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AGR53

Fertility Best Management Practices for Phosphorus Control onOrganic Soils: Banding fertilizer [1]

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This fact sheet is part of a BMP series which was written specifically to address the concern for phosphorus control in the Everglades Agricultural Area. The information contained in this series may be applied to any agricultural area composed primarily of organic soils or Histosols. However *please be aware that this information may not be applicable to any other soil types*.

BACKGROUND

Banding fertilizer applications instead of broadcasting applications could reduce phosphorus losses from 0-40 percent and application rates on the order of 50%, dependent upon the crop and existing fertility levels. Banding refers to the placement of fertilizer in a strip or band adjacent to the crop roots. Protection from adverse chemical reaction with the soil, poor root uptake due to root morphology, and reduced leaching with smaller, lower-P-rate zones are the reasons for banding.Banding will be most effective for crops which do not have continuous root mats between rows, such as, vegetable crops and plant cane.

The primary limitation to banding is the cost of obtaining or developing banding equipment which will properly deliver fertilizer without injuring the plants. It is important to note that an appropriate calibrated soil test must still be used to assure proper application levels. Residual fertilizer bands could also cause some soil testing problems if post-crop tillage does not sufficiently mix the soil.

BACKGROUND TO BANDING OF FERTILIZER

Banding can be implemented at different levels of intensity and by different mechanical techniques. Available banding techniques range from single pre-plant applications to post-plant side-dress application(s) after a pre-plant broadcast application and to banding for both pre-plant and post-plant conditions. Side-dress banding is the most common technique currently in practice. Extending banding to the pre-plant conditions is more difficult. Typically, side-dressing places the fertilizer on the soil surface (mechanically easy to accomplish). Pre-plant banding, on the other hand, ideally places the fertilizer in a band below the soil surface. Getting the pre-plant band in an optimal position in relation to the plant roots in order to obtain uniform distribution within the band requires precise field equipment. Additionally, the optimal positioning and sizing of the pre-plant band is not fully understood for many crops due to the different abilities of plants to adapt their roots to utilize the band. However, the general understanding is sufficient to reduce phosphorus rates dramatically. As additional information on pre/post plant banding techniques comes available, the phosphorus rates will likely be able to be reduced even further.

Generally, standard soil sampling techniques utilizing CST are appropriate for pre-plant conditions. The pre-fertilization soil test, the so-called predictive soil test, is used to assist with the need for and rate of fertilization for a crop to be grown. Soil sampling

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techniques for post-plant conditions, the so-called diagnostic test, require limiting randomized subsampling to the active root and banded zone. Post-plant soil testing has not been promoted primarily because tissue testing is a more reliable indicator of the nutrient status in the field. Further, diagnostic soil testing can not be interpreted accurately because data for such samples is limited and in organic soils the mineralization rate for that part of the season is unknown.

The residual effect of previously banded fertilizer applications have not been documented to create significant non-uniform soil fertility conditions in a field for the next crop. Subsequent tillage normally mixes the soil sufficiently. Matching subsequent crop pattern to residual bands might be possible but has not been studied.

GETTING STARTED WITH BANDING

The following procedure is suggested to make the transition from broadcast to band fertilization. ***Sudden, large changes in farm operations are not recommended***. It is important to gain further experience with the BMPs in order to gain confidence and prevent undesirable problems.

Step One. Contact the Institute of Food and Agricultural Sciences crop specialist at the Everglades Research and Education Center to obtain the latest information on banding for the crop of interest. Specific information for lettuce and sweet corn has been reported by Sanchez, et al. (1990 and 1991). If information is not available, or is too limited for your use, please continue with steps 2 - 3.

Step Two. Selection of banding equipment is the first step in developing an effective fertilizer banding program. Figures 1-5 show the common types of available banding equipment. This equipment can be used independently or in combination with other field equipment such as planters, cultivators, tillers, or sprayers. Whenever possible, we suggest that banding equipment be incorporated with other equipment to minimize field operations.

Phosphorus fertilizer can be applied in either a liquid or granular form, though the liquid is typically more costly. Liquid fertilizers require a positive displacement pump to assure uniform application which, typically, is better than the more prevalent granular spreading systems. Granular spreaders use a slotted rotating drum or disk systems to dispense the granules. Once applied to the soil, fertilizer uniformity within the band will also vary according to the form. Liquids tend to form nutrient rich fingers along macropores in the soil after application as a function of moisture content, soil type and structure. Granular forms, on the other hand, will not spread as quickly and will therefore tend to release the phosphorus to the surrounding soil more slowly.

There will obviously be a balance between uniformity of application and the cost of the application equipment. Therefore, the value of the crop and its sensitivity to banding must be considered when selecting equipment. The uniformly tilled banding system is the most expensive, while the surface strip applicator is the least expensive. If the appropriate field equipment for your condition can not be determined from the available literature, then field tests are needed. Field testing basically requires that various application techniques be used in randomized replicated plot experiments. The specifics of setting up field trials will not be described here, but can be obtained through the Florida Cooperative Extension Service, Institute of Agricultural Sciences.

Step Three. Once the equipment and application techniques have been selected, it becomes necessary to run standard fertility trials to determine the CST response curves for your crop and soil conditions. The problems described earlier concerning soil sampling and residual fertilizer must be considered once again during these fertility trials. Again, to get details on the appropriate procedures for conducting the field trials, please contact your extension agent.

REFERENCES

Sanchez, C. A., S. Swanson, and P.S. Porter. 1990. "Banding to Improve Fertilizer Use Efficiency of Lettuce". *Journal of the American Society of Horticultural Science* 115(4).

Sanchez, C.A., P.S. Porter, and M.F. Ulloa. 1991. "Relative Efficiency of Broadcast and Banded Phosphorus for Sweet Corn Produced on Histosols". *Soil Science Society of America Journal*, 55, May-June.

Espinoza, L.A. 1992. *Response of Celery to Phosphorus Rate and Placement on Histosols.* Master Thesis. Soil and Water Science. University of Florida. Gainesville, FL.

Hanlon, E.A., G. Kidder, and B.L. McNeal. 1990. *Soil, Container Media, and Water Testing Interpretations and IFAS Standardized Fertilization Recommendations.* IFAS, Univ. of Fla, Coop. Extension Circular 817. 49 pp.

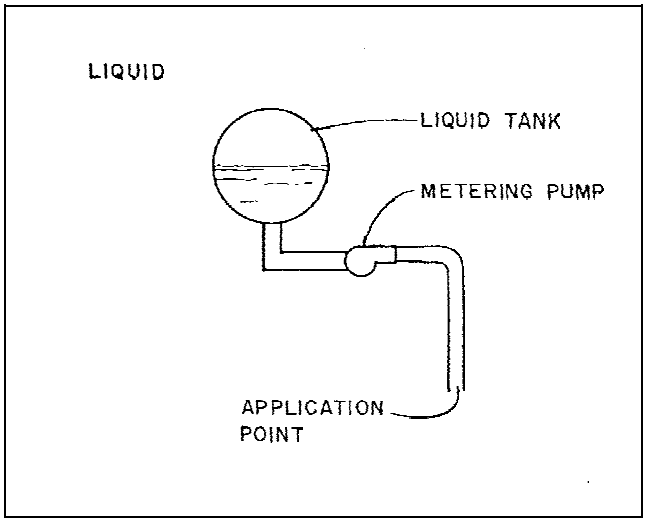

Figure 1. Liquid Delivery System

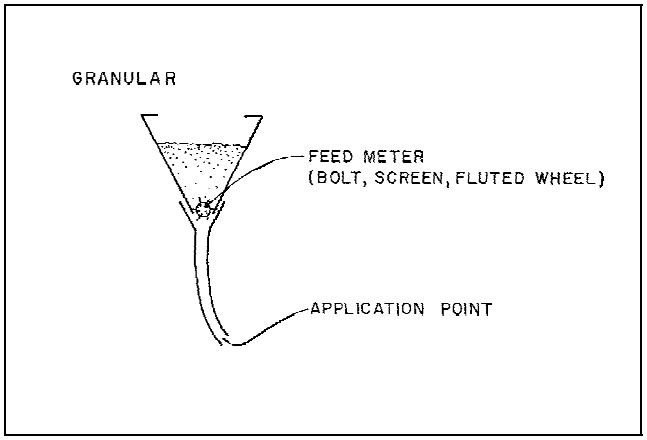

Figure 2. Granular Delivery System

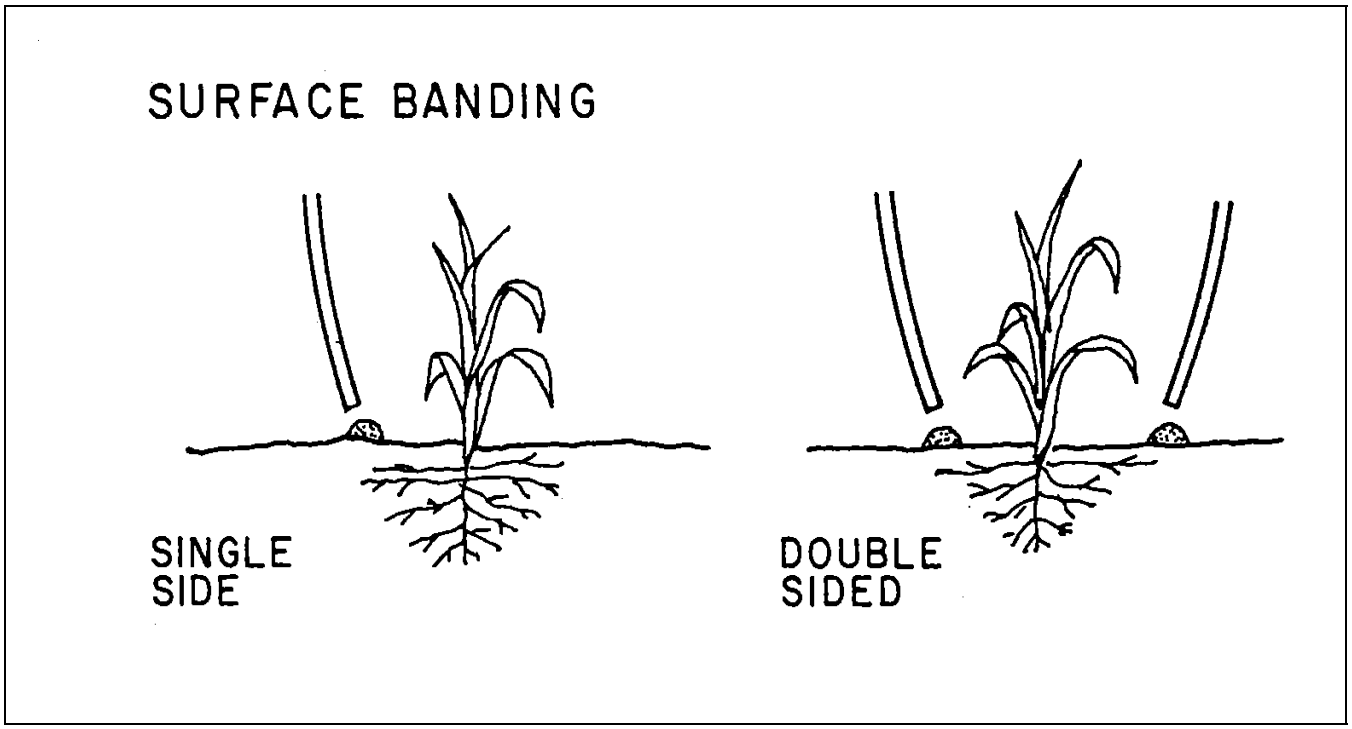

Figure 3. Common types of ground banding equipment: surface banding

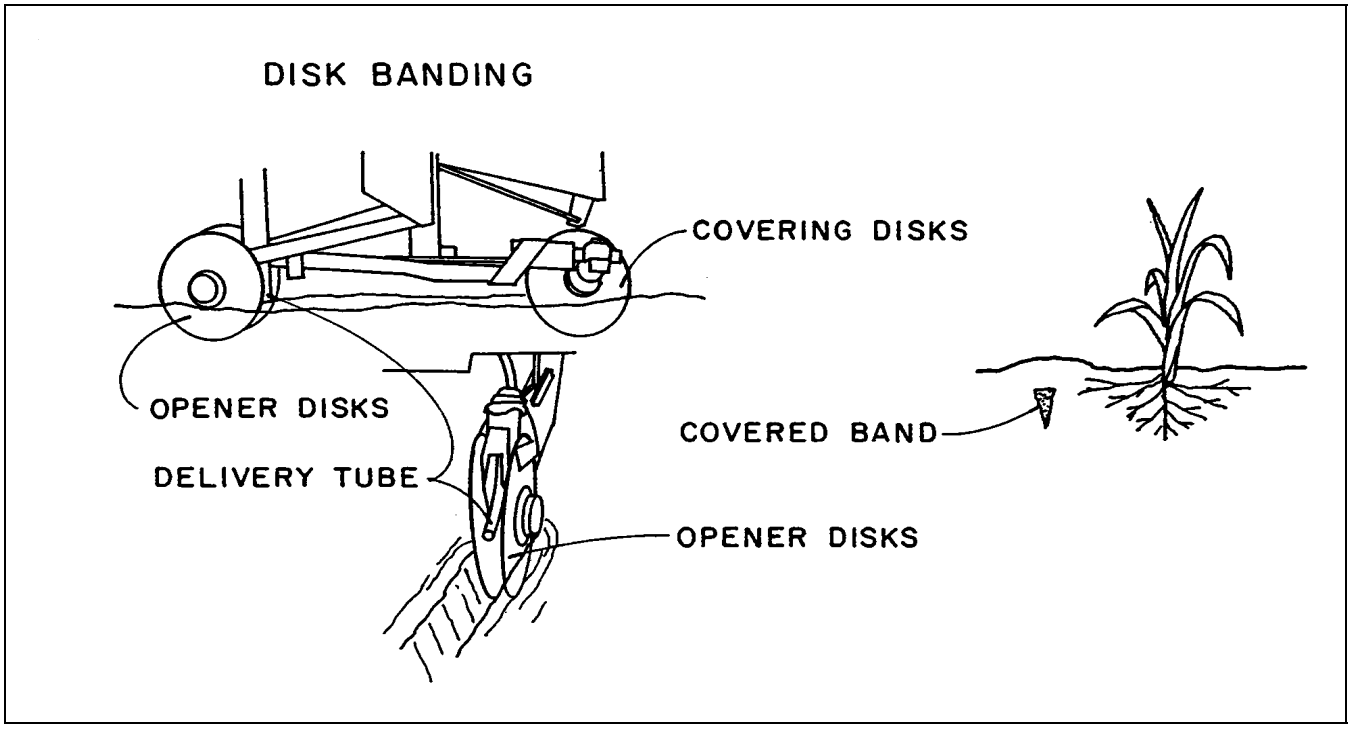

Figure 4. Common types of ground banding equipment: disk banding

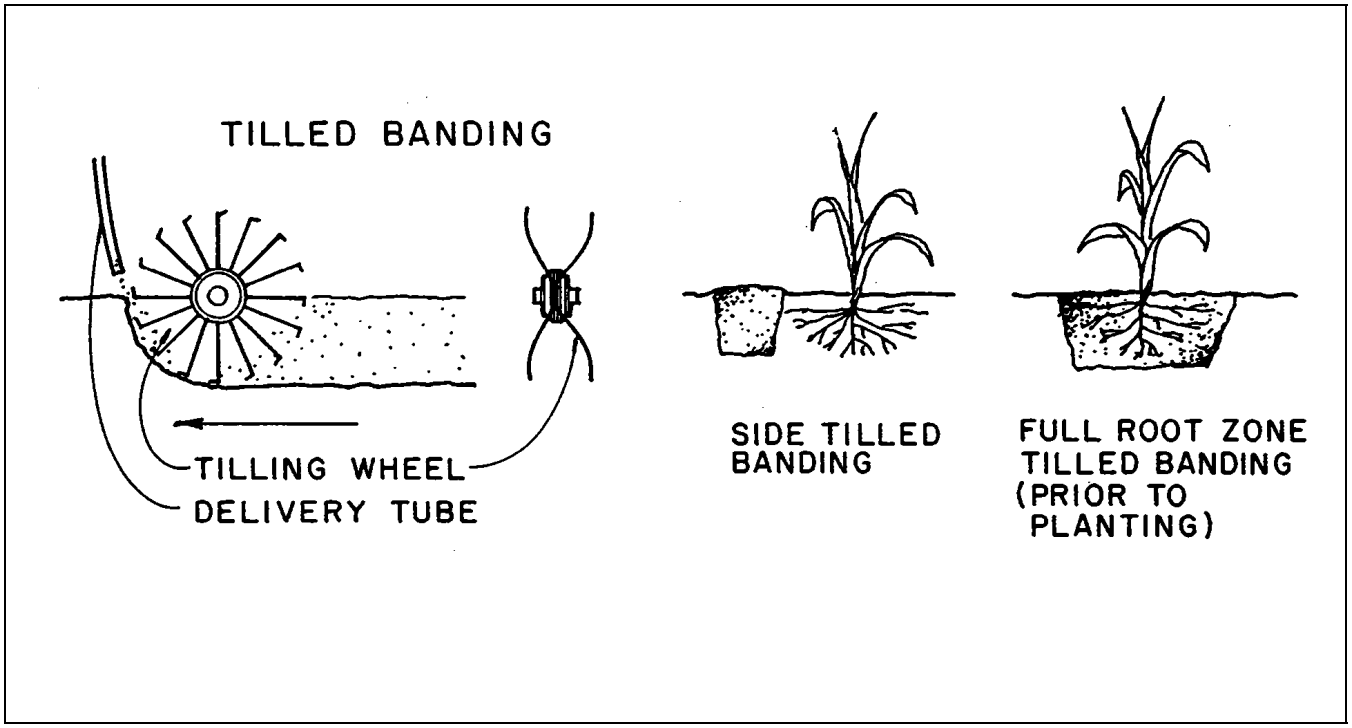

Figure 5. Common types of ground banding equipment: tilled banding