A Special Banding Technique Increases Effectiveness of Phosphorus Fertilizer on Alfalfa

By S.S. Malhi

Alfalfa is an important forage crop in the Canadian Prairies. It has a high demand for P and is responsive to P fertilization when soil test levels are low. Many Prairie soils do not contain enough plant-available P for optimum crop production. Surface-broadcasting is the most convenient way to apply fertilizers on established forage stands. But is it the most effective? Our previous research has shown that most of the fertilizer P recovered in soil as extractable P remains in the top 2-inch layer, even after long-term annual applications of P to alfalfa or grass. Banding fertilizers below the surface is often more efficient for cereal production in our soils, but band application in established forages has not been as effective, mainly because of disruption of root growth during the banding process.

Sub-surface banding using a narrow disc opener offers forage growers another option for phosphorus (P) placement in established alfalfa. Whether applied annually or as a large one-time application, banded P can boost alfalfa yields.

A 5-year field experiment was initiated in 1992 on existing alfalfa stands on a P-deficient Black soil at Ponoka, Alberta, to compare surface-broadcast with sub-surface band applications of P. Triple superphosphate was applied annually in mid to late April (20, 41, 62 and 82 lb/A P_2O_5) or once when the study was initiated in 1992 (102, 205, 307 and 410 lb/A P_2O_5). In the sub-surface application, the P was banded in

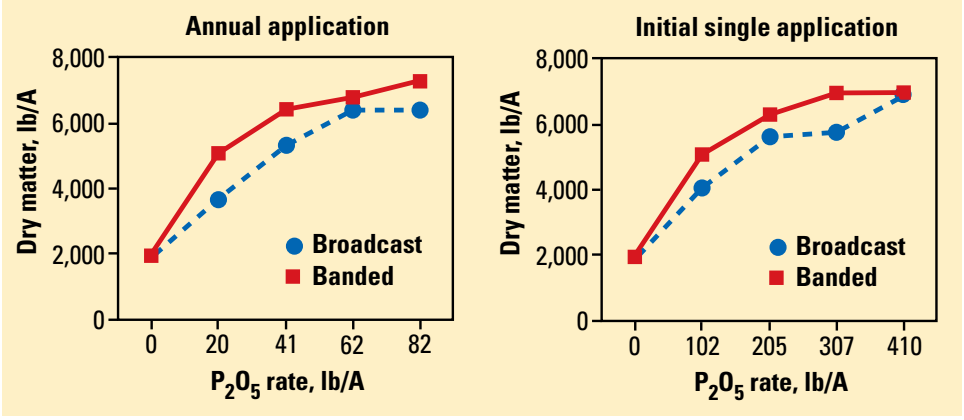

Figure 1. Alfalfa responded to P fertilization over a 5-year period when applied annually or as an initial single application at Ponoka, Alberta.

rows 6 inches apart at a 2-inch depth, using a coulter-type disc. All plots received annual blanket applications of potassium (K) and sulfur (S) fertilizers. The plots were harvested for dry matter yield in early July and mid September of each year.

Phosphorus Response

There was an excellent response to applied P in both the annual and the single applications and for both application methods (**Figure 1**). Forage yields increased three to four-fold relative to the unfertilized check. On average, yield differences between the two application methods were greater at the lower application rates, but tended to disappear at higher application rates. Disc-banding consistently produced greater forage yield than surface-broadcasting when averaged across P rates (**Figure 2**). Over the 5-year period, band application produced an average of about 836 lb/A/yr more dry matter than the broadcast application when the P was applied annually and about 660 lb/A/yr more dry matter when the P was applied initially at the beginning of the study.

There can be several reasons for greater forage yield with subsurface banding than surface-broadcasting application. When P fertilizer is applied to the surface in established forage stands, it remains near where it is placed and may not become fully available to roots for effective use. Phosphorus fertilizer placed below the surface is immediately available to the roots and is present in the moist soil zone where roots are most active for effective uptake. In addition, subsurface banding reduces the contact between P fertilizer and the soil, which reduces the potential for conversion of the P to less available forms, leaving more P for crop uptake.

Band application of P below the surface with a coulter-type disc drill may offer benefits for established alfalfa stands.

The success of subsurface banding

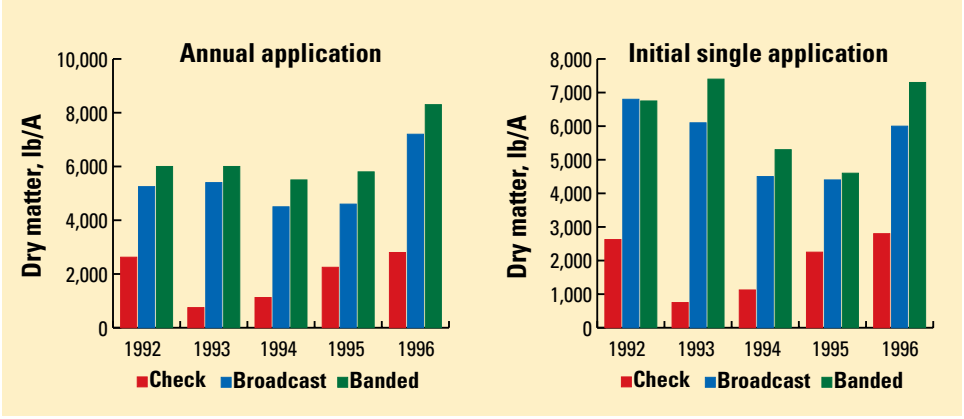

Figure 2. Banding P produced more alfalfa forage yield than broadcasting P (averaged across P rates) when applied annually or as an initial single application at Ponoka, Alberta.

also depends on the banding equipment. A "hoe drill" type implement damages forage stands, causing injury to the superficial roots and loss of moisture by opening the soil, particularly in a dry year or in a relatively dry soil-climatic zone. In the present study, the P fertilizer was banded with a special coulter-type disc drill, which apparently does not cause disturbance to soil or plant roots.

Summary

There was a marked increase in forage yield from P applications in all the five years and excellent residual effects from the single P application. Disc-banding at 6-inch spacing produced greater forage yield than surface-broadcasting, whether P was applied annually or as a single initial application.

Forage productivity can be increased by improving effectiveness of P fertilizer using disc-banding openers on established stands. And, the subsurface banding may reduce the potential for P loss due to surface runoff. However, growers need to balance the potential benefits versus the cost of the banding operation. Banding, especially with narrowly spaced openers, is more expensive than broadcast application so growers are cautioned to ensure the yield increases from the banding offset the additional cost under their soil conditions. BC

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Oregon: Residue and Fertility Effects on Yield of No-Till Wheat

Researchers found that straw residues had an adverse effect on winter wheat yield and, to a lesser extent, on spring wheat yield when cropped no-till following a cereal. Increasing nitrogen (N), phosphorus (P) and potassium (K) fertility increased grain yield substantially, but did little to alter the adverse effects of the stubble. Relative yields for none, low, moderate and high NPK fertility were 22, 59, 94 and 100 percent, respectively, for winter wheat and 36, 82, 99 and 100 percent for spring wheat.

Much of the effect appeared to be the result of standing residue because fine chopping during one year of the study increased yield in a manner similar to elimination of residue by burning in later years. Researchers concluded that results suggest that light quality, lower soil temperature, or increased soil pathogen activity is the likely source of reduced yield. BC

Source: Paul E. Rasmussen, Ron W. Rickman, and Betty L. Klepper. 1997. Agron.J. 89:563-567.