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Extra Crop Is Payoff In Dryland No-till Intensified Cropping System

N management improves in dryland no-till production system where cropping intensity is increased versus traditional wheat-fallow system.

Summary: *Research conducted over the last eight years by Drs. Westfall and Peterson at Colorado State University has shown that shifting from the traditional one crop every two years (stubble mulch tillage, wheat-fallow) to more intense no-till cropping systems (such as two crops every three years or three every four) will result in increased grain production and economic return. Shifting from wheat-fallow to wheat-corn-fallow has resulted in a 72 percent increase in annualized grain production, and from a 25 to 40 percent increase in dollar return to land, labor, capital, management and risk in northeast-ern Colorado. Inclusion of millet as the third crop in a four-year rotation did not increase economic return, compared to the wheat-corn-fallow analysis when using the 10-year average millet price of $5/cwt. However, at millet prices greater than $7/cwt, economic returns would be greater than with wheat-corn-fallow. At current prices of millet, its inclusion would be very profitable. Producers have considerable latitude in selection of the summer crop to be grown in these intensive rotations. Other crops that are adapted to this environment and fit into the producer's program should be considered.*

Nitrogen rate and placement studies revealed that higher N fertilizer rates are needed for intensive cropping systems as compared to traditional wheat-fallow. This results because the 72 percent in-crease in grain production removes more N, thereby depleting soil N reserves, making soil testing very important. Nitrogen fertilizer-use efficiency is also increased with intensive cropping systems, giving producers greater dollar return from their fertilizer inputs. While producers have considerable flexibility in choice of N fertilizer placements, particularly with summer crops, band applications of N fertilizers, either on the soil surface or below, tend to outperform surface broadcast applications. Increased economic returns, control of soil erosion by wind and water, and increased long-term sustainability will be a result of producer shifts to intensive cropping systems.

Today's agricultural economic situation dictates that a farmer make the most efficient use of all resources. Especially important in the western Great Plains is the effective management of precipitation and stored soil water. Research has shown that the most common management system in the Great Plains (wheat-fallow with stubble mulch tillage) stores *25* to 30 percent of the precipitation received during the fallow period. Other research has demonstrated that water storage can be increased to 40 to 60 percent when tillage is reduced or eliminated.

The question has been, can intensified cropping systems generate enough income to support no-till management, since no-till practices require higher input costs because of herbicidal control of weeds? In an attempt to answer the question, Drs. Westfall and Peterson of Colorado State University began a project to investigate the possibility of producing more crops over several years, using a no-till system. The no-till system was selected because of its ability to store more rainfall.

If more intensive cropping can be sustained, several questions concerning N fertilizer management also must be ad-dressed. It has been reported that nutrient cycling in soils changes when no-till practices are started. Crop residue accumulation on the soil

Table 1. Northeast Colorado return to land, labor, capital, management, and risk; 1,200-acre farm. Figures are in percent of wheat-fallow stubble mulch system.

Tillage preceding wheat planting	Wheat-fallow %	Wheat-corn-fallow %
Stubble mulch	100	140
Reduced-till	92	136
No-till	72	125

surface also influences many factors related to fertilizer management. Nitrogen requirements may need to be increased in order to maintain higher productivity under the more intensive cropping systems. At the same time, losses of fertilizer N from the cropping system to the environment, via nitrate leaching and gaseous evolution of ammonia, need to be minimized.

The primary focus of this discussion is on the economic viability of more intensive no-till cropping systems in a dryland environment and the N management requirements of a no-till production system where cropping intensity and crop diversity are increased as compared to the traditional wheat-fallow system.

Bottom line

The take-home message for dryland farmers from research on the intensive cropping system is clearly shown in Table 1. Switching to a wheat-corn-fallow rotation from wheat-fallow dramatically increases the return to land, labor, capital, management, and risk. Without the added crop, corn in this case, producers are the losers even though they switch to no-till in dryland areas. Their mistake is choosing to stick with the traditional wheat-fallow rotation in their attempts to be in compliance with federal conservation regulations. The reason return decreases in a traditional wheat-fallow system with reduced tillage is because herbicide costs increase (i.e., tillage is less expensive than herbicide application) and there is no added crop production to compensate.

Just a 50 percent adoption of the more intensive system would increase return to Colorado farmers by *$35* million annually. This does not take into consideration monetary trickle down to allied industries or services that may benefit due to increased farmer net profit. For the entire Great Plains, a 50 percent adoption would increase farmer return to land, labor, capital and management by $90 million.

Wheat

On the average, wheat yields responded to N rate and N source/placement at both test sites in Sterling (1989-1992) and Stratton (1990-1992), Colorado (Table 2). However, the response of wheat yield to N rate at Stratton was higher than that at Sterling, going from 0 to 90 lbs/A of N. Total soil profile NO3-N data from 1990 and 1991 showed that Sterling had more residual nitrogen *(50* to 60 lbs/A of N) than Stratton.

The two N source/placement treatments that have annually ranked high in wheat production are UAN split placement and preplant broadcast urea. Averaged over four years (1989-1992), yields were higher at Sterling than the other two treatments; they also rank among the top three treatments at Stratton (Table 2). UAN preplant broadcast generally performed better at Stratton than Sterling. Performance of the UAN split timing treatment generally has been inconsistent and is dependent on weather conditions at sidedress time in the spring. If rainfall occurs after fertilization, N fertilizer will move into the root zone and the method works well.

Wheat yields at Stratton responded differently to N fertilizer, depending on the rotation. Lower wheat yields were

Table 2. Rotation and N fertilization effects on no-till wheat yields at Sterling (1989-1992) and Stratton, CO (1990-1992).

Rotation	N Source	Placement	lbs/AN[1]			
			0	30	60	90
			bu/A			
		Sterling				
Wheat-fallow	UAN	preplant broadcast	-	31.2	32.3	35.0
	UAN	split placement	-	32.4	35.0	37.5
	UAN	split time	-	32.7	32.8	34.1
	UAN	broadcast	-	32.7	33.3	35.8
			31.2	Mean		
Wheat corn fallow	UAN	preplant broadcast	-	32.3	31.7	34.1
	UAN	split placement	-	36.5	34.7	37.5
	UAN	spilt time	-	31.0	33.0	32.5
	Urea	broadcast	-	32.7	35.9	38.1
			28.9	Mean		
		Stratton				
Wheat-fallow	UAN	preplant broadcast	-	40.6	43.8	43.2
	UAN	split placement	-	41.6	44.1	42.7
	UAN	split time	-	38.0	39.3	43.0
	Urea	broadcast	-	40.8	43.6	46.2
			37.4	Mean		
Wheat-corn-	UAN	preplant broadcast	-	36.8	42.3	43.7
	UAN	split placement	-	36.9	38.9	44.7
	UAN	split time	-	35.6	41.4	42.7
	Urea	broadcast	-	40.1	45.0	43.9
			30.9	Mean		

[1]N rates at Sterling in 1989 were 0, 25, 50 and 75 lbs/A of N.
Split placement = 30% below seed, 70% dribbled over seed.
Split time = 30% below seed, 70% sidedressed.

found in the wheat-corn-fallow versus the wheat-fallow rotation in treatments receiving less N fertilizer due to the greater depletion of soil N in the more intense cropping system. Soil profile (0 to 6 feet) NO3-N data taken from Sterling in the fall of 1991 showed the same interaction with rotation and N fertilizer. Soil profile data from Stratton, however, did not exhibit this interaction.

When comparing N-use efficiency of wheat, the wheat-corn-fallow rotation had greater N-use efficiency than the wheat-fallow rotation at both Sterling and Stratton. This effect can be attributed to the fact that wheat-corn-fallow soils are generally more N-depleted than wheat-fallow soils.

At the Sterling location, as N rate in-creased, N-use efficiency decreased. This same trend was observed at Stratton. Comparison of N source/ placement effects on N-use efficiency revealed that UAN split application had significantly higher N-use efficiency than the other three application methods at Sterling. Applying N fertilizer in a band near the seed and over the row at planting consistently allowed the most efficient use of N. Besides being readily accessible to the plant, this application method more effectively avoids loss of N through immobilization and volatilization.

Corn

Corn grain yield and crude protein increased with N rate at both Sterling and Stratton. Although corn yields at Stratton were higher than at Sterling for the 70-and 105-lb/A rates of N, the *overall* aver-age yield at Sterling was slightly higher than at Stratton. Generally speaking, Sterling has outproduced Stratton in corn production when precipitation has been comparable at both sites.

Dryland corn at both Sterling and Stratton averaged about 72 bu/A for the two highest N rates. Yield levels of the check plots (0 lbs/A of N) have been higher at Sterling ***(54.5*** bu/A) than at Stratton (41.3 bu/A), indicating that soil N mineralization rates are greater at the Sterling location. Both sites, however, produced about one bu/A of corn for every one lb/A of N taken up by the plant.

Differences among N source/ placement treatments were not distinct. UAN split treatment produced high yields at Sterling, but was the lowest yielding at Stratton. These results indicate that producers have some flexibility when choosing N application methods for dryland corn.

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