Texas Agricultural Extension Service
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Phosphorus Fertility in Wheat

It is Not a Question of How Much But Also Where

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Winter wheat, like most cool season grass responds well to phosphorus (P) fertility. The degree of response to added fertilizer depends on several variables, including the amount of P in the soil prior to fertilizer application, where relative to the wheat seed this applied P is located, soil temperature at planting and for 4 to 6 weeks thereafter, soil pH, and available moisture in the fertilizer P enriched zone during crop growth. A first logical step in assessing P needs in wheat is a soil test. This soil test will give relative amounts of P in the soil. If you can run a stratified soil test, take samples from the surface (0 to 2 inches), and from 2 to 8 inches. In western regions of the state where fall rainfall is limiting to wheat growth, P concentration at the second (2 to 8") increment is most useful in determining the need for and amounts of P to be applied. In high rainfall areas, where adequate or excess moisture at the surface is more the rule than the exception, more attention should be paid to surface P concentrations with the soil test.

Grazing or winter forage production from wheat is very important to most Texas wheat growers, with anywhere from one third to one half of the crop utilized only as a forage and never harvested for grain and more than 70% of the total crop grazed at some time during the growing season. Due to this requirement, early and rapid vegetative growth is very important to Texas wheat growers. As P plays a key role in this early forage growth as well as root and tiller development, it is vital to test soils and apply appropriate amounts of P prior to or during preplant land preparation. Numerous trials throughout Texas have demonstrated that P is as significant as nitrogen (N) in early forage development, that N uptake and utilization are greatly diminished in a P deficient crop, and that prevailing rainfall dictates the most efficient way to incorporate P. Deep, banded P application (4 to 8 inch depth) has resulted in greatly enhanced forage production in trials in the Rolling Plains and under irrigation in the Northern High Plains. Response with respect to forage production is greatest with dry fall weather patterns, which tend to be the rule rather than the exception over much of west Texas. Traditional surface incorporation techniques work best in this same region if unusually wet fall weather occurs. Grain yields are similar if adequate rainfall is received by mid-February. In dry spring weather, wheat treated with deep banded P produces significantly greater grain yields than wheat treated with surface incorporated P. Limited trials have compared depth of incorporation on deep banded P. In very dry weather patterns, P incorporated to the 7 to 8 inch depth resulted in significantly higher grain and forage yields than wheat with P banded at the 4-inch depth, which had

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greater yields than wheat treated with surface incorporated P. In two years of the study, wheat treated with P banded at both the 4 and 8 inch depths was slightly superior to wheat fertilized at only the 8 inch depth.

In higher rainfall climates, where the soil surface stays moist during most of the fall growing period, wheat treated with P in the seed furrow at planting responds better than other P incorporation techniques. This P placement advantage is more dramatic with late planting in cool soils. Another production system in which excellent responses are obtained to seed furrow P is acid soils. Acid soils tend to have high concentrations of available aluminum, which causes stunting, unthrifty growth and low yields of forage and grain. Seed furrow P neutralizes some aluminum toxicity. Seed furrow P applications have been utilized by some farmers as a band-aid approach where it is impractical or economically unfeasible to apply ag lime. In general, even in the drier climates where we see dramatic forage and grain yield responses to deep banded P, seed furrow banding is superior to surface incorporation, as banding concentrates P near the wheat crown, giving excellent proximity for early root development and reducing reaction with cations which make the P fertilizer unavailable. In soils and climates where fall moisture is abundant to excess, and a relatively early planting date insures relatively rapid root development, surface incorporated P is equivalent to or better than other application technologies discussed here.

Wheat is not a crop known for its high margin of return. Drought, spring freeze, winterkill and various plant diseases greatly reduce predictability of grain yields. Many Texas wheat producers have opted to use wheat as a dual purpose, forage and grain crop to reduce risk and have two sources of income. It is clear that P fertility is also a risk management tool, making wheat grain and forage yields less subject to the vagaries of the weather. In order to capture the potential of P fertility in our wheat crop, however, we must assess weather risks and use our knowledge to place P in the soil profile so that we have the greatest probability for uptake during the early portion of our growing season. Without careful attention to P fertility and P placement, we know that nitrogen use efficiency is greatly diminished and cost per unit of wheat forage and grain produced greatly increases.