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Magical Foliar Nutrition for Wonderful Pulses Yield

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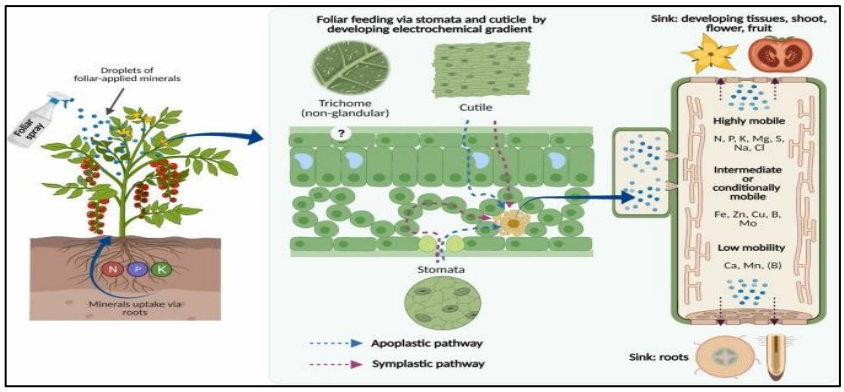
"Foliar nutrition is the simple and effective techniques to overcome nutrient deficiency and flower and pod drop in later stages of the pulse crop growth. Pulse magic is an innovative foliar nutrient solution designed to enhance the productivity and quality of pulse crops such as chickpea, pigeonpea, urd bean and mung bean. Combining macro and micronutrients with plant growth regulators like auxins, cytokinins and gibberellins. Pulse magic addresses critical challenges in pulse cultivation, including flower and pod drop, nutrient deficiencies and abiotic stresses. Its application at flowering and pod formation stages improves nutrient uptake, enhances the flower-to-pod ratio and boosts photosynthetic efficiency, resulting in an 18-20 per cent increase in yield. By promoting sustainable farming practices and reducing dependency on excessive chemical fertilizers, pulse magic offers an eco-friendly and cost-effective solution for improving pulse crop productivity and ensuring food security."

Introduction

Pulses are essential components of sustainable agriculture and a critical source of protein in human diets, especially in developing countries and to vegetarians. A nutritious fodder for animals. Further, pulses help mitigate global warming and keep the planet cool. Atmospheric nitrogen fixation, a unique activity in pulses which in symbiotic association with Rhizobium make the crop self-reliant with respect to its nitrogen requirement. So also, the nitrogen fixation makes the climate cool by transferring the nitrogen from atmosphere to plant which absorb and retain heat 300 time more than carbon dioxide, the green-house gas. They also improve soil health in terms its physical, chemical and biological properties and make soil better to enhance crop productivity. Despite their significance, pulses are given least importance in terms of crop preference, resource allocation (Land, water and nutrients) and management too for the reason that they are inherently low yielders.

In India pulses are cultivated in an area of 29.29 mha and production of pulses are 24.65 mt with the productivity of 842 kg ha^{-1}. India, with more than 35 m ha pulses cultivation area, is the largest pulses producing country in the world. It ranks first in area and production with 37 per cent and 29 per cent, respectively. Even though India is larger producer of pulses and at the same time India ranks first in consumption of pulses. We need more pulses to meet the demand of vegetarian population of the country.

The productivity of pulses remains relatively low, largely due to challenges such as flower drop, poor pod setting and their special ability. The symbiotic nitrogen fixation in a way is a reason for low productivity. The pulses are highly sensitive to moisture stress, especially high rainfall during flowering. The wet or



waterlogged soils prevent uptake of right quantity of nutrients results of which plant will be unable to support the flowers. Further, the cool condition favours the pest and disease incidence which is also a cause for flower drop.

The nitrogen fixation is an energetically expensive process, because 16 ATP molecules are required to breakdown the N_2 molecules, twelve additional ATP molecules are required for NH_4 assimilation and transport, totalling to 28 ATP molecules. The nodulating plants must provide 12 g of glucose to their bacterial partner to benefit 1 g N. This leads to lower total biomass production as well as pulses yield ability. Further, another reason for low grain yield of pulses is due to the fact that nitrogen fixation reduces or come to halt after flowering leading to shortage of nitrogen as well as other nutrients for pod development and seed fill. To correct this, nutrient from leaves moved to pods and seed making the leaves wither and fall off bringing down the photosynthesis- a reason for lower yield.

Ultimately, the shortage of nutrients at a critical stage of flowering and grain filling is the reason to low yield in pulses. In addition to this the other reasons for low yield like moisture stress and pest / diseases are directly linked to nutrient deficiency.

The promising strategy to address this challenge of low yield in pulses is the foliar application of nutrients and plant growth regulators at critical stages i.e. at reproductive stage.

The basal dose of soil applied nutrients get exhausted within a month of its application due to plant absorption followed by various kinds of losses of these applied nutrients viz. leaching, volatilization and fixation make the use efficiency of nutrients of 30-40 percent. The basal dose of nutrient especially nitrogen, applied to pulses is also known as starter dose indicating it is applied just to promote better root growth for nodulation and nitrogen fixation. Exhaustion of basal applied nitrogen and slowdown of biological nitrogen fixation leads to nitrogen deficiency at pod formation and grain filling stage expressed as small sized seed which is a reason for low yield. This is more true with long duration pulse crop like pigeonpea. Further, there is no recommendation of nutrient application as top dressing to pulse for fulfilling the nutrient demand.

Foliar nutrition, is the option to correct this short supply of nutrients at a critical stage quickly, efficiently and economically. Soil application of nutrients at flower / pod formation and grain filling stage take lot of time to reach the place of their requirement, the leaves. To retain the leaves intact on plant for few more days and keep them photo synthetically active so that the photosynthates produced at this stage will directly get translocated to pods and seed aid in enhancing the pulses yield. On the other hand, foliar application of nutrients reduces loss of applied nutrients as they are applied directly to the sight of action, the leaves making it more efficiently used. The reduction in quantity used need less monetary input making it a economical option. Foliar application is more eco friendly because loss of nitrogen to atmosphere which is a greenhouse gas causing global warming is controlled.

Foliar nutrition means the application of nutrient solutions directly to the aerial parts of

plants, primarily the leaves to facilitate nutrient absorption through the stomata and cuticle. This method serves as a supplemental or corrective approach to traditional soil-based fertilization, allowing rapid rectification of nutrient deficiencies, particularly during critical phenological stages. Foliar nutrition is commonly employed under conditions where root uptake is impaired, such as in cases of soil nutrient imbalances, drought stress or suboptimal root activity and has been shown to enhance physiological processes and crop productivity.

Plants absorb foliar-applied nutrients primarily through stomata, cuticle and epidermal cells on the leaf surface. Stomata facilitate rapid nutrient uptake during their open state, while the cuticle allows diffusion of small and water-soluble molecules. Nutrient ions also penetrate *via* ion exchange mechanisms, replacing hydrogen ions on the leaf surface. Surfactants in foliar sprays enhance absorption by improving solution spread and cuticular penetration. Once absorbed nutrients are translocated through the phloem to growing tissues, ensuring efficient utilization. The efficiency of foliar uptake is influenced by leaf anatomy, environmental conditions and spray formulation.

Foliar nutrition is done using water soluble fertilizers. Commonly, urea or diammonium phosphate (DAP) 2 per cent is recommended at flower initiation stage of short duration and twice for long duration crops at flower initiation and pod formation stage. Urea can be dissolved and used immediately. While, DAP has to be soaked overnight and the supernatant solution is used next day for spraying. Now-a-days water soluble complex fertilizers like 19:19:19 is applied @ 1 per cent. The concentration of solution to be prepared using 10 g fertilizer per litre of water make it 1 % solution and 20 g fertilizer per litre of water make it 2 per cent solution. In general, 200 - 250 litre of spray solution is required per acre depending on crop canopy.

Plant growth regulators play an important role in inducing as well as decrease the flower and pod shedding. Some of the plant growth promoters like ethereal @ 250 ppm, NAA @ 40 mg/l, GA3 @ 20 ppm, Plano fix @ 50 ppm and Cycocel are effective in inducing and retaining the flowers and pods in pulses.

Pulse Magic is a combi product of macro and micronutrients and growth regulators. The standard composition of pulse magic is as follows:

Pulse magic contains about 10 % nitrogen which supports vegetative growth and protein synthesis and 40 % phosphorus critical for energy transfer, root and reproductive development of pulses. Pulse magic possess 3 % micro nutrients such as zinc (Zn), boron (B), iron (Fe) and manganese (Mn), which support enzymatic activities and reproductive functions.

Pulse magic include 20 ppm of plant growth promoters in the category of Auxins (Stimulate cell elongation and differentiation, crucial for pod development), Cytokinins (Promote cell division and delay senescence, enhancing flower and pod retention) and Gibberellins (Encourage stem elongation, flowering and fruit development).

It primarily works by improving the plant's metabolic and hormonal activities, which play a crucial role during the flowering and pod

formation stages. The application of pulse magic reduces flower and pod drop, a common phenomenon in pulses caused by hormonal imbalances, nutrient deficiencies and environmental stress. By promoting better nutrient uptake, enhancing photosynthetic efficiency and regulating plant hormones like auxins, cytokinin's and gibberellins, it creates a favourable physiological environment for the retention and conversion of flowers into pods.

Pulse Magic application leads to improved reproductive success in pulse crops such as chickpea, pigeon pea, urd bean and mung bean. The enhanced flower-to-pod ratio directly contributes to higher seed yield. Furthermore, increased nutrient availability ensure better-quality produce. Thus, the integration of pulse magic into pulse production practices offers a sustainable solution to improving productivity while maintaining soil health and environmental balance.

Method of Using Pulse Magic in Pulse Cultivation

Pulse Magic can be applied as foliar application on the crops. Foliar spray of pulse magic directly delivers nutrients and growth regulators to the plant's leaves for quick absorption and action. Spray evenly on the foliage, ensuring complete coverage.

Ideal stages: Flowering initiation and pod formation stage is the ideal stage for pulse magic application for enhancing the pulse crop yield.

Dosage: A Packet of pulse magic which contains 2 kg of powder which contain nutrients and 100 ml of growth promoters in it is sufficient for one spray per acre of pulse crop which has to dissolved in 200 liters of water. Short duration pulses like urd bean and mung bean needs one spray. While, for long duration pulse crop like pigeonpea needs two sprays making the required quantity of pulse magic of 4 kg per acre. Spraying can be done by using backpack sprayer or power / petrol sprayers or drones can be used depending on availability.

Benefits: Enhances flower retention and pod formation, mitigate the impact of moisture stress and boosts photosynthesis ultimately enhancing crop yield.

Importance of Pulse Magic in Pulse Cultivation

Pulse Magic plays a vital role in enhancing the productivity and quality of pulse crops. Pulses such as chickpea, pigeon pea, urd bean and mung bean are essential for ensuring food security and sustainable agriculture. However, their productivity often suffers due to flower and pod drop, poor nutrient availability and abiotic stresses. Pulse magic addresses these challenges by providing a balanced combination of nutrients, plant growth regulators. Its importance can be summarized as follows:

1. Enhancing Flower-to-Pod Ratio

Pulse magic significantly reduces flower and pod drop, ensuring better conversion of flowers into pods. By regulating hormonal balance through auxins, cytokinins, and gibberellins, it promotes reproductive success.

2. Improving Yield and Quality

With a higher flower-to-pod ratio, pulse crops exhibit improved seed yield and overall productivity. There will be about 18-20 % increase in crop yield. Pulse magic ensures uniform pod setting and development, resulting in better-quality produce.

3. Boosting Nutrient Uptake and Utilization

The inclusion of macro and micronutrients enhances the plant's ability to absorb and utilize nutrients effectively. Improved nutrient supply during critical growth stages ensures robust flowering and pod formation.

4. Promoting Sustainable Agriculture

By improving yield without excessive use of chemical fertilizers, pulse magic contributes to sustainable farming practices. It minimizes resource wastage and supports soil health, making it an eco-friendly option.

5. Cost-Effectiveness

By enhancing yield and reducing the need for other inputs, pulse magic offers economic benefits to farmers. Its targeted application

reduces the dependency on excessive chemical sprays, lowering overall cultivation costs.

Conclusion

Foliar nutrition at critical stages of crop growth plays vital role in enhancing pulse crop yield and quality. Combination of macro and micronutrients and growth regulators enhances nutrient uptake, promotes hormonal balance and supports robust flowering and pod development. Pulse magic, a combi product of nutrient and growth promoters emerges as a promising solution to the challenges of low pulse productivity, addressing nutrient deficiencies, flower and pod drop and environmental stresses. Its eco-friendly and cost-effective nature ensures sustainable agricultural practices, contributing to higher yields and better-quality produce.

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