FACTORS AFFECTING THE PROTEIN CONTENT OF WHEAT IN NORTHEAST SASKATCHEWAN

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The protein content or concentration of grain usually is affected by factors which influence yield. Wheat yields have been found to be influenced by phosphate fertilizers, sodium bicarbonate soluble P and nitrate-nitrogen in soils in N.E. Saskatchewan. Recently, through the use of the "Soil moisture estimator program system" of Baier et al., estimated soil moisture use has been related to yield response of wheat to phosphate fertilizer at different stages of crop development. Grain yields (kg/ha) of unfertilized control plots were significantly related to sodium bicarbonate soluble-P by the equation: $\hat{Y}=3478-.17P^{*}+11.5\ P^{2**}$., $R^2=64.3\%$. Protein percentage of grain from control plots was significantly related to soil nitrate-N and soil moisture use at several periods of crop development (Table 1). Higher moisture use in the planting to emergence crop development period resulted in more protein. High moisture use or higher than average soil moisture conditions are classically associated with lower protein content of grain. This was true at the later stages of growth in the heading to soft dough (H-S) and soft dough to ripe (S-R) crop development periods. Similarly, irrigated (not stressed) wheat in the flowering stage resulted in lower protein percentage of grain than wheat not irrigated. The protein content of wheat ranged from 10.1 to 20.2% in N.E. Saskatchewan.

The average protein percentage in the Melfort area was between 12.00 and 13.00% in the 1975-76 crop year. This low percentage indicates that higher than average conditions of soil moisture or less than average available nitrate-N in the soil existed for crops grown to be delivered within this period. Farmers have no control of weather factors, but may be able to seed "high protein" crops on drier, upland soil or "low protein" crops, such as malting barley, on lowland soil. Well drained upland soil will usually produce higher protein grain than poorly drained, high moisture regime soil. In the same field, the Soil Science Department of the University of Saskatchewan found that as much as an 8.2 greater percentage of protein content was grown on knolls than on poorly drained soils. The well drained land could be harvested separately in order to take advantage of a higher protein grade for wheat.

Phosphate fertilizer decreased protein percentage as shown in Fig. 1, averaged across sites and years. The decrease in protein percentage (ΔY) among sites from P fertilizer was significantly correlated with exchangeable ammonium-N (kg N/ha) and tended to reduce the fertilizer effect: $\Delta Y=-4.2+.10\ NH_4$.

Another factor, temperature, possibly could affect protein content of wheat, but temperature is closely correlated with moisture use or evapotranspiration. Therefore, it is extremely difficult to separate the effect of temperature, a measure of the energy of molecular motion, from the effect of water, an essential constituent of living plants.

Table 1.

Protein Percentage of Manitou Wheat Related to Soil Nitrate-N and Soil Moisture Use in N.E. Saskatchewan

Protein %	Soil Nitrate-N Kg N/ha	Heading to ripe period Soil moisture use (cm)
13.2	50	10.00
10.3	50	12.50
14.4	100	10.00
11.6	100	12.50
15.7	150	10.00
12.8	150	12.50
10.0	150	15.00
16.9	200	10.00
14.1	200	12.50
11.2	200	15.00

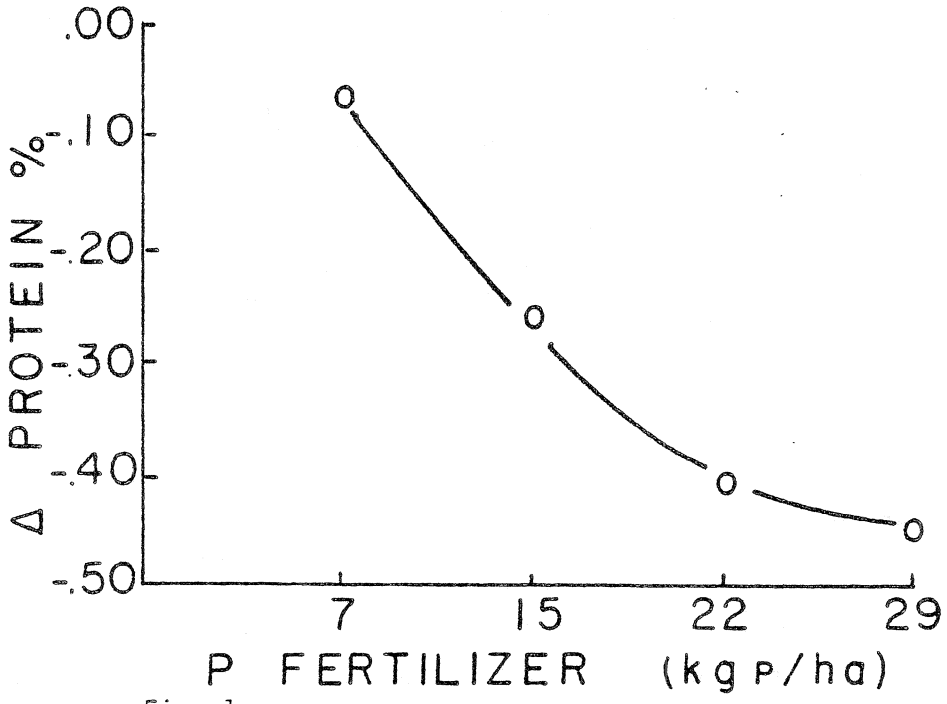

Fig. 1.

Reduction in Protein Percentage in Relation to Phosphate Fertilizer.