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Did the Fertilizer or Drought Burn it Up?

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Did the Fertilizer or Drought Burn it Up?

by James Gerwing, Extension Soils Specialist

Fertilize during a dry year, especially with nitrogen, and you'll burn up the crop! That's a statement occasionally made by farmers in South Dakota. Research at SDSU, however, does not support this belief. Two examples of recent fertilizer research under very dry conditions are given in Table 1. Wheat in McPherson Co. and corn in Day Co. received nitrogen rates up to 125 and 150 lbs. per acre. Neither a yield increase or a yield decrease was measured at either location. Drought at both locations limited yields to about 20 bushels wheat and 40 bushels corn per acre.

In a different study in Clay County in 1988, increasing the phosphorus soil test level from 20 lbs/A to 60 lbs/A increased barley yields from 12.5 bu/A in the lower soil test plots to 20 bu/A at the higher soil test level. That's not a large yield but still over a 60% increase in yield, not a decrease. In winter wheat plots in Stanley County in 1988, nonfertilized plots yielded 14.5 bu/A while fertilized plots yielded 16.5 bu. Again, not big yields due to heat, drought and diseases, but clearly the 80 lbs of Nitrogen, 40 lbs of phosphorus and 80 lbs of potassium chloride did not burn up the crop.

The number of bushels produced per inch of water used (water use efficiency) usually increases with adequate fertilization. A summary of 22 spring wheat experiments in South Dakota over a 3-year period showed water use efficiency increased from 1.18 bushels per inch of water used in the check plots to 1.57 bushels per inch in the fertilized treatments (Figure 1).

Research in South Dakota indicates that crops actually depend more on fertilizer to produce each bushel during dry years than wet years. There are two reasons: 1) during dry years, microbial activity in soil which breaks down crop residue and organic matter releasing nutrients to crops is slowed and 2) crops are shorter and have a smaller root system making it more difficult for them to extract nutrients from soil. Even though crops obtain a larger proportion of their nutrients from fertilizer during a dry year, total amounts of fertilizer nutrients needed may be less because crop yield is severely limited.

When planning fertilizer programs following a drought year, consider both soil test levels and yield goals. If subsoil moisture levels are low next spring, yield goals may be reduced. This would result in lower fertilizer recommendations. Some caution must be used if yield goals are reduced. If rains would come after it's too late to apply additional fertilizer, lack of nutrients rather than water will limit yields. In other words, if you plan for a good year, you may get one; if you plan for a poor year, you are certain to have one.

Table 1. Influence of high nitrogen fertilizer rates on wheat and corn under drought conditions.

McPherson County, 1985		Day County, 1987	
Nitrogen Rate 1/	Wheat Yield	Nitrogen Rate 2/	Corn Yield
lb/A	bu/A	lb/A	bu/A
0	20	0	42
25	21	30	41
50	19	60	42
75	18	90	39
100	18	120	41
125	22	150	37

1/ NO_3-N Soil test: 43 lb/A 2 feet
2/ NO_3-N Soil test: 66 lb/A 2 feet

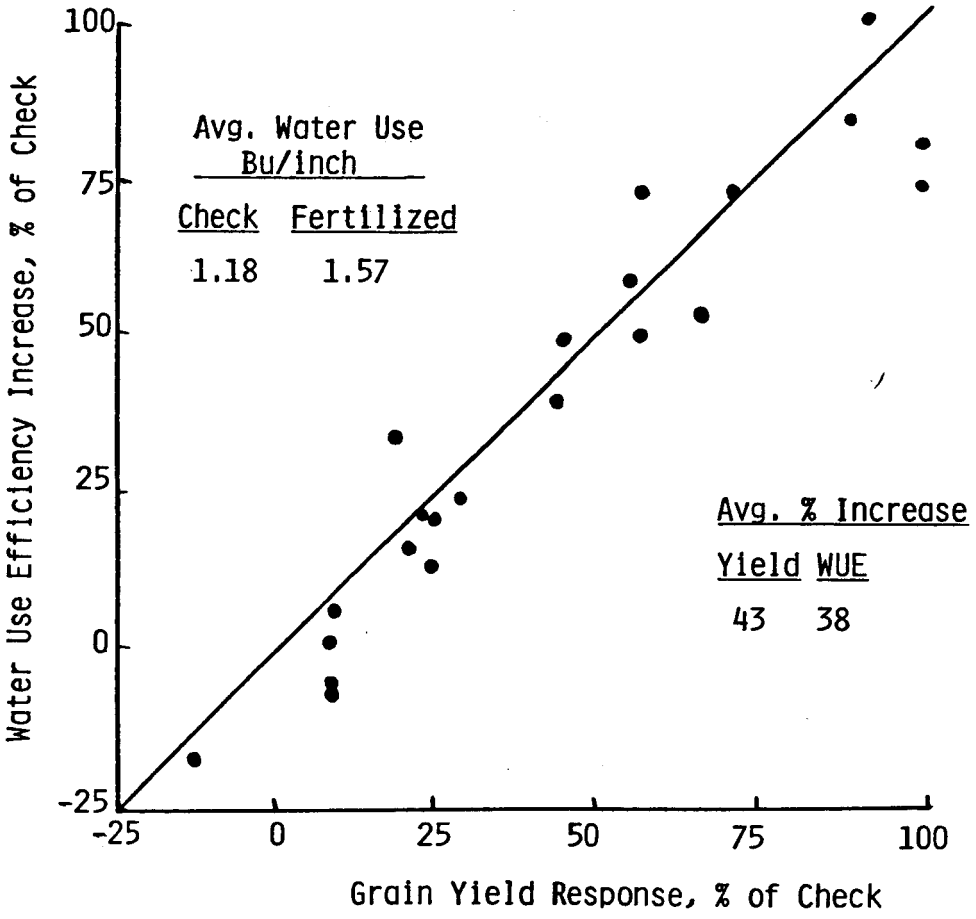

Figure 1. INFLUENCE OF FERTILIZER RESPONSE ON THE INCREASE IN WATER USE EFFICIENCY OF SPRING WHEAT (SDSU)