

Soil Health Improvement for Growing Vegetable Crops Through Optimum Nutrient Management

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Abstract

Nutrition management is an important practice in crop production, which has profound implications for soil health. This observation highlights the importance of nutrient management strategies that help uniquely improve land conditions for plant production. Arborists can increase soil fertility, boost crop production, and reduce environmental impacts by perfectly balancing nutrient flows, adapted to specific vegetation species, land types, and local conditions. This review explores their land management techniques, such as organic and synthetic fertilizers, cover cropping, and predation, as well as their various techniques in maintaining soil health, which have been shown to be as excellent as predicting soil fertility on their lands. Emphasizes the roles of land. Furthermore, it outlines nutrient management's economic and ecological benefits, making it essential for modern, sustainable vegetable farming.

Introduction

Nutrient management is very important for growth and development of vegetable crops. Soil having a greater number of minerals, organic matter and water, which are taken by crops. The deficient or unavailable any of essential nutrients in the soil, it causes the adverse effects on development of vegetable crops and several deficiency symptoms are observed. So, management of soil nutrient is very necessary to vegetables for successful production. Most of the plant nutrients are absorbed by the roots of the plant but some are absorbed by the leaves when we give them in special formulations by foliar spray. Nutrient management includes the fertilizer type to be applied, application method and application rate. Soil reactions observed when fertilizers are applied in this. The physiological disorders in vegetable crops can be



overcome by proper management of nutrients. Nutrient management improved the soil health and soil health protect to the plant from biotic and abiotic stresses. Soil health define as “the capacity of a soil to function as a vital living system within ecosystem and land use boundaries to sustain plant production, maintain or enhance water and air quality, and promote plant health.”

Plants nutrients and soil health

Equally 17 essential nutrients are necessary for the growth and development of all crops. If there is a deficiency of even one of these nutrients, then the growth and development of the plant get affected in some way or the other. According to Arnon and Stout (1939), Any element has to fulfil three criteria which are as follows: a) In the absence of mineral nutrients, the plant cannot complete its life cycle; b) nutrient elements are specific to plants and cannot be replaced; c) the elements should be directly involved in metabolism. Soil health is an internal characteristic of the soil. Some people are thinking of ‘soil health’ as the biological capacity of soil and It is a vital living system which is very important for plants, humans and animals. Healthy soil has the all-essential nutrients, good water holding capacity and colonies of beneficial micro-organisms.

Important relationship between soil health and vegetable crops

Soil health is the base of successful vegetable production. The characteristics of healthy soil are that it has a balanced pH, good structure, optimum nutrients and a community of various beneficial microorganisms. These factors directly help in growth and development of vegetable crops and also increased their yield and quality.

Fertilizers effect on soil health

Adequate and balanced amount of nutrients are required for the growth and development of vegetables. These nutrients go inside the soil and are absorbed by the roots of the plants. Before this, it is important for us to know that the nutrients work only when the soil is healthy. When plants do not get nutrients in sufficient quantity or they get more than the required amount, it has a bad effect on their soil health. This situation occurs when the farmer applies nutrients in the soil without soil testing. Apart from this, many chemical fertilizers are given in the soil which form acids like sulfuric acid and hydrochloric acid which cause adverse effects on soil health. In addition, many microorganisms are destroyed due to the application of this chemical fertilizer and the fertility of the soil becomes weak. Both organic fertilizers

and soil amendments are responsible for improving the texture and structure and have positive effects on the soil.

Methods of fertilizer application

Applying fertilizers to the root zone of plants increases the efficiency of fertilizers. While attempting application, care should be taken to have minimum contact of fertilizer with the soil so as to have lessened fixation of nutrients. Upon soil contact, phosphatic and potassic fertilizers get fixed and their availability is hindered. However, different methods of application in practice are (a) Broadcasting, (b) Top dressing, (c) Localized placement, (d) Contact placement, (e) Band placement, (f) Row placement and (g) Pellet placement.

Other form of application

- i. Starter solution:** Starter solution is prepared in 1:2:1 ratio and used to soak the seeds and dip the roots. This solution helps in germination and quick growth of vegetable crops.
- ii. Fertigation:** Fertigation is the method by which we provide fertilizers, soil amendment and other water-soluble materials to plants through irrigation. Through this system, plants easily absorb nutrients and increase their growth and development, which increases yield of vegetable crops.
- iii. Foliar spray:** In many vegetable crops, nitrogen and micronutrients are applied through foliar spray and these nutrients are absorbed directly by the leaves of the plants.

Improvement in nutrient use efficiencies

To improvement of fertilizer use efficiency (FUE) many innovative ways are required like the use of ferti-seed drill, soil testing, use of neem-coated urea, use of customized fertilizer, etc. Customized fertilizers are a combination of micronutrients and major key fertilizers that are good for soil health and plant growth. In addition, fertilizer is used in the right amount, right place, and right time with the right methods can improve also FUE.

Fertilizer dose

The amount of fertilizer is measured according to the needs of the crops and their physiological activity. Different vegetable crops take different amounts of fertilizer based on their requirement. Recommended dose means the optimum level of N, P and K fertilizers required for the plant for better growth, yield and quality. Different RDF of vegetable crops are given in Table 1.

Table 1: RDF for vegetables

Vegetable crops	FYM (t/ha)	N (kg/ ha)	P ₂ O ₅ (kg/ha)	K ₂ O (kg/ha)
Amaranth	10-25	75-90	150	80-100
Ash Gourd	20	50-100	50	50-60
Broad Bean	10-15	50-75	100	60-75
Beet Root	25	60	40	50
Bitter Gourd	10-12	100	50	50
Bottle Gourd	20-30	22-55	20-60	17.5-44
Brinjal	15-20	100-120	75-85	45-50
Broccoli	15-20	60-80	100	100
Brussels Sprout	20-25	200	100	100
Cabbage	20-25	180	50	50
Capsicum	25	120	80	50
Carrot	20	70	40	40
Cauliflower	15-20	120	100	60
Chilli	20-25	150	180	60
Chinese Cabbage	20	90	50	30
Chow-Chow	15-20	120	80	80
Cluster Bean	10-12	45	60	20
Cowpea	25	20-25	50-70	50-70
Cucumber	10-15	50-100	35-50	50-75
Dolichos Bean	10-12	15-20	20	00
Garlic	50	100	50	50
Ivy Gourd	10-12	60	40	40
Lettuce	10-15	50-60	90	50-60
Muskmelon	25-30	125	55	55
Okra	15-20	100-120	80	80
Onion	15	100	50	50
Garden Pea	20-25	40-50	50-60	40-50
Potato	25-35	120-150	45	150
Tomato	20	180	120	150

Source: Chadha, 2019

Time of manure and fertilizer application

Time is very important for nutrient application in soil to vegetable crops. In the case of organic manure, it is applied in the field before field preparation but potassium and phosphorus fertilizers during field preparation. Nitrogenous fertilizers are applied in different split doses during specific times depending upon the vegetable requirements.

Nutrient management for soil health

- i. Soil testing:** This is the first step before nutrient management is soil testing. For this, soil samples are collected from different areas and the nutrients present in them are analysed in laboratory. Through soil testing, we come to know about the nutrients present in the soil. Through which we apply the nutrients that are lacking in soils.
- ii. Balanced nutrient management:** Soil nutrient intake and crop needs must be balanced. If nutrients are applied at a suitable time and in the required amount then a good crop yield is obtained. When used in small amounts it reduces the yield but when used in large amounts it causes crop damage.
- iii. Cover crops and crop rotation:** Longer crop rotations have been required to enhance the physical properties of soil, reduce erosion of soil, reduce the nitrogen (N) potential leaching, increase organic matter and produce crops with higher yields. Because they increase organic matter in the soil, improve soil structure and fertility, increase the ability to retain water in the soil and control weed growth. Cover crops improve soil health and have a significant impact on vegetables.

Conclusion

In conclusion, nutrient management is very essential for growing of vegetable crops. Plans are required a total 17 nutritive element which essential for different function. A healthy soil protects from several nutrient disorders and enhance the yield and quality of vegetable crops. The major components of nutrient management are soil testing and balance application of nutrient because soil testing indicate only deficient nutrients and farmers apply only these particular nutrients.

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