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August 1982

Nitrogen Fertilization of Dryland Wheat in Southwest Kansas

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Fertilization of dryland winter wheat was studied for many years by agronomists at the Garden City Experiment Station. These studies were conducted in several counties and were discontinued when it was felt that adequate data were available. The results of these older studies indicated that wheat seldom responded to N on silt loam soils but did respond on sandy soils. In the mid 1970s renewed interest in nitrogen fertilization developed because of the implementation of improved cultural practices and newer varieties of wheat. Therefore, studies were conducted from 1977-1980 with the objective of determining if the improved practices and varieties would result in responses to N.

Studies were conducted in Lane, Stevens, Kearny, Grant, and Hodgeman counties of southwest Kansas. The tests were on silt loam soils in all counties except Stevens, which was on loamy fine sand, and Grant in 1979, which was on sandy loam. All fields had been fallowed the previous year. Nitrate measurements were determined on soil samples taken prior to fertilization in each year. Ammonium nitrate at rates of 0, 25, and 50 lbs N per acre was topdressed in March of each year.

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Results

Soil test values are presented in Table 1, along with a "yes or no" indication as to whether or not an increase in yield due to fertilization was obtained. Yield data are presented in Table 2. Generally a response to N occurred if the soil test value for nitrates in the surface two feet of soil was less than 50 pounds (about 10 parts per million). Two locations, Kearny in 1978 and western Hodgeman in 1979, did not respond although the values were 31 and 41 pounds respectively. Conversely, there was a response in Lane County in 1980, even though the soil test value was 89.

Grain protein contents are given in Table 3. A low protein content is frequently regarded as an indication of inadequate N fertility. However, yield levels and climatic conditions also influence protein content. High or low yield levels can dilute or concentrate protein content. This may have been the case in eastern Hodgeman County in 1979, when unusually favorable climatic conditions resulted in high yields, yet protein contents were relatively low. Both yield and protein increased due to N. In contrast, yields were relatively low in Grant County in 1977, yet protein levels were high; neither yield nor protein responded to N. Protein responses occur more readily than yield responses, however. While only 11 of the 21 locations showed a yield response, 18 locations showed a protein response.

With the exception of the site in Stevens County, a sandy location that responded each year, yield responses seemed to depend on where the sites were located in southwest Kansas. A response in Kearny County occurred only in 1979, a year in which climatic conditions were highly favorable for wheat. A response in Grant County also occurred in 1979, on a sandy loam soil where such a response is likely. Further east, in Lane County, responses occurred in three of four years. Three of the six sites in Hodgeman County responded. Thus, yield responses appear to be more likely in the higher rainfall, eastern area of southwest Kansas. Increases in protein content, however, seemed to be independent of the location.

Conclusions

Increases in wheat yield due to nitrogen fertilizer are more likely in the eastern counties of southwest Kansas. Occasional responses may occur in the western counties, however. A response to nitrogen will not re-

sult every year, regardless of the location, unless the soil is sandy and moisture adequate. Increases in protein content are likely, and occur independently of the location or soil type. Rates of N between 25 and 50 pounds will usually be adequate for maximum grain yield.

For more than a decade wheat yields have increased because of improvements in cultural practices and varieties. The higher yields result in additional depletion of soil nitrogen reserves. Thus, increased use of N fertilizer in the future is likely. Soil tests for N are helpful in determining fertilizer requirements.

Table 1. Soil test values and the response of wheat to nitrogen fertilizer in five southwest Kansas counties. 1977-1980.

Year	County					
	Lane	Hodgeman		Stevens	Kearny	Grant
		West	East			
-Nitrate-Nitrogen: lbs. N in surface 2 ft.						
1977	83 (No)			36 (Yes)	83 (No)	79 (No)
1978	24 (Yes)	18 (Yes)	11 (Yes)	32 (Yes)	31 (No)	94 (No)
1979	44 (Yes)	41 (No)	34 (Yes)	(Hail)	48 (Yes)	49 (Yes)
1980	89 (Yes)	94 (No)	155 (No)	36 (Yes)	86 (No)	124 (No)

¹(Yes) or (No) indicates whether or not an increase in yield occurred due to nitrogen fertilizer.

Table 2. Effect of nitrogen fertilizer on the yield of winter wheat. 1977-1980.

County	Soil type	Applied (lb/A) ¹											
		1977			1978			1979			1980		
		0	25	50	0	25	50	0	25	50	0	25	50
Grant	Silt loam ²	22a ³	23a	26a	36a	36a	37a	39a	44b	46b	65a	63a	61a
Kearny	Silt loam	44a	43a	45a	43a	43a	43a	37a	43b	47c	41a	46a	41a
Lane	Silt loam	42a	46a	46a	32a	34a	42b	45a	52ab	55b	37a	39a	51b
Hodgeman (West)	Silt loam	---	---	---	27a	32b	31b	35a	31a	38a	26a	31a	29a
Hodgeman (East)	Silt loam	---	---	---	19a	23b	26b	53a	64b	66b	37a	32a	28a
Stevens	Loamy fine sand	22a	27b	32c	31a	34ab	36b		(Hail)		30a	37b	45c

¹Nitrogen (34-0-0) was applied in March of each year.

²1979 test in Grant county was on sandy loam.

³Yields within a row in the same year followed by a different letter are significantly different at the 5% level.

Table 3. Effect of nitrogen on the grain protein content of winter wheat. 1977-1980

County	Soil type	-N Applied (lb/A) ¹ -											
		1977			1978			1979			1980		
		0	25	50	0	25	50	0	25	50	0	25	50
Grant	Silt loam ²	15.7a	15.5a	15.8a ³	11.8a	12.2a	14.2b	10.0a	12.1b	13.8c	12.0a	13.3b	13.8c
Kearny	Silt loam	11.4a	13.3b	13.4b	11.7a	12.6b	13.6c	11.9a	13.1b	14.3c	9.9a	10.4a	12.3b
Lane	Silt loam	11.7a	12.5ab	13.3b	12.0a	12.5b	13.4c	10.7a	11.4b	12.8c	9.2a	9.4a	10.1b
Hodgeman (West)	Silt loam	-----	-----	-----	13.4a	14.6a	14.0a	12.4a	12.9b	14.3c	12.0a	12.8b	13.8c
Hodgeman (East)	Silt loam	-----	-----	-----	12.6a	12.0a	14.0b	9.7a	10.6b	11.8c	15.4a	15.4a	15.9a
Stevens	Loamy fine sand	10.1a	12.2b	13.9c	11.6a	13.7b	15.5c	(Hail)			9.4a	10.2b	11.5c

¹Nitrogen (34-0-0) was applied in March of each year.

²1979 test in Grant county was on sandy loam.

³Yields within a row in the same year followed by a different letter are significantly different at the 5% level.

Contribution 82-494-s, Department of Agronomy.

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Keeping Up With Research 61 August 1982

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