

Foliar Fertilization

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SUMMARY

This article is about foliar application technique of feeding plants by liquid fertilizers. It includes components of foliar fertilization, factors affecting on effectiveness of foliar fertilizer, difficulties associated with foliar fertilization, causes of low nutrient use efficiency and mechanism of foliar absorption.

INTRODUCTION

Foliar fertilization is a technique of feeding plants by applying liquid fertilizer directly to their leaves. Foliar fertilization is gaining importance in recent times for increasing crop yields, resistance to diseases and insect/pests, improved drought tolerance and enhanced crop quality (Haytovas, 2013). Gris, (1843) a French scientist was the first who sprayed iron solution over plants and corrected the deficiency. The efficiency of nutrient uptake is considered to be 8-9 folds higher when nutrients are applied to the leaves compared with nutrients applied to soil. The soil application of any fertilizer including organic and commercial forms for higher crop production may be relatively inefficient due to biological, chemical and physical properties of the soil that can decrease nutrient availability. Foliar fertilization is more attractive for giving supplemental doses of minor and major nutrients, plant hormones, stimulants and other beneficial substances to correct deficiencies quickly. But plant response is dependent on species, fertilizer form, concentration and frequency of application as well as the stage of plant growth.



Components of Foliar Fertilization

- Most soluble conventional fertilizer materials can be used for foliar fertilization.
- Hot mix liquid and dry soluble formulations are usually preferred, as they are designed to be dissolved in water and contain few contaminants.
- Synthetic fertilizer materials are not permitted in organic production, while fish-based fertilizers and seaweed sap are among the most common foliar feeds in organic farming.

Why Foliar Fertilization ?

- Improve plant growth & yield of crop
- Quickly correct nutrient deficiencies

- To promote crop growth under adverse conditions (i.e. Stress)
- To improve nutrient use efficiency
- To reduce chemical load
- Improvement of crop quality
- Improve disease resistance

Causes of Low Nutrient Use Efficiency

Nutrients	Efficiency (%)	Causes of low efficiency
Nitrogen	30-50	Immobilization, Volatilization, denitrification, leaching
Phosphorus	15-20	Fixation in soils as Al-P, Fe-P, Ca-P
Potassium	70-80	Fixation in clay-lattices
Sulphur	8-10	Immobilization, leaching with water
Micronutrients (Zn, Fe, CU, Mn, B)	1-2	Fixation in soils

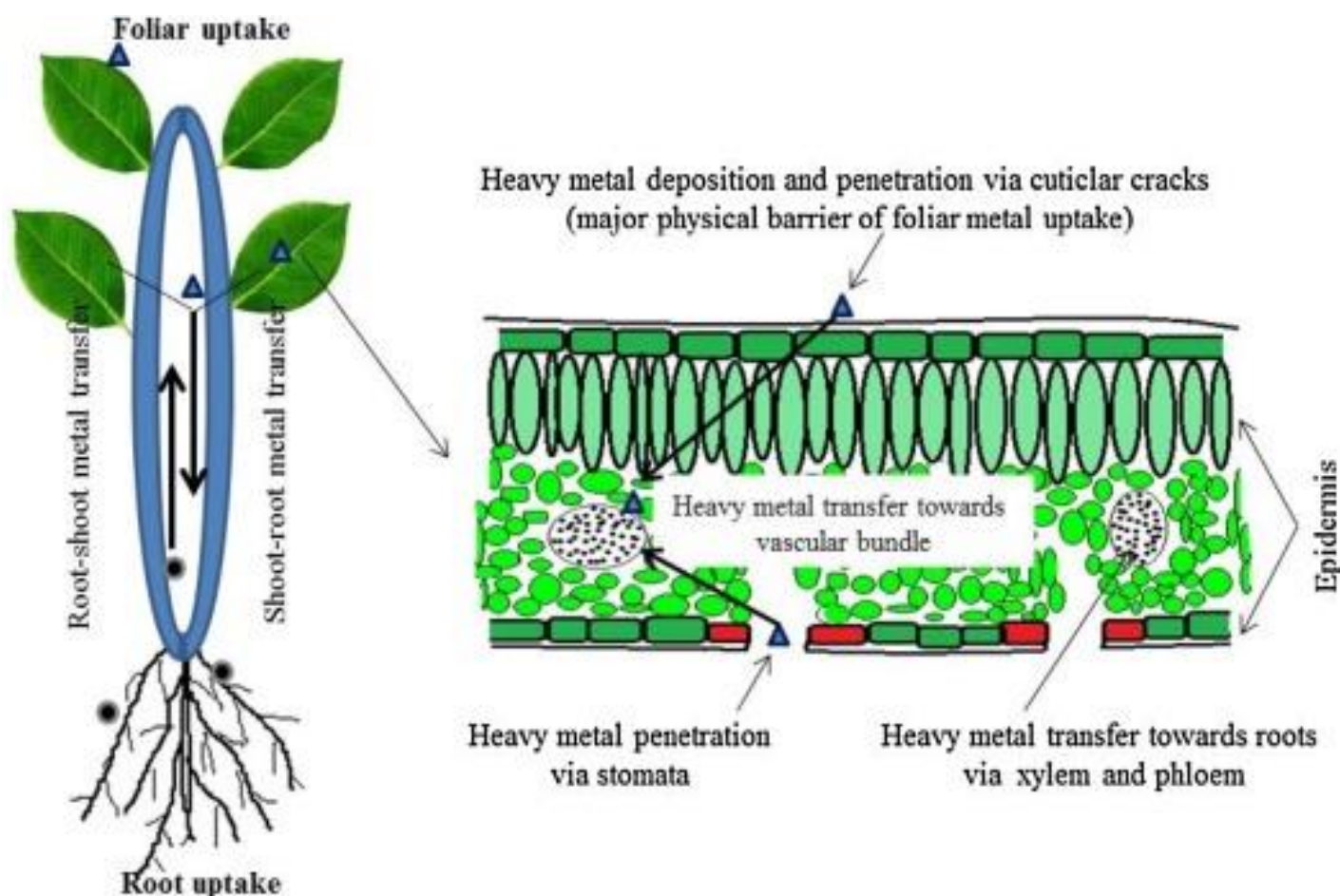
Mechanism of Foliar Absorption

Penetration:

Penetration of foliar nutrients through stomata or cuticle

Translocation:

Transport of ions from cell to cell through vascular channels (xylem, phloem) from leaves to where they are consumed.



Meteorological Conditions Favouring Foliar Applications

There are some ideal meteorological conditions that are required for favouring foliar applications as follows:

Time of day	Late in evening after 6:00 pm Early in the morning before 9:00 am
Good Temperature for absorption	Ideal is around 21 ⁰ C, low is also preferred around 18-19 ⁰ C
Humidity	High i.e. greater than 70% RH
Wind speed	Low i.e. less than 8kmph
Rainfall	Rainfall within 24 to 48 hrs of spraying may reduce the absorp

Factors Affecting On Effectiveness of Foliar Fertilizer

1. Spray Solution

Solution pH : pH mainly affect the solubility level of several elements such as phosphorus, which improves its solubility as pH decreases.

Molecule type : Materials with high molecular weight penetrate much slower than those with low molecular weight

Spray droplet size : Bigger drops may resist drift but decrease penetration through the plant canopy.

2. Environmental Conditions

Humidity : In high humidity, the solution will be active for a longer period enabling solutes to penetrate before it dries completely.

Temperature : When solution dehydration is not a limiting factor, temperature rise increases absorption.

Light : Light effect can be related to the stomata opening and the temperature resulting from the radiation.

3. Leaf Characteristics

Leaf age : As the leaf ages it tends to thicken with more wax and broader cuticle tissue. This increased barrier reduces penetration rate.

Leaf surface : Some plants have high density hairs (trichomes), which may cause the spray drops not to contact with the actual leaf surface – the water drops ‘stand’ on the hairs.

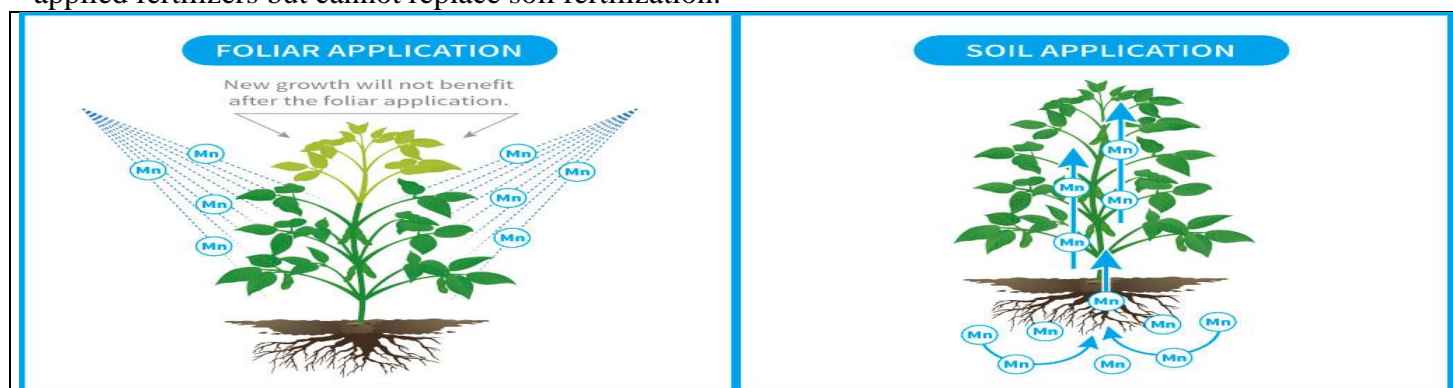
Leaf disposition : Leaf angle towards the ground influences spray solution retention on the leaf surface.

Plant species : Hydromorphic and Xeromorphic and differ in cuticle thickness, stomata position

Plant State : Plants with lower metabolic activity have been shown to have a lower ‘sink’ activity, resulting in lower translocation.

Difficulties Associated With Foliar Fertilization

- Foliar toxicity like marginal leaf burn or scorching may occur if higher doses of soluble fertilizer solution are used.
- As solutions of low concentrations are to be used only a small quantities of nutrients can be applied in a single day.
- Several applications are needed for moderate to high fertilizer rates.
- Foliar fertilization with nitrogen, phosphorus, and potassium (N-P-K) can be supplemented along with soil applied fertilizers but cannot replace soil fertilization.



Basis of application of foliar nutrients is depending upon the plant symptoms or plant tissue tests.

Basis of application of soil nutrients is depending upon the soil tests, which may or may not benefit the plants.

Response of foliar fertilization is within 3 to 4 days of application.	Here the response may take 5 to 7 days depending upon the favourable soil conditions.
We cannot apply nutrients in required amount due to toxic effect on plants	We can apply nutrients in required amount.
Not all the nutrient demand be fulfilled by foliar sprays, thus it may best nutrient deficiency corrective measure	Soil application can have better source of nutrient uptake.

CONCLUSION

From the over reviewed discussion, we may come to the conclusion that, the foliar fertilization through macro & micro nutrients can increase the efficiency of applied nutrients leading to increase in crop production in major reviewed field crops. It can efficiently supply nutrients during late growing season/stages of critical nutrient demand, when the efficiency of plant to uptake nutrients from soil is decreased. Foliar fertilization may also reduce the excess addition of chemical fertilizers in soil as observed especially for potassium.

REFERENCES

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