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Foliar Application of Fertilizers

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ABSTRACT

Foliar feeding is a technique of feeding plants by applying liquid fertilizer directly to their leaves. Plants are able to absorb essential elements through their leaves. The absorption takes place through their stomata and also through their epidermis. It is the application of fertilizers to foliage of the crop as spray solution is known as foliar spray. This method is suitable for application of small quantities of fertilizers, especially micronutrients. Major nutrients can also be applied by this method when there is no adequate moisture in top layer of soil. Foliar application is not substitute for soil application, but only a supplement to it.

INTRODUCTION

Plants require 16 nutrients for their growth and development. Three of these, carbon, hydrogen and oxygen, are obtained from the atmosphere and from soil water. If proper conditions of aeration and moisture are maintained in the soil, there is no problem with these three nutrients. However, if any of the other 13 elements, nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, boron, copper, manganese, molybdenum, zinc, or chlorine, are deficient, they must be applied for the plants' use. These nutrients may be applied to the soil or they may be applied to the foliage of the plants. When applied to the foliage they are known as foliar sprays.

Why foliar application?

Plants absorb nutrients through the roots and through the foliage. Many plant nutrients are needed in such great quantities that it is impractical to supply them through the foliage. However, when soil conditions are unfavorable, when micronutrients are needed, or when spraying for insects and disease, it may be desirable to make foliar applications of the plant nutrients. When plant nutrients are applied to the foliage of the plant, smaller quantities of the fertilizer material are required than when applying to the soil. The danger of fixation and/or leaching is also reduced when nutrients are applied to the foliage of the plant.

The application of the fertilizer at the same time as an insecticide, fungicide, etc., reduces labor costs and machinery costs, thereby reducing the cost of crop production. Nutrients applied to the foliage are generally absorbed more rapidly than when applied to the soil. Foliar application provides a means of quickly correcting plant nutrient deficiencies, when identified on the plant. It often provides a convenient method of applying fertilizer materials, especially those required in very small amounts and the highly soluble materials.

Table No. 1. Amount of fertilizers and water volume used in foliar spray of macro and micronutrients

Sr. No.	Nutrients	Formulation or salt	Kg per 500 liter of Water
1	N	CO (NH ₂) ₂	3–5
2	N	(NH ₄) ₂ SO ₄ ; NH ₄ NO ₃ ; (NH ₄) ₂ HPO ₄ ; NH ₄ Cl; NH ₄ H ₂ PO ₄	2–3
3	P	H ₃ PO ₄ ; others see N above	2–3
4	K	KCl; KNO ₃ ; K ₂ SO ₄	1.5–2.5
5	Ca	CaCl ₂ ; Ca(NO ₃) ₂	1.5–2.5
6	Mg	MgSO ₄ ; Mg(NO ₃) ₂	3-10
7	Fe	FeSO ₄	3-6
8	Mn	MnSO ₄	1-2
9	Zn	ZnSO ₄	1.5-2.5
10	Cu	CuSO ₄	0.5-1
11	B	Sodium borate	0.25–0.5
12	Mo	Sodium molybdate	0.1–0.15

Source: Adapted from Fageria et al. (1997); Fageria and Barbosa Filho (2006).

Limitations of foliar application

Those fertilizer materials suitable for foliar application must be soluble in water (Table 1). Most of these are salts and when applied in too high concentration the solution will cause "burning" of the plant tissue. Often the safe concentration of the fertilizer material in the solution is so low that repeated applications are required to supply the needs of the plant. This is especially true of nitrogen, phosphorus, and potassium. Foliar applications become soil applications if excess solution is applied or if rain falls shortly after application. This results in inadequate absorption of the nutrient by the foliage and loss of time, machinery use and labor for the application of the material. However, it is not a complete loss as some of the material that gets to the soil will be absorbed by the plant roots.

Fertilizer materials are not compatible with all insecticides, fungicides, etc. If mixed with incompatible materials, loss of effectiveness of the fertilizer, the insecticide, etc., or of both may result. In addition, this may also increase the danger of burning to the plant.

How to make foliar applications

The most effective means of foliar application is the use of spray equipment. Either low pressure or high pressure equipment may be used. Spray equipment provides better placement, less loss by dripping and more effective coverage of the foliage than most other methods of application. The hose-end applicator may be used also. It does not provide as accurate coverage as the spray equipment does. It also results in greater loss of plant nutrients as it has a broader coverage than other types of spray. However, its lower cost, lower maintenance and ease of use often offset these disadvantages, especially for the home gardener.

Foliar applications may be made also by use of a sprinkler can. This has the same disadvantage as the hose-end applicator. However, it is satisfactory for the home gardener or other small scale use. When mixing fertilizers for foliar application use the recommended amounts of the fertilizer material. For most fertilizer materials this is 2 to 4 pounds of the fertilizer in 100 gallons of water. Urea may be used at 12 lbs/100 gallons, sodium molybdate or molybdic acid at the rate of 2 lb/100 gallons but only 4 to 8 ounces per acre of these are needed for plant growth. Borax or other Boron sources should be used at only 1 to 2 lbs/100 gallons of water. The chelate sources of iron, zinc, copper and manganese are used at 2 to 3 lbs/100 gallons of water. These materials are more likely to be compatible with insecticides, etc., than are the sulfates and chlorides of these plant nutrients. A sticker-spreader is required to reduce the surface tension of the water so that the spray solution will spread evenly over the foliage to give uniform application of the plant nutrients. The non-ionic sticker-spreaders are generally better than the ionic types. Household detergents may be used also. The sticker-spreaders are generally used at about one cupful per 100 gallons of water or 1 teaspoonful per gallon. Always follow the directions on the containers when using materials of this nature. For small quantities of spray use 1 teaspoonful/gallon for each 1 lb/100 gallons of fertilizer material recommended. Apply the solution to both the upper and lower surfaces of the foliage. Apply until the solution just begins to drip from the foliage.

How often to make foliar applications

Frequency of application depends upon the needs of the plant as judged by deficiency symptoms, growth rate of the plant, age of plant, etc. Generally applications should be made every six to eight weeks. Applications should be made as deficiency symptoms first appear although it is best to prevent the appearance of deficiency symptoms as yield and quality are reduced. Establish a spray program based upon sound principles of management and the recommendations of your County Agricultural Agent.



Fig 1. Foliar application of fertilizers

CONCLUSIONS

Foliar feeding today plays an important role in crop production. Some crops are fed almost exclusively through the leaves. In many others absorption by aerial parts constitutes the only practical means for supplying specific nutrients. With almost all crops foliar feeding will eventually play some role in their nutrition at one time or another in their development. Leaf feeding is rapidly being standardized as an insurance against specific deficiencies and the hazards of unpredictable weather which may occur during the growth of some crops. The concept that foliar sprays should be applied only after the appearance of a deficiency disorder is confirmed, since decline in yield and quality usually precedes the appearance of visual symptoms. Nutrient sprays like fertilizers applied to the soil should be used with the objective of maintaining crops at an optimal rather than at a suboptimal or marginal productivity status

REFERENCES

- Fageria N, K., Barbosa Filho M. P., Moreira, A. and Guimares, C. M. (2009). Foliar fertilization of crop plants. *Journal of Plant Nutrition*. 32: 1044-1064.
- Fageria, N. K., and V. C. Baligar. 1997. Response of common bean, upland rice, corn, wheat, and soybean to soil fertility of an Oxisol. *Journal of Plant Nutrition* 20: 1279–1289.
- Fageria, N. K., V. C. Baligar, and R. B. Clark. 2006. *Physiology of Crop Production*. New York: The Haworth Press.
- Kannan, S. (2010). Foliar fertilization for sustainable crop production. *Sustainable Agriculture Reviews*. 4: 371- 402.