGAN, OK: One experimental site is in Beaver Co. near the town of Forgan in a 18" precipitation zone. The 160-acre field is located on Dalhart fine sandy loam, 1-3% slope soil. The field was planted to Old World bluestem (OWB) in 1989. In May 1994, controlled burning was used to remove the old grass growth on 25 acres to establish various land management treatments. In 1995, an additional 25-acre block was burned to re-establish a similar set of treatments; in 1996 another 25-acre block was swathed and the hay baled because of a statewide "burning ban". In each block, wheat was established (1) using conservation-till (CT) practices, (2) in a wheat-sorghum-fallow rotation using CT practices, and (3) using no-till (NT) practices.

Conservation tillage was performed by undercutting the OWB sod plots with a 36" V-blade sweep in July; no other tillage was performed during the summer of 1994 and wheat was planted in September. In 1995, sweep tillage was performed in June, August and again in October, prior to planting because of significant regrowth of the sod and weeds. In 1996, CT plots were also disked after sweep tillage because of significant weed growth and the

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B. DUKE, OK: The second experimental CRP site is in Jackson Co. near the town of Duke in a 29" precipitation zone. The 160-acre field is located on LaCasa-Weymouth clay loams on a 1-3% slope. Field plots were established to compare (1) disk-tillage (DT) to establish the first wheat crop and (2) NT practice to convert CRP lands to wheat production. Disk-tillage is considered a conservation practice to kill and partially incorporate the OWB sod. Repeated diskings (between 2 and 3 times) were required in June, 1994 through 1996. Additional disking was performed before planting in October. The OWB sod in the NT plots was sprayed with 1 lb ai/acre of glyphosate in June and in September before drilling the wheat. A no-till drill was used to plant all plots, at a rate of 70 lb/acre. Forty lbs/acre of 18-46-0 fertilizer was placed in the seed row. Additional fertilizer was surface broadcast before planting for a total of 80 lbs/acre of urea-N and 35 lbs/acre of P_2O_5. Thirty lbs/acre of urea-N was topdressed to all wheat plots in March. Grain yields were measured.

II. <u>Herbicide and fertilizer needs for re-cropping CRP field without removing the old grass</u>.

a. Small field plots (20 ft x 25 ft) were established at both sites without removing any old growth. Wheat was seeded directly into the existing OWB stand to evaluate the effectiveness of selected tillage-herbicide combinations to kill the sod. Two hundred lbs/acre of 18-46-0 and 100 lbs/acre of urea-N were applied to plots either moldboard plowed, disk plowed or no-tilled. Glyphosate was applied at 0.25, 0.5, 0.75, 1.0 and 1.5 lb ai/acre and Landmaster BW at 40 and 54 oz/acre were applied across the plots before tillage in either May or July 1994. Tilled plots were disked once before planting wheat at a rate of 80 lbs/acre. Wheat was topdressed with 100 lbs N/acre in March. OWB and weed control, and wheat vigor ratings were made periodically. Stand count and yields were measured.

b. Small field plots (20 ft x 25 ft) were also established to evaluate the effects of nitrogen and phosphorus fertilizers for winter wheat production in CRP lands. OWB was treated with 1 lb/acre of glyphosate in June 1994. Liquid fertilizer was applied to the grass before the primary tillage treatments of either moldboard plowing, double disking, or

no-till were made. Fertilizers applied were: 0 lbs/acre N, 100 lbs/acre N as 28% UAN, 100 lbs/acre N as 28% UAN + 50 lbs P_2O_5/acre, 100 lbs/acre N as 34-0-0. The plots were planted to wheat at a rate of 80 lbs/acre. Visual ratings of wheat vigor and stand density were made periodically during the growing season. Grain yields were determined with a plot combine.

RESULTS AND DISCUSSION

a. Wheat Performance with the Old Grass Growth removed.

The 1994 and 1995 grain yields from field-scale plots are shown in Table 1. NT wheat yields were significantly higher than CT yields except for the first-year wheat crop at Forgan in 1995.

Table 1. Dryland wheat yields on Former CRP Lands.

Location	Year	Tillage System[1]	First year Crop	Second-year Crop[2]
Forgan	1994	ST	13 b	
		NT	17 a	
	1995	ST	12 a	3 a
		NT	4 b	2 a
Duke	1994	DT	24 a	
		NT	27 a	
	1995	DT	7 b	6 b
		NT	14 a	14 a

[1] ST = Sweep-tillage; DT = Disk-tillage; NT = No-till
[2] Drought of 1995-96

Herbicide treatment and tillage delays in 1994 depleted soil moisture in the CT plots at Forgan; the higher soil profile moisture in NT plots resulted in better stand, forage accumulation and grain yields than in CT plots. Sweep tillage was found to be an effective means of controlling OWB only if the soil remained dry for several days following tillage and air temperatures were hot. A 90%+ kill of OWB resulted. At Duke, early herbicide suppression of OWB helped emergence and growth of wheat. Although the crop seemed to grow better under the high residue-NT system, grain yields averaged about 26 bushels for both tillage systems in 1994. However, NT performed significantly better during the drought of 1996. The wheat crop was produced mainly from soil water stored and no significant rains fell between October 1995 and June 1996.

b. Wheat Performance with the Old Grass Growth Maintained Intact.

In contrast, if we did not removed any of the old grass, small plot results showed that in all cases, disk and moldboard plowing increased wheat yields significantly over no-till. There are two explanations for the contradictory observations: (1) increasing rates of glyphosate up to 1.5 lb/acre did not control the standing sod if it was applied once before July; glyphosate applied to the thick residue reduced its effectiveness, depending upon the proportion of exposed new growth; and (2) large amounts of surface residue interfered with seed placement, row closure and therefore soil-seed contact during planting. Initially, there were 3 and 7 tons/a of old growth at Forgan and Duke, respectively. Stand counts showed that there were 26, 62, and 71 plants/m^2 for no-till, disked and moldboard plowed plots, respectively. Therefore, the amount of dry matter remaining at the soil surface greatly influenced how well we can perform reduced tillage, kill the growing grass, and establish a good stand.

Table 2 . Percent Control of Old World bluestem, as found on CRP fields, 4 weeks after an application of herbicide.

Glyphosate Rate	DUKE, OK		FORGAN, OK	
	Application Date		Application Date	
	June 94	July 94	May 94	July 94
(lbs/A)	(%)			
0.25	33	10	12	37
0.50	59	39	13	47
1.0	73	69	13	87
1.5	61	83	13	93
	LSD .05 13		LSD .05 9	

Nitrogen and phosphorus fertilizers were critical for producing acceptable agronomic wheat yields regardless of tillage method (Table 3). In nutrient depleted CRP fields, unfertilized small plots yielded 34% and 60% of fertilized plots at Forgan and Duke, respectively. When the old grass growth was not removed before tillage and herbicide application , highest wheat yields were attained with moldboard plowing and no differences were observed between fertilizer sources.

Table 3. Effects of fertilizer on winter wheat yield.

Tillage system (no removal of the old OWB growth before tillage or spraying)					
Fertilizer	No-till	M. plow	Disk	Mean	$LSD_{0.05}$
	(Bu/acre)				
	I. Forgan, OK				
0	1	10	6	5.7	
100 lbs N/a (34-0-0)	14	26	24	21.3	
100 lbs N + 50 P_2O_5 /acre	9	22	16	15.7	3.2
	II. Duke, OK				
0	8	20	14	14.0	
100 lbs N/a (34-0-0)	22	30	28	26.7	
100 lbs N + 50 P_2O_5 /acre	16	30	29	25.0	3.7

CONCLUSIONS

Although it is highly desirable to conserve as much of the organic matter in the surface mulch, there seems to be too much mulch to effectively plant wheat either minimum or no-till and get acceptable stands and crop yields unless the mulch is removed. Moldboard plowing is a way to bury the old grass growth and incorporate the plant materials into the soil. With high amounts of supplemental fertilizer, good wheat stands and high crop yields were attained; but this clean-till practice makes the soil very susceptible to wind and water erosion and plowing greatly enhances the decomposition of the residue organic matter and that of the native soil. Sweep tillage is an effective minimum- till system that provides good OWB control and loosens the soil surface, provided the soil remained dry for several days following tillage and air temperatures were hot. Controlled burning is an inexpensive and effective way to remove the old grass growth. The new grass growth is killed more effectively with herbicides. No-till wheat production into control-burned and killed OWB sod offers the highest degree of soil erosion control and maintenance of soil organic matter. In most cases, wheat yields have been as good as conventional or minimum-till production. Early suppression of OWB is vital to crop production in much of this semi-arid region. Adequate lead time is necessary to conserve stored water and re-supply the soil profile with moisture.

For many farmers, the final decision about post-CRP land uses will depend on the economics of crop and livestock enterprises and the final forms of conservation and farm programs. Loss of government payments in seven years with the 1996 Freedom to Farm bill will cause many to re-evaluate any earlier decision. Results from this three-year project will be analyzed and will become the basis for producer recommendations.