Paper

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The Oklahoma CRP Project: Post-CRP Production Alternatives for Highly Erodible Lands in the Southern Great Plains.

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ABSTRACT

The 1.5 M acres of Conservation Reserve Program (CRP) lands planted to Old World bluestem (OWB) in the Oklahoma and Texas Panhandles require many improvements before they are used for hay or grazing livestock production. The greatest limitations are inadequate N, P, stand density, and forage quality. The large accumulation of old dry matter lowered the forage quality of existing stands. Removal of old growth, fertilization, and weed control improved grass production and quality and stand density. Early suppression of the warm-season grass cover is essential for conserving stored soil water when reverting to annual crop production on CRP lands. This is vital to the success of producing winter wheat in the year a CRP contract expires. Water conservation is equally important for producing a warm-season crop the following summer. Fertilizers were essential for obtaining acceptable agronomic yields, regardless of tillage method. Climatic factors had significant effects on the productivity of the soils and soil quality improvements under the CRP. Increases in OWB forage production ranged from a small to 3-fold increase, depending on whether the study was in the 18-in rainfall zone at Forgan or the 29-in rainfall zone at Duke, respectively. Wheat yields in 1994 were 75% higher at Duke than at Forgan. In 1995, marginal yields were obtained at both locations due to the extremely dry conditions. Cotton was not planted at Duke because of the drought of 1995-96, whereas a sorghum crop was possible at Forgan, highlighting the risks of crop production in the Great Plains.

INTRODUCTION

Congress mandated the set-aside of approximately 45 million acres of erosion-prone croplands for 10 years to protect the soil resource and the environment across the nation. The program was established in Title XII of the Food Security Act of 1985. Soon after its inception, the very nature of its merit, the program's implementation strategies, benefits and deficiencies, and its future have been extensively debated (Grazinglands Forum, 1988). Today, the most pressing issues include changes in the program and the long-term uses of CRP lands.

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Results of surveys of CRP landowners' attitude showed that a large portion of the 36.5 M acres enrolled in the program may revert to crop production (Novak et al., 1991). A lack of integrated management information exists on how best to use highly-erodible lands (HEL) in grazing livestock production or to revert to annual cropping while meeting conservation compliance. Texas has 4.1 M acres and Oklahoma has 1.2 million acres enrolled in the CRP program. Forty percent of the OK acreage is in the panhandle and another 48% is in the western counties along the Oklahoma-Texas border. Six counties reached the enrollment limit early in the sign-up process. Before CRP, much of this land was cropped annually to winter wheat (*Triticum aestivum* L.). Cotton (*Gossypium hirsutum* L.) production is also important in SW Oklahoma. Sediments, airborne dust, and particulate-associated nutrient discharges are significant problems in the production of both crops. Old World bluestem (*Bothriochlora ischaemum* L.) and native grasses have been extensively used for permanent soil cover in the Panhandles of Oklahoma and Texas.

Benefits of the CRP include erosion control, improved wildlife habitat, reduction in surplus commodities, and farm income support (Dicks, 1994). The program often has been credited with substantial reduction in sediment discharges and airborne dust in many parts of the country (Margheim, 1994). The effects of integrated management practices for HEL on soil productivity and water quality are not fully understood, particularly at the field or watershed level. Management systems to prevent soil degradation that is likely to recur once these HEL are returned to crop production must be developed.

The time to consider future use of CRP lands is at hand as the majority of contracts in Oklahoma are expiring (Fig. 1). If the best course of action is to use the lands for livestock production, what are optimal grass management and grazing practices? If we are to revert to crop production, what are the best-management practices to preserve or prolong

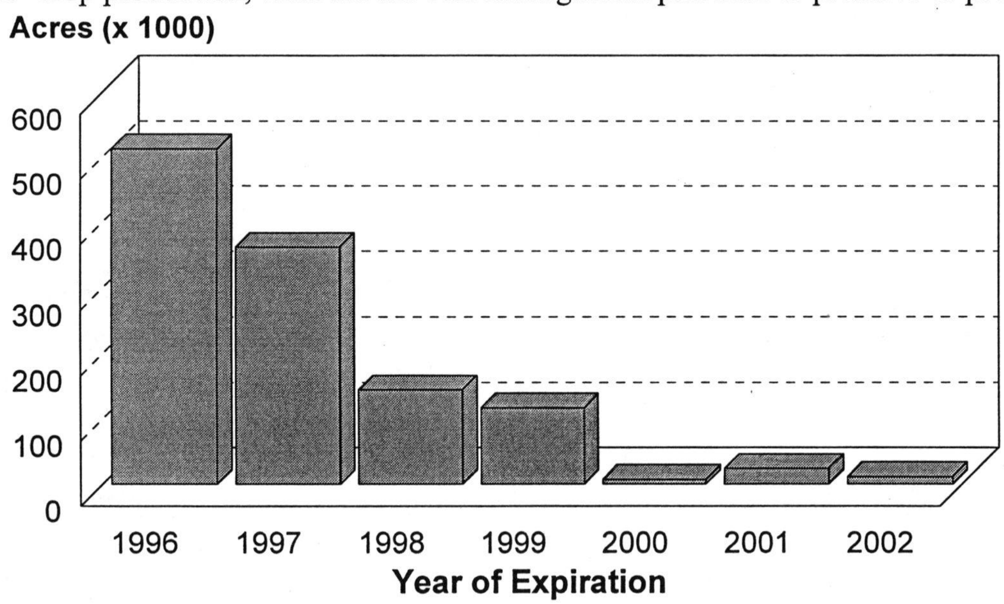


Fig. 1: Number of acres with expiring contracts in Oklahoma through the year 2002 (USDA-FSA)

the improvements in soil quality accrued under the Program? When reverting to crop production, USDA research and education agencies have endorsed a 1993 resolution by the National Association of Conservation Districts. Resolution ARC-11 has anticipated that no-tillage and other forms of residue management methods will become major tools of production to control the continual erosion of the soil resource across the nation. The organization has recommended the use of no-till and residue management practices in re-cropping CRP lands. In dry and semiarid regions, an added advantage of residue management methods is the conservation of soil water for agronomic production (Unger and Wiese, 1979; Deibert et al., 1986; Dao, 1993; 1996). In 1994, a collaborative multi-agency project was developed and implemented on two CRP fields under contract. Project objectives were to identify best-management practices on how to prepare for grazing or haying CRP grasslands or to revert successfully to wheat and cotton production on highly-erodible lands in the Southern Plains. Field performance and economics of the best options were evaluated to help end-users determine their best course of action after the CRP.

METHODS

Research and demonstration studies were established in two CRP fields under contract since 1987 and 1989 to evaluate sustainable post-contract management options for CRP lands. Field-scale experiments were conducted to compare forage and crop production systems. Treatments included a minimum-input practice and the optimal management of OWB stand, conservation-tillage (CT, i.e., sweep or disk to kill the sod), no-till (NT) practices to plant winter wheat into killed OWB sod, and row-till cotton. Small plot-scale studies were conducted to study the preservation of old grass residues, herbicide and tillage combinations that will kill the sod, and fertilizer needs of a winter wheat crop growing under such conditions. Grass and crop growth and yields, weather conditions, soil characteristics, and water status during the growing season and non-cropped periods were measured. Estimates of soil physical and biochemical property changes and erosion were made to document the relative persistence of benefits accrued under the CRP. A journal of field supplies, operations, equipment, and time was kept to derive an economic analysis of each land use option.

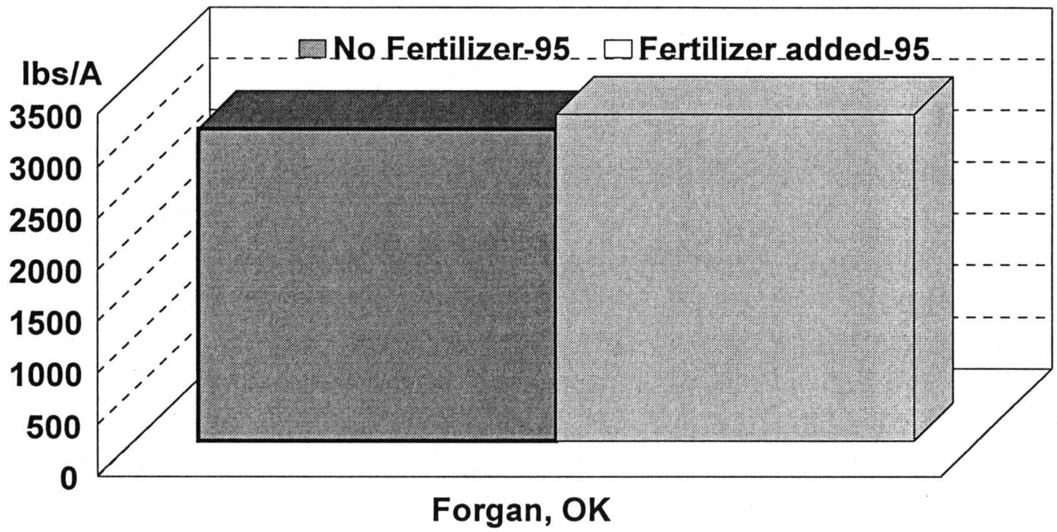
Active involvement of the state and federal action agency field offices in conducting the field research were pursued. Local agri-businesses and producers performed selected field operations to facilitate technology transfer. Other outreach efforts were made to prepare publications and news articles for the local and regional press. Field days were conducted at each location to inform the public and elaborate on the research and management options.

RESULTS

I. Old World bluestem Production:

After the initial removal of the old growth, baseline unfertilized OWB forage production in 1994 averaged 2800 and 3200 lbs/acre at Forgan and Duke, respectively (Fig. 2 and 3). The data showed that CRP lands require many improvements before they could be used in hay or grazing livestock production. Greatest limitations to grass production were inadequate nutrients (N and P), stand and forage quality. The large accumulation of old dry matter lowered the quality of the hay. The old growth smothered existing crowns and impeded growth of new tillers. It also prevented new seedlings from establishing in bare soil between existing crowns (Knapp and Seastedt, 1986).

In 1995, OWB did not respond to 60 lbs/acre of urea-N and 20 lbs/acre of P at Forgan. Scant summer precipitation and a mid-September frost may have contributed to the lack of a response to fertilizer application. In contrast, adequate precipitation and warm temperatures



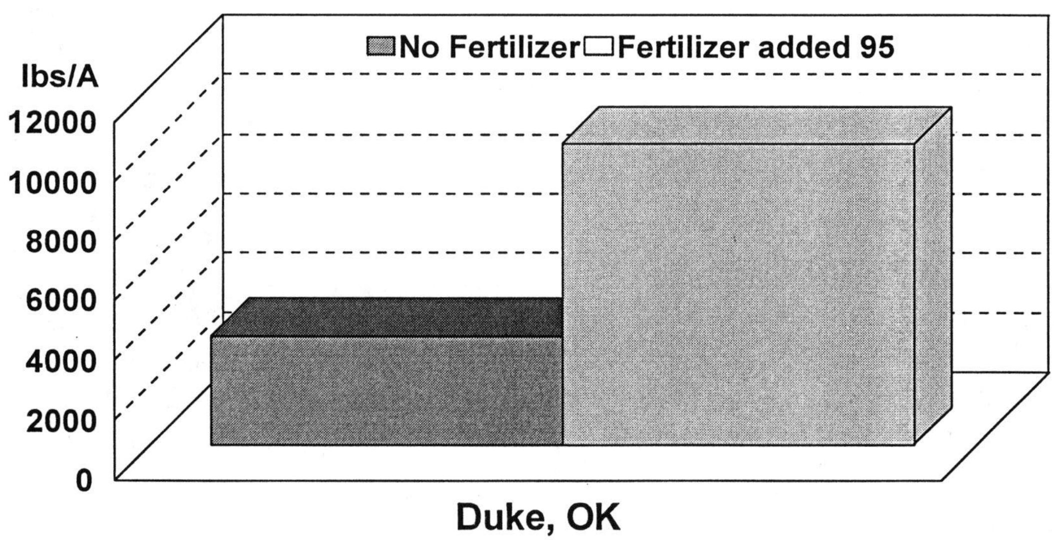


Fig. 2 and 3: Old World bluestem forage production as affected by fertilizer application and locations in the summer of 1995.

resulted in a 3-fold increase in forage production in the fertilized plots over the unfertilized at Duke (Fig. 3). It appeared that OWB produced adequate amounts of forage or hay for livestock production. Had the forage been grazed, the OWB would have produced between 250 to 400 lbs/acre of beef based on correlation of peak standing biomass and cattle average daily gain. Improved management enhanced forage production and quality.

II. Conversion to Winter Wheat Production

The timing of suppression of a hardy warm-season grass cover is critical for conserving stored water. This is vital to the success of producing winter wheat in the year a CRP contract expires; otherwise producers will lose a full year of production. Unsuppressed growth of the warm-season grass during the spring depleted the soil profile of moisture; therefore, early tillage or chemical suppression of the OWB sod must occur in April or May. Producers must be allowed to work to suppress the sod much earlier than the 90 to 120-day period before the expiration date of a CRP contract.

The amount of dry matter removed is critical to how well we can perform conservation- and no-tillage, kill a hardy warm-season sod, and establish a good plant stand. Without removing the old growth, application of 0.75 to 1 lb ai/A glyphosate suppressed OWB at Forgan while rates up to 1.5 lb/A did not at Duke. However, a spring and fall sequential applications of 1.0 lb/A of glyphosate to the regrowing grass gave better than 90% control of OWB with prior removal of the old growth. Although it was desirable to preserve as much of the organic matter of the mulch, excessive amounts interfered with acceptable stand and crop performance.

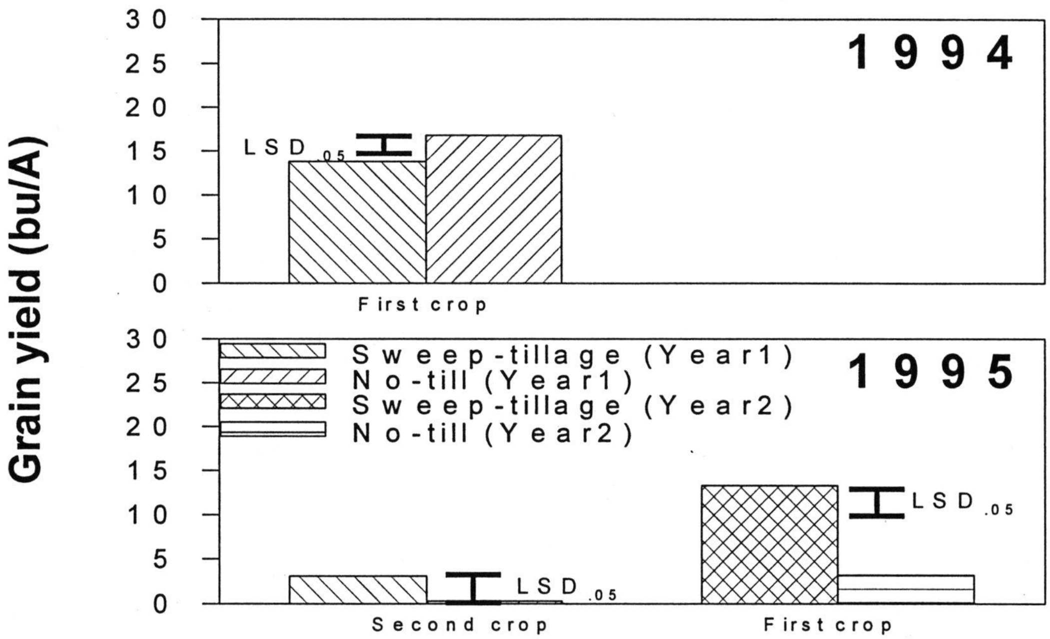
At Forgan, delay in herbicide treatment and tillage depleted soil moisture in the CT plots in 1994. Higher soil profile moisture in NT plots resulted in better stand, forage accumulation and grain yield than in CT plots, except for a first-year wheat crop at Forgan in 1995 (Fig. 4 and 5). At Duke, early herbicide suppression of OWB helped emergence and growth of wheat. The crop seemed to grow better under the high residue-NT system. Wheat yields averaged 26 bushels and were slightly different between tillage systems in 1994. However, NT was significantly better than CT during the drought of 1995 when the crop was produced mainly from stored water and no significant rains fell between October 1994 and June 1995.

III. Sorghum Production.

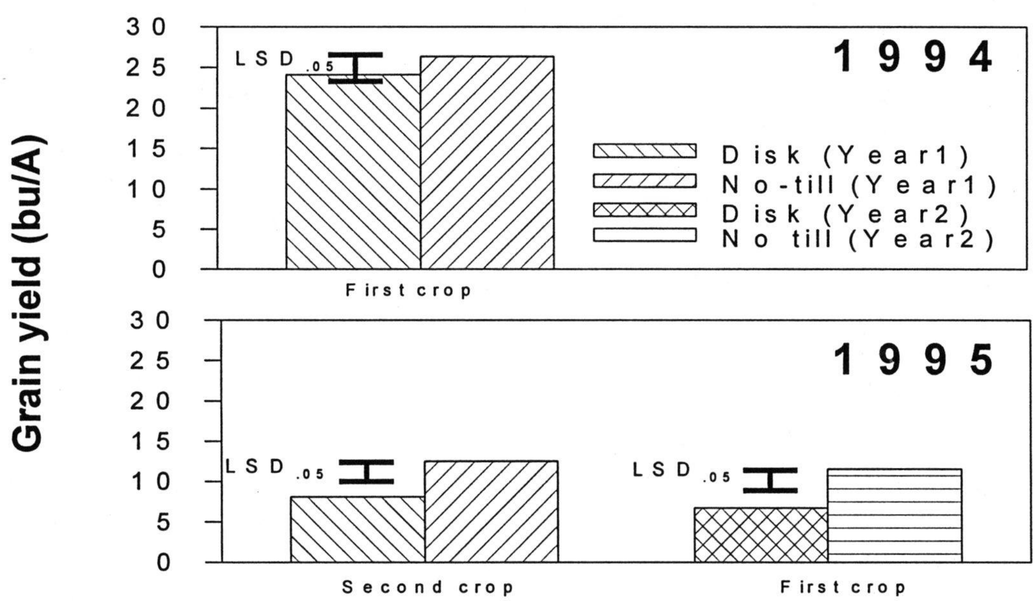
Late planting, extremely dry summer weather and the lack of control of OWB by tillage resulted in a crop failure for 1995. A 1996 sorghum crop was planted and yield data are not available at this time.

IV. Cotton Production.

In 1995, dryland cotton yields averaged 90 lbs/acre as poor weather conditions existed at planting and during boll-setting stage. A 1996 crop was not planted due to the extremely dry conditions that prevailed at the site and throughout the region. Variability in weather conditions served as a constant reminder of the precarious Great Plains environment and the high risk of agricultural production in the region.



Forgan, OK



Duke, OK

Fig. 4 and 5: Effects of tillage systems on wheat production on former CRP lands.

CONCLUSIONS AND RECOMMENDATIONS

Our results showed the need to move back the time line that CRP landowner or operator would be permitted to work on the grass cover, if provisions for soil erosion control are in place. Early spring suppression of the grass will conserve stored water that is vital to the production of a fall-seeded crop in the Great Plains and saves a year of production. The results also showed that management actions are needed now. Landowners or operators should be advised of the risks of the neglected conditions and nutrient depletion that currently exist on CRP lands. It appeared that improved management will enhance forage quality and grass stand. Conservation and no-till practices provided adequate erosion control for the first year following conversion from the CRP.

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