Phosphorus Reduces Stress in Intensive Dryland No-Till Crop Rotations

By D.G. Westfall, G.A. Peterson, and J.L. Sanders

Adequate plant nutrition is essential for intensively managed cropping systems. Colorado studies are demonstrating the role of plant nutrients in improved yields, lower nitrate (NO_3) carryover, increased soil organic matter and weed suppression.

RESEARCH in Colorado has demonstrated that conversion from traditionally tilled, stubble-mulch, wheat-fallow systems to no-till, more intensive, rotations is economically and environmentally more sustainable in a semi-arid environment.

Even though more nitrogen (N) fertilizer is required by the more intensive, no-till cropping system, less residual soil NO_3 remains in the soil, reducing the possibility of NO_3 movement toward groundwater. The intensive, no-till system provides greater water use efficiency, higher grain yields (75 percent increase), and higher net returns (30 percent increase).

Phosphorus Reduces Stress

Maximum benefits of increased cropping intensity cannot be realized unless phosphorus (P) deficiencies are corrected. Eroded soils with low P soil tests need P fertilization along with N to allow maximum yield expression in the wheat-corn-millet-fallow rotation.

Too often, producers fail to test their soils for P and therefore lose an excellent opportunity to increase profits. Using N alone will not allow maximum return on P deficient soils.

PHOSPHORUS fertilizer increases tillering and head number of wheat on soils testing low in available P. Notice that on this P deficient soil the drill rows where 20 lb/A P_2O_5 was applied are closed by abundant tillering. Where no supplemental P was added, the rows are not closed and the soil surface is more exposed to water and wind.

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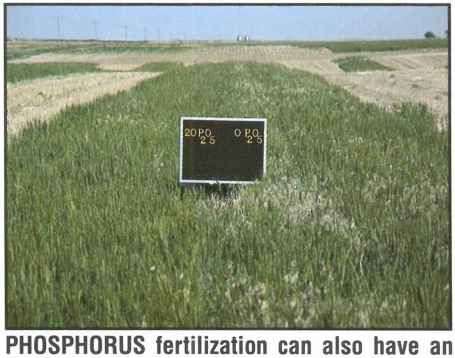
PHOSPHORUS deficiency limits early growth of many crops. In this photograph, the 20 lb/A P_2O_5 treatment advanced the early growth of dryland, no-till corn. The reduction of stress in the early stages of corn growth by P fertilization may increase yields when P is limiting.

ASSESSMENT of soil P status via soil testing is a best management practice (BMP) necessary for sustainable agriculture. Sustainable agriculture relies heavily on crop production systems that maintain or increase soil organic matter over the long term. In this study, the 20 lb/A rate of P_2O_5 increased crop residue remaining after harvest about 0.5 ton/A/year. The photograph shows a wheat-corn-millet-fallow rotation with a visual difference in surface residue due to P fertilization of a P deficient soil.

The need for good P fertilizer management is amplified as management becomes more intensive in a rotational cropping system. ■



PHOSPHORUS fertilization can also have an effect on weed suppression in crop stands. This photograph shows that where P was applied on a P deficient soil, downy brome germination and growth were dramatically suppressed. As previously indicated, P increases tillering of wheat. Increased tillering and a heavier crop canopy reduce sunlight availability for downy brome germination and growth and have an overall suppressive effect on weeds.