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Fundamentals of Vegetable Production

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Vegetable crops plays a significant role in nutritions and food security of the world. India is producing 204.83 million metric tonnes of vegetable from an area of 11.35 million hectares (2022-2023). Our countries are largest producer of okra and ginger among vegetable and second rank in the production of onion, potato, cabbage, cauliflower and brinjal according to the FAO (2021). India is the second largest producer in the world after china and accounts about 15 percent of the world vegetable production. India is also the largest producer of spices in the world. Recently, farming community have shifted the traditional cereal crops to the vegetable farming due to high yield potential, short duration, intensive& multiple cropping system, high income and also due to the more generation of employement.

Climatic factors:

The main climatic factors affecting the production are temperature, light, rainfall, relative humidity and soil. A crop variety to be grown in an area must be adapted to the temperature and photoperiodic conditions prevailing in that area. Temperature plays a key role on seed germination, vegetative growth, flowering, fruiting, incidence of insect pests and diseases and quality of produce. The growth and development of some vegetable crops, particularly warm season or tender crops, is affected when the temperature is less than 5^0C e. g. tomato, chillies, okra, cowpea, cucurbits etc. These crops generally suffer when temperature goes below 15^0C for a considerable length of time. The growth normally increases when the temperature increases up to 40^0 C. The cool season crops such as pea, potato, cole crops, root crops, palak, methi, garlic etc. are frost tolerant and generally survive at temperature ranging from 0 to 5^0 C.

Optimum light requirement of crops ensures high rate of gross photosynthesis with normal rate of respiration which results into high net photosynthesis. Light intensity varies with the location, season, climatic conditions and elevation. Optimum light requirement varies with

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the crop and its sages. Most vegetable crops require bright sunshine for better growth. Crops such as tomato, brinjal, chilli, capsicum, cucurbits, peas, beans, and root crops require 3000–8000-foot candles of light while cabbage and potato require 2000–8000-foot candles. Based on responses to light duration, plants may be classified into long day (requiring short nights of 8-10 hrs), short day (requiring long nights of 10-14 hrs) and day neutral (photo-insensitive) plants. If long day plants are grown during the period of short days, there will be weak vegetative growth due to less production and accumulation of carbohydrates and protein. On the other hand, if short day plants are grown during long days, there will be abundant production of carbohydrates resulting in excessive vegetative growth with no flowering. Atmospheric humidity has a key role on the incidence of pest and disease, occurrence of flowering and storage quality of vegetable crops. High humidity promotes the incidence of diseases like downy mildew and blight whereas low humidity increases the incidence of powdery mildew and mites. High temperature coupled with high humidity favours the incidence of insects like jassids and thrips and viral diseases in plants.

Soil requirement:

Vegetables are grown in a wide variety of soils ranging from sandy loam to clayey. The soil should be fertile and well drained with continuous supply of nutrients and moisture. Early or short duration crops can be grown on light soils as such soils are low in nutrient contents and poor in moisture retention. Loamy and clay loam soils are rich in nutrients with high water retention capacity for longer period and hence are preferred for high yield. The optimum soil pH for most of the vegetable crops is 6.5-7.0. Under acidic conditions (pH below 6.5), availability of nutrients like nitrogen, phosphorus, potassium, magnesium and calcium to the plants is low. When soil pH is above 7.0, availability of iron, zinc, boron and manganese become low.

Land preparation:

The field must be prepared well as the vegetable crops prefer loose friable soil. A well-prepared land helps in improved germination and destruction of potential weeds. It also increases the efficiency of irrigation with more uniform irrigation.

Nutrition requirement:

Nutrition requirement of crops depend on type of vegetable crop and its variety. All the vegetable crops show good response to nitrogen application as it is required for vegetative

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growth of plants. Nitrogen being highly mobile is easily lost from soil and only 50-60% of applied N is available to plants. Nitrogen use efficiency can be increased by its application in several splits coinciding with the crop requirement. Phosphorus is associated with root development and also increases the number of fruits whereas potassium increases the size of fruits besides imparting resistance to pests and diseases. Both P and K increase the keeping quality and storage life of vegetables. Full dose of P and K are applied at planting time of the crop and in active root zone (3-5 cm below soil surface) because their uptake by roots is more in the early stages of crop growth and they are less mobile than N.

Nutrient requirement of a crop depends upon the specific demands of roots, shoots, leaves and fruit development. Vegetable crops with edible vegetative parts have higher N requirement whereas bulb, root and tuber crops require more K. Solanacious crops and cucurbits require more P. Cabbage, cauliflower, radish, onion, turnip etc. require more sulphur. The nutrients can also be supplied to the plants as foliar spray. Well decomposed and dried organic manure (FYM) should be applied 15-20 days before sowing. It increases water holding capacity and aeration in soil besides providing major nutrients to plants.

Selection of variety:

The variety to be grown in an area should be high yielding and well adapted to local climatic conditions and should be resistant to major biotic and abiotic stresses of the area.

Sowing/planting time:

Sowing the seed or transplanting the seedlings at ideal time is essential for obtaining higher yield of a crop. Time of sowing/planting of vegetable crops should be according to environmental conditions prevailing during growing period.

Seed rate:

Seed rate varies with the seed size, time of planting, seed purity, seed viability, type of soil, soil moisture etc. Seed rates are higher in direct sowing than in transplanting. Spreading type varieties require lower seed rate and are sown at wider spacing. Wide spacing facilitates intercultural operations.

Method of sowing or planting:

Vegetable crops should be sown or planted in rows preferably by dibbling. Row sowing helps in conducting interculture operations, roughing etc. Vegetables seeds can be planted on flat beds, raised beds and on ridges depending upon the season, soil types etc.

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Depth of sowing:

Depth of sowing depends upon soil moisture, size of seed, soil type and growing season. Large size seeds are sown dipper than smaller size seeds (depth generally 2.5 times more than the seed diameter). In dry soils and sandy soils, seed should be planted deeper than in clayey soils.

Intercropping:

Short duration and short stature vegetable crops like coriander, methi, onion, cauliflower, pea and radish can be grown as intercrops in widely spaced crops like tomato, brinjal, potato etc.

Irrigation requirement

Irrigation requirement depend upon stage of crop and environmental conditions. Plants require less water when young but transpire more water during later part. Each crop has its critical stages for irrigation during which water stress reduce yield considerably. Flowering and fruit development stages are critical stages for irrigation in many vegetables like cucurbits, okra and leguminous vegetables whereas stolon formation and tuber development are critical stages in potato. Head formation in cabbage and lettuce and bulb formation and development in onion and garlic are critical stages of irrigation. Leafy vegetables, cauliflower and root vegetables require optimum soil moisture during early growth period. Shallow rooted crops need irrigation at frequent interval whereas deep rooted crops can be irrigated at longer intervals.

Weed control:

Weeds offer serious competition with vegetable crops for light, space and nutrients as the crops are slow growing in initial stages. Use of FYM, high application of fertilizer and frequent irrigation to vegetable crops favour the growth of a number of annual weeds in the fields. A pre-emergence application of herbicide (pendimethalin @ 1.5 - 2.0 kg a.i./ha), followed by one hand weeding at 30 to 45 days after planting was found economical in most vegetable crops.

Use of plant growth regulators:

Growth regulators play an important role in altering the physiological processes in plants for improving the yield and quality. Dormancy in potato can be broken by soaking the tubers in GA (50 ppm). Two sprays of the Ethrel (100 ppm) in cucurbits first at 2-4 leaf stage and second at 15 days after the first spray increase the female flower and yield in

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cucurbitaceous vegetables. Two sprays of Napthalene Acetic Acid (NAA) @ 10-15 ppm at 30 and 45 days after planting prevent the flower drops and increase the fruit set in solanaceous vegetables. Sprouting in onion and garlic can be inhibited or dalayed by spraying of Malic Hyrazide (MH) @ 2000-2500 ppm. Spraying of GA3 is used to retard the ripening whereas spraying of GA and silver nitrate is used to induce the maleness in cucurbits.

Use of mulching:

Mulching is done with organic materials like straw, green or dry leaves and artificial materials like plastic or polythene sheets to protect the crop from adverse environmental conditions. Mulching has a favourable effect on the growth and productivity of vegetable crops as it conserves soil moisture, increases soil aeration, increases soil temperature during winter and also increase microbial activity in soil.

Protected Cultivation:

Protected cultivation is a process of growing crops in a controlled environment. This means that the temperature, humidity, light and such other factors can be regulated as per requirement of the crop. Closing of the green house during the nights rises the CO_2 level resulting from the respiration by the plants that in turn is used for photosynthesis by the plants during the early hours of the following days. The rise in temperature, relative humidity, CO_2 level and enriched nutrition under protected conditions is accountable for the speedy growth and increased production. Temperature can also be lower down by providing cooling through ventilation, fogging or operating the fan pad system.