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Balanced and integrated nutrient management for sustainable vegetable production

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Balance nutrient for crop plants, people and animals need balanced nutrition for normal growth and good health. Plants require an adequate and proportionate supply of all 17 essential nutrients for optimum growth and productivity. Any nutrient deficiency acts as a weak link inhibiting efforts to enhance farm productivity and profitability Balanced use of plant nutrients corrects nutrient deficiency, improves soil fertility, increases nutrient and water use efficiency, improves crop and environmental quality, and above all enhances crop yields and farmers' income.

Integrated nutrient management (INM) : INM combines inorganic, organic and biological sources of nutrients in a judicious and efficient way into ecologically sound and economically viable farming systems. Inorganic fertilizers of interest for balanced nutrition today include – urea, di-ammonium phosphate (DAP), muriate of potash (MOP), gypsum, agribor/borax, zinc sulphare and others to meet equivalent amounts of nutrients (Fig. 2). Organic fertilizers include prominently – vermicompost, farm yard manure, poultry manure, green manuring, and bone-meal. Biological fertilizers include mainly – vesicular arbuscular mycorrhizae (VAM), phosphate solubilizing micro-organisms (PSM) and nitrogen-fixing bacteria.

Test based taluk-wise fertilizer recommendations: The zone or state-wise blanket fertilizer recommendations contribute to the mismatch between need and supply, and un-realization of even the optimum productivity potential. Vegetables in general respond more to balanced nutrition and suffer severely in its absence than other crops. To get sustainably higher productivity and profitability, adopt taluk-wise balanced fertilizer recommendations (See Manual for taluk- and crop-wise recommendations). Prior to land preparation and bed formation, basal doses of fertilizer, as recommended, need to be applied in the field and mixed with the soil. Application of fertilizers, including secondary and micronutrients, to soil is also recommended, and the benefits are seen in the succeeding 2-3 crops.

Foliar nutrient application where basal S, B and Zn are not added : Vegetable farming is a high input proposition with higher returns, so any expected loss due to failure to apply basal S, B and Zn needs to be corrected. Plants can absorb nutrients from dilute solutions applied on to the leaves, so Zn, B and S deficiencies can be readily corrected through foliar application as described here(a) Foliar application of Agribor (0.1%) + Zinc sulphate ¬(0.5%) + Unslaked lime (0.25%), 2-3 times at 10-15 days interval between 30–60 days after sowing/ transplanting. To make this fertilizer solution, dissolve 100 g agribor + 500 g zinc sulphate + 250 g lime in 100 litre of water (good for ½ acre).

– The addition of unslaked lime is needed to neutralize acidity caused by zinc sulphate ionization.

– The solution required for one ha is 500 litres.

Fig. 1 : Foliar application of nutrients to plants

– Optimum time of day for foliar application is early morning or early evening, because of less evaporation and longer period for absorption of nutrients through opened stomata.

Advantages of foliar nutrient application :

– Nutrients applied to the foliage are absorbed more rapidly than when applied to the soil.

– Smaller quantities of the nutrients are required than when applying to the soil.

– The danger of fixation and/or leaching is also reduced.

– It provides a convenient method of application for fertilizers required in small amounts.

– Urea meant for top dressing may further be split and applied along with micronutrient sprays, @ 1-2% (*i.e.* 1-2 kg urea/100 litre of solution) for getting higher efficiency.

INM in nursery raising: To harvest good productivity in vegetables (tomato, chillies, brinjal, onion etc.), which are first raised in nursery and then transplanted, it is very important to raise healthy seedlings by following INM as described below:

Fig. 2 : Vermicompost application in rows

– Apply 4-5 kg vermin compost (Fig. 5) and 100 g 12:32:16 (N:P:K) fertilizer or equivalent nutrients fertilizer in a bed measuring 3 m (long) × 1 m (wide).

– Spray seedlings with 0.2% urea + 0.05% agribor + 0.2% zinc sulphate + 0.1% unslaked lime when plants are of 8 -10 cm height (2-3 weeks).

Integration of vermi compost or farmyard manure (FYM) with chemical fertilizers : The advantages of organic manure application for soil health and crop growth/ productivity are well documented Unless addressed, the poor organic carbon status in majority of the farmers' fields in Karnataka will have implications on productivity of vegetables and on low use efficiency of fertilizers added. So, VC or FYM should be added along with chemical fertilizers for sustainability and success of Suvarna Bhomi Yojane initiative (See Manual for recommendations).

Fig. 3 : A farmer applying micronutrients

Where basal organic manure has not been applied, it is recommended to take corrective measures by application at the base of vegetable seedlings, vermin compost @ 2 t ha^{-1} along with top dressing of urea. Ensure mixing manure with the soil while earthling up.

Use of biological fertilizers : Instead of sole nutrients, use of huge amounts of fertilizer nutrients for vegetable crops and integration of cost effective biofertilizers can contribute in enhancing the use efficiency of fertilizer management to bring in better economics or benefit/ cost ratio.

Vesicular Arbuscular Mycorrhizae (VAM) : VAM infects roots, increases effective root surface and soil volume explored for nutrient uptake through extensive mycelia along with the solubilizing effect by chemicals released. VAM culture may be applied by mixing with organic composts and spreading at sowing/transplanting; coating onto the seed; dipping seedlings into the VAM spore solution; or spraying on the soil around the plant and watered into the root zone. Depending upon the number of spores in the VAM culture, the quantity of the culture should be adjusted in a way to apply 10 to 20 spores per individual germinating plant.

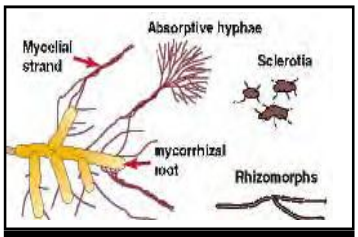

Fig. 4 : VAM infected root

Phosphate solubilizing micro-organisms (PSM) : PSMs can solubilise the complex insoluble form of phosphorus into simple soluble forms that can be taken up by P.

For PSM application, mix the culture uniformly with the seeds by using a minimum amount of water, dry the inoculated seeds in the shade and sow immediately. If the seed is to be treated with pesticides; first follow the pesticide treatments and finally treat seeds with PSM. For transplanted crops, mix the inoculants in a bucket of water, stir the mixture vigorously and then dip the roots of seedlings in this mixture before transplanting. Use 5 to 10 g culture (109 spores per g) per kg of seed, 1 to 2 kg for soil application per acre of land, 1 kg for root application (root dipping) of one acre of crop.

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