CROP PHENOLOGY WISE NUTRIENT MANAGEMENT IN VEGETABLE CROPS: AN OVERVIEW

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Vegetables are cultivated in over 10 million hectares in India with annual production of 184 million tonnes. Mostly these crops are cultivated under irrigated conditions and annual fertilizer consumption of vegetable crops is 0.7 million tonnes. Among various inputs, fertilizer alone accounts for 20-30% total of cost of production. The current nutrient recommendations are blindly followed without considering the nutrient requirement of the crop and nutrient supplying capacity of soil. This resulted in low nutrient use efficiencies and wastage of costly fertilizer nutrient elements otherwise potential threat to environment. The nutrient use efficiencies of N, P and K fertilizers seldom exceeds 50%, 20% and 70%, respectively (NAAS, 2006). In long run it may cause reduction of factor productivity (total and partial) and nutrient imbalances in soils definitely affect the sustainability of production system.

It is well known that nutrient requirement of each crop/ variety varies according to its yield potential and tissue nutrient concentration. This is related to genetic potential; high yielding varieties and hybrids are very much responsive to applied fertilizers. The agronomic interventions are also play a major role in achieving the potential yield of the crop by providing favorable environment for plant growth. But current nutrient management practices involve application of N, P and K in improper ratio without following the 4 R's principle of right source, right dose, right method and right time of fertilizer application. Drip irrigation is generally followed to meet the daily water requirement which saves about 30-40% of water and enhances yield (Hebbar et al., 2004). Similarly split application of fertilizers through fertigation according to the crop nutrient requirement may result in reduction of fertilizer consumption. Also right placement of fertilizers near the root is proven to be very much beneficial. Further interaction of nutrient and water in root zone essentially improves the nutrient uptake (Malhotra, 2016).

The first and foremost thing is to understand the nutrients supplying capacities of soils through periodic soil testing, then growth stage wise nutrient requirement of the crop and the nutrients ratio at each growth stage under the targeted yield. Based on the above criteria, nutrient management schedule has to be prepared. The required nutrients may be supplied through fertigation as far as possible. Water soluble fertilizer (WSF) can be used for its easy supply through drip irrigation lines and for readily available to plants. Further if there is any requirement of secondary and micronutrients at particular stage can also be supplied without any difficulties. Furthermore development of crop growth stage specific complex/customized water soluble fertilizers will be of more advantageous.

GROWTH STAGE WISE NUTRIENT MANAGEMENT STRATEGIES

Synchronization of crop demand based balanced nutrient supply at specific growth stage using water soluble fertilizers through drip fertigation system can reduce fertilizer requirement, improve crop yield, enhance nutrient use efficiency and lessen environmental pollution. Drip fertigation of 80% recommended doses with WSF has registered 22.3 and

31.0% higher tomato yield over conventional fertilizers in drip and furrow irrigation methods (Prabhakar et al., 2001; Hebbar et al., 2004). It has been reported that through fertigation system nutrient use efficiency can be improved to the extent of 80-90% for N, 40-50% for P and 90% for K (Malhotra, 2016). Moreover crop specific customized fertilizers can also be developed. For instances, many private ventures come up with customized fertilizer formulations/products for potato (8:16:24:6:0.5:0.15 denoting individual levels of N, P, K, S, Zn and B) in UP region; for groundnut (15:15:15:9:0.5:0.2) and maize (20:0:15:0:0:0.2) in AP; and two products on tomato, gourds and leafy vegetables (20:10:10:5:2:0.5:0.3:0.2 and 15:15:15:5:2:0.5:0:0.2 denoting individual levels of N:P:K:S:Mg:Zn:B:Fe) for Maharashtra and Gujarat (Rakshit et al., 2012). These kinds of products can also take care of secondary and micronutrient requirements of crops. Likewise many products are available in the market. However the ratio mostly 1N:1P:1K is not representing crop requirement and are very lethal to soil health. Further crop need based growth stage specific fertilizer formulations are not available. Therefore it is mandatory to focus on growth stage wise nutrient requirement and development of fertilizer formulations to achieve the higher crop yield with better quality without environmental degradation.

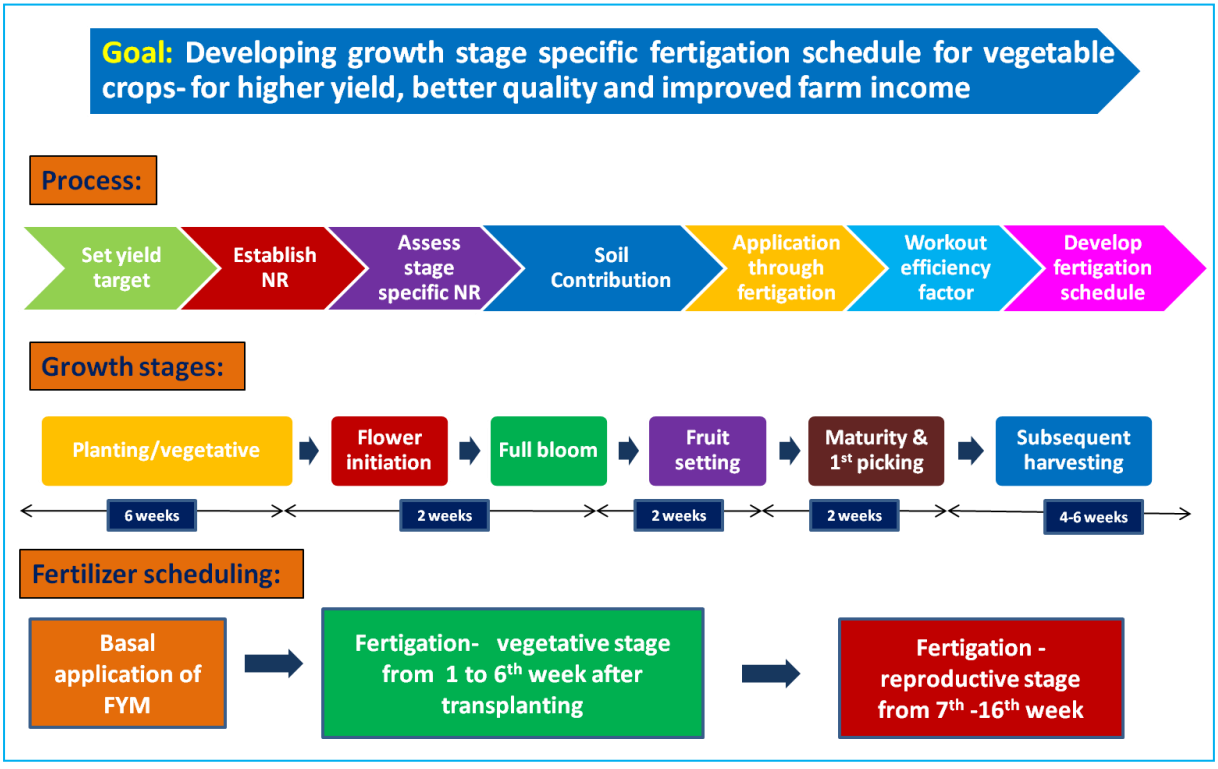

Figure 1. Schematic view of development of growth stage wise nutrient management

The schematic model of growth stage wise nutrient management is depicted in figure 1. It explains under given yield target, plant growth rate and dry matter accumulation at specific phenophase needs to be recorded. Nutrient uptake (both macro and micro nutrients) in each crop growth stage has to be estimated. Further contribution of soil is also to be taken into account. Based on these factors actual nutrient requirement of crop at individual growth stage and the ratio with which the nutrients are absorbed needs to be worked out. Then fertigation scheduling has to be prepared for the crop and efficiency to be accounted. If there is any modification required has to be carried out and finalized. Major advantages are: i) Enhancement in crop yield and quality; ii) Reduction in fertilizer consumption and cost of production; iii) Decline in fertilizer wastage and environmental pollution; and iv) Improvement in nutrient use efficiency. Further it is practically possible as mostly vegetable crops are cultivated under irrigated condition. Hence the crop need based growth stage specific nutrient management in vegetable crops is a viable option for

enhancing productivity and sustaining the vegetable production systems.

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