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# Ready Reckoner on Production methods for Select Vegetable Crops



**ICAR RESEARCH COMPLEX FOR GOA**  
Ela, Old Goa, Goa - 403 402.

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**READY RECKONER ON  
PRODUCTION METHODS FOR SELECT VEGETABLE CROPS**

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**Front Cover:** Basket of commonly grown vegetables in Goa.

Photo by *Ms. Preeti Pereira, Senior Research Fellow*

**Back cover:** Improved varieties of vegetable crops.

Courtesy: *IHR, Bangalore*

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
## Foreword



Vegetable crops occupy an important component in any agricultural production system. They are short duration crops with good market demand throughout the year; hence a farmer can get continuous income through vegetable cultivation. It is more so in Goa, since more than 85 per cent of demand of vegetable crops are imported from the neighbouring states like Karnataka and Maharashtra. The area under vegetable crops is hovering around 7000 hectares in Goa. It is mainly cultivated during rainy season on hill slopes and winter season on paddy fallow lands. The existing production and productivity can be increased many fold if proper production technology is followed by the small and marginal farmers.

With this background, ICAR Research for Goa is continuously working on introduction, improvement and standardization of production technology for important vegetables of Goa. In addition to this, Tribal sub Plan (TSP), a government of India sponsored programme is implemented in Goa for various agricultural activities through the institute. Under this important programme, promotion of vegetable cultivation by providing quality seeds, agricultural inputs, technical guidance on improved production technologies, capacity building through on and off campus trainings, publication of books, bulletin and extension folder on various vegetable crops are some of the activities under taken.

In this endeavour, ICAR is publishing a small but an important booklet entitled "**Ready Reckoner on Production methods for Select Vegetable Crops**" authored by *Dr. M. Thangam, Dr. (Mrs.) S. Priya Devi, Dr. (Mrs.) Safeena S. A. and Dr. N. P. Singh* for the benefit of vegetable farmers of Goa in particular. I congratulate the authors for their efforts in compiling and bringing out this booklet on vegetable crops.

  
(Narendra Pratap Singh)  
Director

## Preface

Vegetable crops are important sources of vitamins and minerals in human diet apart from adding palatability to the food. It is one of the important sources of protein for vegetarian people. As per the recommendation of ICMR, WHO etc. each person should consume around 330 grams of vegetables comprising of fruit vegetables, root vegetables and green vegetables to meet the daily requirement of minerals, vitamins, fibre, energy etc.

There is need to publish a brief but covering important aspects of improved vegetable production technology in Goa. Hence, a humble attempt has been made to compile the information on select vegetable crops for the benefit of farmers. Simultaneously the seeds of improved varieties in select vegetable crops are also arranged for distribution to the tribal farmers of Goa through the financial support of TSP.

The authors wish to express their sincere thanks and gratitude to **Dr. N.P. Singh**, Director, ICAR Research Complex for Goa for permitting to publish this booklet under financial support from Tribal Sub Plan (TSP), Govt of India. They also place on record the support and encouragement given by the director for not only this publication, but also for undertaking various farmer beneficial programmes under TSP.

**Authors**

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**Common technical term used in vegetable production and its description**

**Kharif season:**



The *Kharif* crops are better known as the monsoon crops in Indian sub continent. *Kharif* crops are usually sown towards the end of May in the state of Kerala, coastal Karnataka, Goa and Konkan region of Maharashtra during the onset of south-west monsoon season.

**Eg.** In Goa-Cucurbit vegetable crops viz., ridge gourd, bitter gourd, cucumber, snake gourd etc. are cultivated as *Kharif* crops.

**Rabi season:**



*Rabi* season refers to the period when agricultural crops are sown in winter and harvested in the spring. The water that has percolated in the ground during the rains is the main source of water for these crops. However *Rabi* crops require irrigation.

**Eg.** In Goa-Vegetable crops viz., sweet potato, brinjal, chilli, cluster bean, amaranthus, okra (Lady's finger), onion, bottle gourd, pumpkin etc. are cultivated as *Rabi* crops.

**Seed:**



A seed is a small embryonic plant enclosed in a covering called the seed coat, usually with some stored food. It is the propagation organ in seed producing crops like vegetable crops

**Eg.** brinjal, chilli, cluster bean, amaranthus, okra (Lady's finger), onion, bottle gourd, pumpkin etc.

#### Direct sown crops:

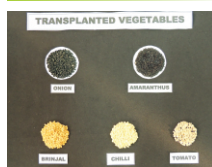


In this method of sowing, the seeds are directly planted (sown) in main field rather than by raising seedlings in nursery.

#### Example:

Bhendi, radish, amaranth, coriander, fenugreek, cucurbits, cowpea, cluster bean, lab lab, french beans, carrot radish, beetroot, turnip, peas.

#### Transplanted crops:



In this method of planting, initially vegetable seeds are sown in raised nursery beds to produce healthy seedlings. After required growth of seedlings is obtained (usually 25-30 days), the seedlings are removed and replanted in main field at required spacing.

#### Example:

Tomato, brinjal, chillies, cabbage, cauliflower, knol-khol, curry leaf, Bellary onion.

Vegetables raised by cuttings: Chekkurmanis, drumstick, coccinia, basella, alternanthera, mint, tapioca, sweetpotato.

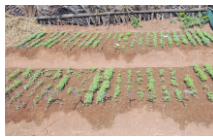
#### Ridges and Furrow:



In transplanted vegetable crops, the seedlings are generally planted on one side of ridges and water is supplied in furrow so as to maintain proper moisture and aeration to the plants.



**Raised beds (Nursery):**



It is the nursery technique where in vegetable seeds (of transplanted crops) are sown on raised beds in lines with a gap between two lines so as to get good quality and healthy seedlings.

**Pro-Trays:**



Pro-trays are nothing but propagation trays made of plastic cups of different sizes usually filled with cocopeat, organic manure, Vermicompost *etc.* to produce healthy seedlings in shorter period of time. Only one seed is sown in each cup, hence saving of costly seeds is possible (In case of  $F_1$  hybrid varieties).

**Farm Yard Manure (FYM):**



FYM is the decomposed manure obtained from different agricultural waste from a farm including cowdung, leaves, twigs and other plant parts.

**Vermicompost:**



Vermicompost is the product or process of composting using various worms, usually red wigglers, white worms, and other earthworms to create a heterogeneous mixture of decomposing vegetable or food waste, bedding materials, and vermicast.

**Nitrogen (N):**



Nitrogen is an important plant nutrient required for plants for their growth and development. It is commercially available in the form of granules (Eg. Urea).

**Phosphorous (P):**



Phosphorous is the second important plant nutrient required for formation and development of root system in the plants. It is generally applied before sowing of seeds or planting. It is advisable to use rock phosphate in acidic soils of Goa (Eg. Rock phosphate).

**Potassium (K):**



Potassium is the third important plant nutrient required for quality improvement in produce like taste, aroma and to impart pest, disease and other abiotic resistance to plants. It is commercially available in the form of Muriate of Potash in granular form (Eg. Muriate of Potash).

**Conversion of NPK to fertilizers:**

**To convert N into Urea:**

Eg. 10kg of N =  $10 \times 2.2$  (Conversion factor for Urea) = 22kg of Urea has to be applied

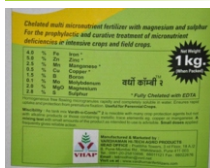
**To convert P into Super Phosphate:**

Eg. 10kg of P =  $10 \times 6.2$  (Conversion factor for Super Phosphate) = 62kg of Super Phosphate has to be applied

**To convert K into Muriate of Potash:**

Eg. 10kg of K =  $10 \times 1.6$  (Conversion factor for Muriate of Potash) = 16kg of Muriate of Potash has to be applied

### Micronutrient:



Micronutrients refers to group of nutrients viz., boron, copper, iron, manganese etc. which are required for plant growth and development but at lesser quantity. The shortage of these micro nutrients lead to development of deficiency symptoms in plants like yellowing of leaves, drying, browning etc. It can be overcome by spraying of micronutrients at recommended dose in vegetable crops.

### Fungicides:



Fungicide refer to agro-chemical usually sprayed or dusted on economic plants to control plant diseases like (leaf spot, rot, plant rot etc) at recommended dose. It is broadly classified into two types viz., contact and systemic fungicides based on mode of action.

### Insecticides:



Insecticides refer to agro-chemical usually sprayed to control insects in economic plants at recommended dose. It is broadly classified into two types viz., contact and systemic insecticides based on mode of action.

### Acaricides:



Acaricides refer to agro-chemical usually sprayed to control mites (eight legged insects) in economic plants. The important mite infestation in vegetable crop is seen in chilli with upward curling of leaves due to sucking of mites

**Weedicides:**



Weedicide refer to agro-chemical usually sprayed on weed plants (un wanted plants in field) to kill or control them. They are broadly classified in to two types based on mode of action like for grasses and broad leaved plants

**Neem based oil/chemical:**



Neem oil based botanical pesticides are an important component in organic vegetable production. It is generally used to keep away the insects from eating or damaging the plants.

**Wetting agent:**



It is a special chemical generally used along with insecticides/fungicides/Acaricides to increase the efficiency of agro chemicals.

**Biofertilizer:**



It is a speciality organic fertilizer produced using beneficial bacteria/fungi/actinomyces *etc.* to improve the health of plants, to suppress disease infection and to improve the soil microbial activities.

Eg. *Azospirillum*, *Phosphobacter etc.*

**Growth regulators:**



Growth regulators are special chemicals used in agriculture for wide range of utilities. In vegetable crops, growth regulators like ethereal are used in cucurbitaceous vegetable crops to increase the female flower production so as to increase the yield.

**Spraying precaution:**



Chemical like insecticides, fungicides, herbicides etc are injurious to health when it is directly inhaled during spraying on plants. Hence covering the mouth and nose with recommended mask is must during spraying.

**Parts Per Million (PPM):**

PPM means parts per million. Generally plant growth regulators are sprayed in PPM concentration. One PPM solution is prepared by dissolving 1 milligram chemical in 1 litre of water.

**Per cent solution:**

One per cent solution is prepared by dissolving 10gram of chemical in one litre of water. It is generally used in preparing fertilizer solution for drip irrigation (Fertigation), pesticide spray *etc.* in agriculture.

## Ready Reckoner on Production methods for Select Vegetable Crops

### Introduction:

Vegetables occupy an important place in our daily diet. For vegetarians in particular, vegetables are the only source to increase not only the nutritive value of foodstuff, but also the palatability. For a balanced diet, an adult should have an intake of 85 g of fruits and 300 g of vegetables per day as per the dietary recommendations of the nutrition specialists.

However, the present level of production of vegetables in our country can permit a per capita consumption of only 120 g of vegetables per day. Besides this, different factors like escalation in the price of agricultural inputs such as fertilizers and pesticides, and middle men's profit during the change over the wholesale to retail market have pushed up the cost of vegetables high so that a middle class family finds it extremely difficult to purchase the day to day requirement of vegetables.

### Nutritional profile of different vegetable crops:

Name of the vegetable	Energy (K. cal)	Moisture (%)	Carbohydrate (%)	Proteins (g)
Amaranthus tender	45	85.7	6.1	4.0
Brinjal (Egg plant)	24	92.7	4.0	1.4
Chilli (Green)	29	85.7	3.0	2.9
Cowpea (Vegetable)	48	85.3	8.1	3.5
French bean	26	91.4	4.5	1.7
Lady's finger/Okra	35	89.6	6.4	1.9
Onion	50	86.6	11.1	1.2
Pumpkin	25	92.6	4.6	1.4
Tomato (red)	20	94.0	3.6	0.9
Bottle gourd	12	96.1	2.5	0.2

### Brief production details on select vegetable crops

#### 1-Brinjal

Brinjal is one of the most common tropical vegetables grown in India. A large number of cultivars differing in size, shape and colour of fruits are grown in India. Immature fruits are used in curries and a variety of dishes are prepared out of brinjal. Fruits are moderate sources of vitamins and minerals like phosphorous, calcium and iron and nutritive value varies from variety to variety.

#### Soil and climate:

Brinjal is a hardy crop and it cultivated under a wide range of soils. Since a long duration crop with high yield, well-drained and fertile soil is preferred for the crop. Crops grown in sandy soils yield early and those grown in clayey soils yield more. Ideal pH for cultivation of crop is 5.5–6.6.





#### **Sowing:**

Seeds are sown in nursery bed and transplanted to main field after four weeks during summer and after 7 to 8 weeks during winter, when it is 8-10 cm tall. Depending on growth of varieties and seasons of cultivation, 300 to 500 g seeds are required for one hectare. Since brinjal seedlings grow fast, sufficient care must be taken to sow seeds as thin or loose as possible. Hardened seedlings withstand transplanting shock better and establish well in main field.

#### **Main field preparation and transplanting:**

Proper drainage is essential for growth of brinjal. Soil should be prepared to a fine tilth by 4 to 6 ploughings. FYM should be incorporated in soil at the time of final ploughing. Seedlings are transplanted in levelled land in plots of convenient size for irrigation. It may be grown on raised beds/ridges during rainy season. In undulating land, in order to avoid soil erosion, small pits are dug at the point of planting and seedlings are planted.

Spacing depends on variety, season and fertility of soil. For long duration and spreading varieties, a spacing of 75-90 cm x 60-75 cm and for bushy and non-spreading varieties a distance of 45-60 cm on either side are given. For early and less spreading varieties, paired row planting is advantages due to easiness in harvesting and other cultural operations.

#### **Special operations to improve yield and quality of produce:**

- Foliar spraying with *Pseudomonas fluorescens* 0.5 % at 15 days interval for 6 times
- Triacantanol 625 ml is mixed with 500 l of water (1.25 ppm), is sprayed on 15<sup>th</sup> and 30<sup>th</sup> days after planting.



- Planofix @ 125 ml in 500 l of water (0.25 ppm) is sprayed at 45<sup>th</sup>, 60<sup>th</sup> and 90<sup>th</sup> DAP.
- Micronutrient mixture @ 1 g/lit (0.1 %) is sprayed for 2 times at 40<sup>th</sup> and 80<sup>th</sup> days after planting.
- 19:19:19: + MN @ 1% (10 g/lit) is sprayed for 60 days after planting.

#### Harvesting and Yield:

Brinjal fruits are harvested at immature stage after attaining full size, but before losing its glossy appearance. Dullness of fruit indicates over maturity. Usually fruits are harvested along with its stalk with a slight twist by hand. In some varieties, a sharp knife is also used for harvesting fruits along with fleshy calyx and a portion of fruit stalk.

The harvested fruits are graded and packed in baskets or in loose gunny bags. They should be taken to remove the fruits affected by Phomopsis blight.

#### Bacterial Wilt in Brinjal:

Bacterial wilt is caused by *Ralstonia solanacearum*, a soil bacterium in acidic soils of Goa. Disease develops very rapidly in warm weather. Initially leaf drooping followed by wilting of entire plant within few days.



#### Disease Management:

- Plant bacterial wilt resistant varieties viz., Surya, Swetha, Arka Nidhi, Bholanath, Singhnath and Utkal Madhuri
- Treat the seeds with talc based formulation of antagonistic *Pseudomonas fluorescens* (10g/100g of seeds) and soil application of antagonistic (50g mixed with one kg of soil and incorporated in the nursery bed)
- Dip the seedlings in the antagonistic @25g of talc formulation per litre of water for 20-30 minutes before transplanting.

## 2-Chilli

Chilli is a quintessential spice in every Indian cuisine and is grown throughout length and breadth of country. Green chilli, Chile pepper, Cayenne pepper, Tabasco, Paprika, Sweet/Bell pepper, Pimentos, Serrano pepper are all derived from fruits of different species of *Capsicum*. Pungent forms are used as green chilli, whole dry chilli, chilli powder, chilli paste, chilli sauce, chilli oleoresin or as mixed curry powder. Dried fruits are extensively used as spice.

Chilli is one of the richest sources of vitamin C and its content is more than that of tomato. Fruits accumulate maximum ascorbic acid when it turns to maturity and it ranges from 100 to 320 mg per 100 g of fruits. Active principle for pungency is capsaicin and its content in Indian varieties ranges from 0.002 to 1.86 %, Capsaicin is a counter irritant. The principal colouring pigment of dried chilli is a carotenoid pigment, capsanthin. Ground powder and oleoresin are primarily used as a spice. It is utilized in food, pharmaceutical and cattle feed industries.

### Soil and climate:

Chilli withstands drought better than water logging and excess soil moisture. As an irrigated crop, chilli is best grown in sandy loam soil and as rainfed crop in black cotton soil. Ideal soil pH for cultivation is around 6.5 and growth is affected in saline soil. Chilli is a crop of warm humid tropics or subtropics and is grown from sea level to 600 m above MSL. The crop cannot tolerate frost. Compared to tomato and brinjal, chilli can tolerate shade to some extent. Medium pungent chilli, cultivated for green chilli and dry chilli purpose, prefers a temperature of 20 – 30°C for growth. Low pungent *Capsicum* prefers a lower temperature of 17–23°C.

**Variety:****Arka Suphal:**

Indeterminate with a plant height of 80-90 cm Dark green Foliage Fruits straight, smooth with pointed tip, 7-9 cm long Fruit colour green changing to deep red Yield: 25t green and 3 t dry chilli/ ha Resistant to powdery mildew and field tolerant to viruses.

**Sowing:**

1.0-1.5 kg seeds sown in an area of three cents is required to raise seedlings to plant in one hectare. Care should be taken to avoid eating away of seeds by ants. Generally, 40-45 days old seedlings are transplanted. Clipping of capsicum and chilli seedling about 10 days prior to transplanting helps to accelerate growth of auxiliary buds and results in better branching. Hardening of seedlings by regulating watering a week prior to transplanting is necessary for better establishment and survival of seedlings in main field.

**Main field preparation:**

Field is brought to fine tilth by 4-5 ploughings and harrowing. Ridges and furrows are prepared at 45-60 cm distance. 40-45 days old seedlings are transplanted in furrows or on sides ridges at 30-45 cm spacing depending on variety, season and soil. Wider spacing between rows ensures easiness in intercultural operations and close spacing within a row gives higher yield.

**Manures and Fertilizers:**

Application of 20-25 tonnes of farmyard manure and 120 kg N, 40-60 kg P<sub>2</sub>O<sub>5</sub> and 20-40 kg K<sub>2</sub>O are recommended in majority of States. Farmyard manure is applied by broadcasting at the time of final ploughing. Spot

application of farmyard manure in furrows or at the point of planting is also followed by farmers. Full dose of P and K and half dose of N is applied 10-15 days after transplanting i.e. after initial establishment of seedlings. Remaining N is applied one month after first application.

#### **Intercultivation:**

In chilli, all inter-cultural operations are aimed at conserving soil moisture, to remove weeds and to provide aeration to soil. Inter-cultivation, by way of hoeing, begins as soon as seedlings are established. In initial stages, shallow inter-cultivation is done to remove weeds and for conservation of soil moisture. In later stages, deep inter-cultivation is done by way of earthing up and making ridges and furrows. Use of herbicides along with hand weeding is practiced for weed control in chilli.

#### **Special operations to improve yield and quality of produce:**

- Foliar spraying with *Pseudomonas fluorescens* 0.5% at 15 days interval is given as biofungicide.
- Micro nutrient mixture @ 500 g/ha (0.1%) is sprayed at 40<sup>th</sup>, 80<sup>th</sup> and 120<sup>th</sup> days after planting.
- Water soluble fertilizers 19:19:19:+ MN and KNO<sub>3</sub> @ 1% are sprayed at 60 and 100 days after planting respectively.
- Triacantanol 625 ml is mixed with 500 l of water (1.25 ppm), is sprayed on 15<sup>th</sup> and 30<sup>th</sup> days after planting.
- Planofix @ 125 ml in 500 l of water (0.25 ppm) is sprayed at 45, 60 and 90<sup>th</sup> days after planting.

#### **Harvesting and Yield:**

Chilli is harvested by hand picking and harvesting extends up to two months. Farmers usually take one or two harvests for green chilli purpose even if crop is raised for dry chilli purpose. Yield of fresh green chilli is 3-4 times more than that of fresh red ripe chilli and 6-10 times than that of dry chilli.

**Pests and diseases:**

**Leaf curl complex:**

Leaf curl in chilli is caused by sucking insects like mites, thrips and aphids and by leaf curl virus. The tiny insects feed on undersurface of young leaves in large numbers and cause crinkling, defoliation and stunted growth. Spraying of neem oil-garlic mixture is recommended as a prophylactic measures for control of insects.



Reduction in size and clustering of leaves may be caused by leaf curl virus. In North India states this is a serious problem and spraying of Metaphos C(2ml/1) is recommended for control of vectors *Aphis gossypii* and *Myzus persicae*.

**Chilli mosaic:**

Vein clearing, yellowing and malformation of younger leaves are characteristic symptom of the diseases. Cultivation of resistant/tolerant varieties like Pusa Jwala, Pant C-1, Pusa Sadabahar, Ujwala, Punjab Lal etc. is effective for avoiding the crop loss.



**Dieback and anthracnose:**

Disease is caused by a soil borne pathogen, *Colletotrichum capsicii*. Initially small water soaked spots appear on fruits which later become sunken and dark in colour with numerous acervully in concentric rings. Affected fruits rot and fall down. In die back, branches show necrosis from top to down. Destruction of affected plant parts and spraying of Dithane M 45 or Bavistin (1-1.5 g/1) of water at 15-20 days interval is effective.

### 3-Tomato

Tomato is essentially a tropical vegetable. The probable origin is the Peru in the South America. The ripe fruits are used as vegetable, soup, salad and in the preparation of products such as pickles, sauce, jam and ketchup. The fruit is a rich source of vitamin A (590 microgram/100 and C (27 mg/100 g)

#### Soil and climate:

A well drained loamy soil is ideal for its growth. It comes up well in a pH range of 6.0 to 7.0. It will not perform well if the temperature goes above 35° C. Similarly its performance will not be good when the temperature goes below 15° C. Between 20° C and 25° C, this crop will exhibit its maximum potential.



#### Variety:

##### Arka Abha:

A pure line selection from IIHR 663-12-3-SB-SB (VC-8-1-2-1) from AVRDC, Taiwan. Plants semi determinate. Fruits semi oblate, with light green shoulder Fruits have stylar end scar with average fruit weight of

75g. Develops deep red color on ripening. Resistant to bacterial wilt caused by *Ralstonia solanacearum*. Bred for fresh market Suitable for both kharif and rabi. Duration 140 days Yield 43 t/ha.

#### Sowing:

Since the seeds are very small in size, they are normally sown in raised nursery beds and the seedlings are planted in the main field later on. Across the beds prepared, lines are drawn at a spacing of 2.5 cm. About 300-350 g of seeds

will be required to plant one hectare. Since the seeds of  $F_1$  hybrids are costly (Rs.15,000/- to Rs.20,000/- per kg), seeds have to be sown individually in small plastic cups or ice cream cups in which 1-2 holes are made at the bottom to ensure drainage. By this method the quantity of seeds required to raise seedlings to plant one hectare can be reduced to 70-90 g.

To protect the seeds from heavy rains, the seed beds are covered by a thin layer of straw or dried grass. The beds are then watered using rose can. About 4 cents of nursery area will be required to plant one hectare. Along the edges of the beds, BHC 10 % dust is applied to prevent ants from taking away the seeds. For  $F_1$  hybrids, the seeds are sown in plastic cups or ice cream cups filled with pot mixture and watered by rose can. At the time of transplanting the seedlings can be lifted from these cups along with ball of earth and placed in small pits formed on one side of the ridges without exposing the naked roots. This will help for cent per cent establishment of hybrid seedlings in the main field.

The seeds germinate in about seven to eight days. After germination, the straw cover is removed and the beds can be irrigated directly. To avoid damping off disease, the seed beds have to be drenched with copper oxychloride solution (2.5 g/lit). Twenty days after sowing 1.6 kg of Furadan granules are applied in lines between the rows of seedlings as a prophylactic measure to kill the thrips which transmit the virus, causing the dreaded disease. "Tomato Spotted Wilt" in this crop. This chemical protects the seedlings from other sucking pests also. The seedlings are ready for transplanting in about 25-30 days after sowing.

**Main field preparation:**

The field is ploughed three or four times. At the last ploughing 20-25 tonnes of farmyard manure has to be applied. Ridges and furrows are formed at spacing of 60 cm.

**Manures and fertilizers:**

The quantity of nutrient uptake varies from variety to variety as well as between variety and hybrids. The hybrids require more amount of nutrients

to express their full yield potential. The nutrient requirement for varieties is 150:100:50 kg of NPK/ha and for hybrids is 250:250:250 kg of NPK/ha. Fifty per cent of the N is applied along with full dose of P and K as basal dressing.

#### **Intercultivation:**

The plants are given a hoeing and then earthed up 30-35 days after transplanting. Just before earthing up, the remaining 50 percent nitrogen is applied as top dressing, mixed with the soil and the plants earthed up. Immediately after earthing up, the field is copiously irrigated. Foliar application of 0.1 % CaCl<sub>2</sub> during fruit set and maturity can help to prevent fruit cracking.

#### **Special operations to improve yield and quality of produce:**

- Foliar spraying with *Pseudomonas fluorescens* 0.5 % at 15 days interval for 6 times.
- Triacntanol 625 ml is mixed with 500 l of water (1.25 ppm) and sprayed on 15<sup>th</sup> and 30<sup>th</sup> days after planting.
- Planofix @ 125 ml in 500 l of water (0.25 ppm) is sprayed at 45,60 and 80<sup>th</sup> days DAP.
- Micronutrient mixture @ 1g/lit (0.1 %) is sprayed for 2 times at 40<sup>th</sup> and 80<sup>th</sup> days after planting.
- 19:19:19+MN @ 1% (10 g/lit) is ksprayed at 60 days after planting.

#### **Harvest and Yield:**

The fruits are harvested at breaker stage (when ¼ of the surface shows ripening symptom), packed in baskets and sent to markets. For ready consumption and local markets, they can be harvested after full ripening. The yield ranges from 15 to 35 tonnes/ha in the case of varieties and 60-80 tonnes/ha in the case of F<sub>1</sub> hybrids.



#### 4-Amaranthus

It is a leafy vegetable which can be grown throughout the year. The leaves and succulent stems are good sources of iron (305 mg/100 g) calcium (397 mg/100 g), vitamin A (8340 micro gram/100 g) and vitamin C (99 mg/100 g). India is considered to be the native home of this crop. Commonly cultivated species for use as leafy vegetable are *Amaranthus tricolor*, *Amaranthus dubius*, *A. tristis* (*A. tricolor* var. *tristis*). There are certain species like *A. hypochondriacus*, in which the seeds are edible which are different from the leafy amaranthus seeds in colour. In leafy amaranthus the seed colour is black while in grain amaranthus, the seed colour is sandal yellow. The grain amaranthus is a rich source of protein and essential amino acids like lysine, leucine, isoleucine etc., which are required for growth of children.

##### Soil and climate

It is adapted to a wide range of soil conditions. But sandy loam with slightly acidic nature is the best suited. Heavy clay and sand are not preferred. Most of the leafy species are adapted to tropical conditions. A temperature range of 20° to 30°C is preferred for better vegetative growth. The grain amaranthus are adapted to both tropical and temperate conditions while the leafy ones are best grown in the plains.

##### Variety:

##### Arka Arunima:

This variety has been developed by pure line selection (IHR - 49). It is identified by IVIC in 1998. It is a multi-cut variety and about 3 cuttings can be taken without



the stem being fibrous. It has broad, succulent and purple leaves and stem. It is resistant to white rust under field conditions. Yields about 26-28t/ha over a period of 60 days. It has low oxalate and nitrate contents. It has got excellent cooking quality and is rich in dry matter content, protein and minerals like Potassium.

**Sowing:**

Though the seeds are very small, since the crop duration especially for green matter production is very short, the seeds are normally sown directly rather than resorting to raising seedlings and transplanting them. A quantity of 2 kg of seeds would be required to sow one hectare. The seed is mixed with 20 kg of fine sand and 5 kg of BHC 10 % dust and then the same is uniformly broadcasted on the beds prepared. The seeds are covered by sprinkling a thin layer of sand or soil. The borders of the beds are applied with BHC 10 % dust to protect the germinating seeds from ants. The seeds germinate in 5-7 days.

**Main field preparation:**

The field is ploughed 2-3 times and beds and channels of 2.0 x 1.2 m are formed. At the last ploughing, 10 tonnes of Farm yard manure is applied per hectare.

**Manures and fertilizer:**

For CO 1 and CO 2, a combination of 50:50:20 kg of NPK/ha is applied as basal dose. But for a clipping type like CO 3, a higher fertilizer dose of 60 kg of N, 50 kg of P and 25 kg of K is recommended. The nitrogen has to be applied in two split doses. The first half as basal (before sowing) and the second half as top dressing eight weeks after sowing (after 5<sup>th</sup> clipping).

**Intercultivation:**

The first irrigation is given immediately after sowing and then the field is irrigated on the 3<sup>rd</sup> day. Subsequent irrigations are given once in a week. The irrigation water should be allowed slowly and steadily, as rapid water flow

may wash off the seeds to one end of the bed resulting in the uneven stand of the crop.

#### **Harvest and Yield:**

In green types, the plants have to be pulled out with the roots on 25<sup>th</sup> day of sowing (CO 1 CO 2). In clipping types like CO 3, the first clipping can be had on 25<sup>th</sup> day of sowing and further clippings repeated once in a week up to 90<sup>th</sup> day. In grain amaranth (*A. hypochondriacus*), the plants are thinned to have a spacing of 30 cm x 30 cm on 25<sup>th</sup> day and they are allowed to flower. The crop will be ready for harvest in 80-120 days depending on the variety and season. The dried spikes are threshed to separate the grains which are used to prepare popped grain, gruel, cakes and other preparations like amaranth malt.

#### **Pest and diseases:**

The tender leaves and stems being the economic part to be harvested within 25-30 days (except clipping type where it can be retained up to 90 days) normally no insecticides are recommended. But if pests like the leaf webber or caterpillars occur, Malthion 1.5 ml/lit is sprayed. Similarly if the white rust is very severe Indofil M-45 has to be sprayed @ 2 g/lit. it is advisable to take up the harvest only a week after the insecticide application.

### 5-Vegetable Cowpea

Though cowpea is mainly cultivated as a 'pulse' crop in which the fully matured grain or seed is the economic part, in some types the pods do not form much fibre and so they are harvested at tender stage and used as vegetable. Hence, all cowpea varieties cannot be used as vegetable cowpea. Cowpea is a native of Central Africa.

#### Soil and climate:

Being a warm season crop, it cannot tolerate very low temperature. Though it can be cultivated during kharif and summer season, it cannot withstand very heavy rains. Heavy rains especially during flowering and fruit set is deleterious. With regard to day length and temperature, different varieties respond differently. Certain varieties are found to adapt to grow in summer, while certain other varieties can grow only during kharif season. It is adaptable to a wide range of soil conditions.

#### Variety:

##### Arka Garima:

Derivative of the cross T.U.V.762 x *Vigna unguiculata* sub sp. *sesquipedalis*. Developed by back cross and pure line selection. Plants tall, vigorous, bushy, with small vines and photo insensitive. Leaf colour light green. Flower colour purple.



Pods light green, long, thick, round, fleshy and string less. Suitable for vegetable purpose. Tolerant to heat, drought and low moisture stress. Duration 90 days. Pod Yield 18 t/ha.

**Sowing:**

A quantity of 15 kg of seeds would be required to sow one hectare. The seeds are either broadcast or sown behind the country plough or drilled at 2–3 cm depth at a row spacing of 45–60 cm. Then beds and channels of convenient size are formed and field is irrigated. After germination of the seeds, the seedlings are thinned to 10–15 cm space in between plants in the rows.

**Main field preparation:**

The field is ploughed 3 to 4 times. Twenty five tonnes of FYM is applied at the last ploughing.

**Manures and fertilizer:**

A quantity of 20 kg of N, 60 kg of P and 60 kg of K per hectare, has to be applied just before sowing and mixed with the soil.

**Intercultivation:**

The weeds should be effectively controlled in first 25–30 days. By that time the crop will cover the soil surface. Life irrigation has to be given on third day of sowing and then it is continued once in a week or days.

**Harvesting and yield:**

The tender pods can be harvested from 40–50 days after sowing and continued once in 5–7 days. The tender green pod yield ranges from 5–8 tonnes/ha.

**Pests and diseases:**

Aphids and jassids can be controlled by spraying demethoate @ 1 ml/lit. By this we can control the spread of cowpea mosaic virus disease and Bean yellow mosaic virus (BYMV) since aphids act as vector for the spread of the virus. To control anthracnose, seeds are to be treated with 0.125 % solution of Ceresan. Powdery mildew can be controlled by spraying wettable sulphur @ 2 g/lit.

## 6-Okra

This is commonly known as lady's finger. It is a tropical direct sown vegetable with a short duration of 90-100 days. South Africa or Asia is supposed to be the centre of origin of this crop.

### Soil and climate:

A well drained deep soil is ideal for its growth. It grows very well in a pH range of 6.0 to 6.8 and does very well in humid tropics with a temperature range of 25-30°C. The best season for growing bhendi is from June to August. The seeds can also be sown during July and the harvest can be completed before October rains.



### Variety:

#### Arka Anamika (IIHR Sel.10):

This is yet another variety developed at Indian Institute of Horticultural Research, Bangalore through the same interspecific hybridization in which the previous variety was isolated. It shows very high degree of resistance to yellow vein mosaic disease and hence suitable for growing during summer season. It has a yield potential of 12-13 tonnes/ha during summer and 16-18 tonnes/ha in kharif. The fruits are dark green in colour and longer than Arka Abhay. Duration is 120-135 days.

**Sowing:**

Seed treatment with biofertilizer like *Azospirillum* can economise the use of inorganic form of nitrogen. To sow one hectare 7-8 kg of seeds will be required. This can be treated with 2 kg of *Azospirillum* culture. First the seeds are mixed with required quantity of supernatant fluid (Kanji) obtained in cooking the rice. The temperature of this fluid should be mild and should not be too high. By this a thin coating of the rice cooked fluid is formed on the surface of the seed. Then 2 kg of *Azospirillum* culture is sprinkled uniformly over this and stirred thoroughly so that a thin lining or layer of the *Azospirillum* culture is formed over the seed cover. The seeds are dried in shade for half an hour and then sown on one side of the ridges at the rate of 2 seeds/hill, spaced at 30 cm.

**Main field preparation:**

The field should be ploughed four to five times. At the last ploughing 25 tonnes of farm yard manure/ha is applied and incorporated. Ridges and furrows are formed at 45 cm interval.

**Manures and Fertilizer:**

As basal dressing, 20 kg of Nitrogen (45 kg of urea) 50 kg of Phosphorus (300 kg of super phosphate) and 30 kg of Potash (50 kg of Muriate of potash) are applied along one side of the ridges as band application and mixed with the soil.

**Intercultivation:**

A pre-emergence application of 1 kg of Fluchloralin or 0.75 kg of metalachlor/ha on third day of sowing using 500 litres of water will help to control effectively the early emerging weeds. Manual weeding and hoeing is done on 25<sup>th</sup> day. On 30<sup>th</sup> day, 10 kg of nitrogen (22 kg of urea) is applied in biofertilizer has been applied basally. Otherwise, 20 kg of Nitrogen (44 kg of urea) has to be applied. The fertilizer is applied as a band 10 cm away from the plants mixed with the soil and the plants are earthed up and irrigated. The second earthing up is given 65 days after sowing. Foliar application of 10% solution of coconut milk (tender coconut) at fortnightly interval from 30

days after sowing can help to increase the yield as well as to delay the formation of fibre in the developing fruits.

**Special operations to improve yield and quality of produce:**

- Foliar spray of *Pseudomonas fluorescens* is applied @ 0.5 % at 15 days interval for 6 times
- Micronutrient mixture @ 1 ha/lit (0.1%) is sprayed for 2 times at 40<sup>th</sup> and 60<sup>th</sup> days after planting.
- 19:19:19: + MN 1 % (10 g/lit) is sprayed at 60 days after planting.

**Harvesting and yield:**

Bhendi comes to harvest 45 days after sowing. The tender fruits should be harvested on alternate days. Since the pods get matured very quickly, the selection of pods with maximum size but still tender is a very important point to be taken into consideration. A total number of 15-18 harvests can be made. The yield varieties from 10-15 tonnes/ha depending upon the variety and season.

**Pest and diseases:**

**Management Of Yellow Vein Mosaic Disease And Its Vector White Fly:**

It is a serious disease of bhendi. The veins of the leaves will be cleared by the interveinal area becomes completely yellow or white. The affected plants produce fruits with yellow or white colour and they are not fit to be marketed. The virus is spread by whitefly (*Bemisia tabaci*). It can be controlled by application of chlorpyrifos 2.5 ml + neem oil 2 ml/lit of water. On no account synthetic pyrethroids should be used because it will aggravate the situation. For sowing during the summer season, when the whitefly activity is high, the susceptible varieties should be avoided. By selecting varieties resistant to yellow vein mosaic like Parbhani Kranti, Arka Abhay (IIHR Sel.4) Arka Anamika (IIHR Sel.10) Co 3 and Varsha Uphar, the incidence of the disease can be minimised. Even in these varieties, when a plant starts exhibiting symptom of the disease, it should be pulled out immediately and burnt by which the spread of the disease can be prevented.



## 7-French Bean

South America is the probable origin for this crop and the tender pods as well as fully matured grains (beans) are used as vegetable.

### Soil and climate:

It is a cool weather crop but does not tolerate frost at the same time very high temperature also. The optimum temperature is 15°C-21°C. Based on the day length, beans are classified as long day, short day and day neutral groups. However, most varieties are day neutral. Based on the growth habit, the bean varieties are grouped as pole beans (which are indeterminate and grow as vines on the support such as pole), bush bean (which have a determinate bushy growth habit and do not require support) and semivine (which are short day plants). Sandy loam soils with a pH range of 5.5-6.0 are ideal for the best plant growth and pod development. Extremely acidic and alkaline soils are unsuitable.

### Variety:

#### Arka Suvidha:

Pedigree selection from the cross Blue Crop x Contender. Resistant to rust Plants bushy and photo insensitive. Pods straight, oval, light green, fleshy, stringless and crisp. Duration 70 days. Pod Yield 19t/ha.



### Sowing:

In plains, ridges and furrows are formed 60 cm apart and the seeds are sown in one side of the ridges at a spacing 10 cm. The seeds have to be dibbled with hand at a depth of 2-3 cm. Three to four seeds are sown at each hill and then thinned to two seedlings. For this, a quantity of 85 kg of seeds would be required to sow one hectare. In hills, the seeds are sown in flat beds formed across the slopes.

**Main field preparation:**

The field is ploughed 3-4 times and 20 tonnes of FYM/ha is applied at the last ploughing.

**Manures and fertilizer:**

A quantity of 50 kg of N, 60 kg of P and 25 kg of K has to be applied per hectare, N, P, K are mixed and applied as band 6 cm away from the seed line. In very acidic soil, a basal application of 400 kg of lime is recommended for increased yields. In plains, nitrogen is split into two equal halves and applied as basal at the time of sowing and as top dressing at the time of flowering.

**Intercultivation:**

In pole type as the vine grows it requires staking. In bush types no staking is required. A pre-sowing application of Basalin @ 2 lit/ha will check the weed growth for 20-25 days. A shallow hoeing is done 35 days after sowing and the plants are earthed up.

**Harvesting and yield:**

The pods have to be harvested when they are tender and fleshy before the formation of fibre. The yield of tender pods vary from 9-10 tonnes/ha in bush type and 12-15 tonnes/ha in pole type.

**Pest and diseases:**

To control aphids systemic insecticide like dimethoate is recommended @ 1 ml/lit. For the control of pod borer, spraying the crop with carbaryl 50 % WP @ 2 g /lit is recommended. Powdery mildew can be controlled by dusting sulphur. To control anthracnose, seeds have to be treated with 0.1 % solution of Ceresan for half an hour. The plants can be sprayed with Indofil z-78 @ 2 g/lit.

## 8-Pumpkin

### Soil and climate:

Pumpkin requires a deep well drained loamy soil. It can also be cultivated in clay soil under rainfed condition. The best pH would be 6.0-7.0. The plants can be grown successfully between a temperature range of 25°C-30°C. When the temperature goes beyond 40°C, the plants are affected by cucumber mosaic virus. If this virus disease appears at very early stage of crop growth, then the fruit set is badly affected. When the temperature goes below 15°C also, the growth of the plant will be very slow and the yield goes down. It does not tolerate frost.



### Variety:

#### Arka Chandan:

A pure line selection from (IIHR-105) Rajasthan. Vigorous vines, green broad leaves without any pattern. Stem hairy. Fruit round with pressed blossom end. Rind colour green with white patches when immature which turns to light brown colour with self colored patches. Thick orange flesh, solid cavity. Fruit weight 2-3

kg. Rich in carotene (3331 iu of carotene/100g flesh) Duration 115-120 days. Yield 33 t/ha.

### Sowing:

Seed rate is 1-1.5 kg/ha. The seeds have to be treated with 2 g of Thiram. In each pit, five seeds are sown and the pits are pot-watered. On the third day, again these pits are pot-watered. The seeds germinate in 7-8 days. After germination, 2-3 healthy seedlings are left in each pit and the other seedlings

are thinned out. After germination of seeds, the pits can be irrigated through channels, once in a week.

**Main field preparation:**

The field is ploughed four or five times and pits of the size 45 cm x 45 cm x 45 cm can be dug at a spacing of 2 m in rows spaced at 2.5 m. The pits can be filled with a mixture of farm yard manure ( 10 kg) and top soil and then 100 g of fertilizer mixture No.6 has to be applied and mixed with the soil. Along these lines long channels of 60 cm width are formed.

**Manures and fertilizer:**

30 days after sowing, 50 g of urea is applied for each pit and mixed with soil. The plants are irrigated immediately.

**Intercultivation:**

Weeding and hoeing are done 2-3 times once in 15 days.

In most of the cucurbits the flowers are unisexual and the male and female flowers are borne separately on the same plant. So the yield of the crop depends on the number of female flowers produced. Ethrel is a growth regulator which can increase the production of female flower in the plants thereby helps to increase the yield. The recommended concentration is 250 ppm (viz 2.5 ml of ethrel in 10 lit. of water). The first spray has to be given when there are two true leaves (15 days after sowing). This is repeated once in a week for 3 more times.

**Harvesting and yield:**

In pumpkin, the first harvest starts from 85-90 days after sowing. Fully matured fruits have to be harvested after the skin colour has turned completely brown from green colour and the pedicel ( fruit stalk) separates from the vine. The yield varies from 20-30 tonnes/ha in a crop duration of 120-140 days. In summer squash unlike pumpkin, the fruits are harvested when they are at one third maturity (tender). The yield ranges from 40-50 tonnes/ha in a crop duration of 85-90 days. In winter squash also, tender fruits are harvested. The yield ranges from 15-25 tonnes/ha in 75-90 days.

### 9-Bottle Gourd

It is a common vegetable cultivated in northern states of the country. The tender green fruits are used as vegetable. The hard shell is used as domestic utensils such as water jug. It is an annual vine trailing on the ground. The fruits vary in shape. It is a very hardy crop and withstands drought condition. It cannot be grown when there is frost. The optimum pH is 6 to 7. It can be grown in a wide range of soil.

#### Soil and climate:

Bottle gourd is a typical warm season vegetable. Though crop tolerates cool climate better than musk melon and water melon, it cannot tolerate frost. Well drained fertile silt loam is ideal for cultivation of bottle gourd. Crop is quite suitable for river bed cultivation because of its deep tap root system. A deep soil supports vines for a long period.

#### Variety:

##### Arka Bahar:

It is a long type developed at IIHR, Bangalore. The special feature is that it is without crook neck. It is an export oriented bottle gourd variety. It was evolved thorough pureline selectin from a local collection (IIHR 20). Fruits are straight, devoid of crook neck medium size each weighting about 1 kg of the marketable stage. Skin light green and shining, flesh is tender with pleasant aroma. It can be packed easily for distant markets. It yields 40-45 tonnes/ha in 120 days.



**Sowing:**

In each pit 4-5 seeds are sown and irrigated. Three to four kg of seeds would be required to sow one hectare.

**Main field preparation:**

The field is ploughed 3-4 times and 10 tonnes of FYM/ha is applied at last ploughing. Then channels of 60 cm width are formed at a distance of 2.5 m. On the inner side of these channels at the raised area, the soil is dug in an area of 45 cm – to the depth of 45 cm and the soil is loosened at a spacing of 2.5 m.

**Manures and fertilizer:**

A quantity 50 g of fertilizer mixture number 6 (6:12:12) is applied and mixed with the soil. In each pit 4-5 seeds are sown and irrigated. Three to four kg of seeds would be required to sow one hectare.

**Intercultivation:**

Two hoeing and weeding have to be done 20 days after sowing and again 40 days after sowing. The vines can be allowed to spread on the inter space of the two channels. Top dressing can be done with 20 kg N/ha on 40<sup>th</sup> day of sowing. Normally the vines are allowed to trail on the soil surface. But during rainy season they are staked on thin bamboo poles as otherwise when the fruits come in contact with wet soil, they rot.

**Harvesting and yield:**

The fruits are harvested when they attain sufficient size but still tender which is tested by piercing the nail of the skin. Over matured fruits need not be harvested and allowed to remain on the vine so that they can be used for seed multiplication for the next season crop. The average yield will be 25-30 tonnes/ha.

## 10-Onion

### Soil and climate:

Though it is a tropical crop, it can be cultivated under a wide range of climatic conditions. The best performance can be obtained in a mild weather without the extremes of cold and heat and excessive rainfall. The optimum temperature is 13°C to 24°C before bulbing and 16°–21°C during bulbing.

### Variety:

#### Arka Niketan:

It possesses globe shaped attractive light pink coloured bulbs. It has high TSS (13-14 per cent) and pungency and it is suitable for growing both in kharif and rabi seasons. It has a yield potential of 41 tonnes/ha in 145 days after transplanting.



**Sowing:**

A quantity of 8 kg of seeds would be required to be sown in an area of 12.5 cents (500 square metres) to plant one hectare. Raised beds of convenient length and width are formed and these beds are inoculated with Vesicular Arbuscular Mycorrhizae @ 1 kg/sq.metre. The seeds are then treated with *Azospirillum* @ 100 g/kg of seeds, sown in lines at a depth of 1-2 cm and covered with top soil. These beds are then covered with straw or dried grass and watered by rose can. The seeds germinate in 7-8 days. Then the straw mulch is removed and the seeding are irrigated. They will be ready for transplanting in 45-50 days after sowing.

**Main field preparation:**

The field is ploughed 4-5 times and 25 tonnes of FYM is applied at the last ploughing. Along with this a quantity of 50 kg of Zinc sulphate or ferrous sulphate is applied and ploughed. Then beds and channels of convenient sizes or ridges and furrows are formed at a spacing of 30 cm. The seedlings are planted on both the sides of the ridges at a spacing of 10 cm between plant to plant along the rows.

**Manures and fertilizer:**

Just before transplanting, the basal dose of N,P and K is applied on both the sides of the ridges (30 kg N, 60 kg P and 30 kg K per hectare). On 30<sup>th</sup> day 30 kg of N/ha is applied as top dressing. For rabi onion the response has been found up to 200 kg N/ha in a recent study conducted at APAU, Hyderabad. In this 50 kg of N has to be given as basal dose along with 30 t FYM+80 kg of P and 50 kg K. On 20<sup>th</sup> and 40<sup>th</sup> day of transplanting 50 kg of N/ha has to be applied. On 60<sup>th</sup> day 50 kg N+50 kg K/ha have to be applied.

**Intercultivation:**

Deep tillage is not recommended since it is a shallow rooted crop. Irrigation is necessary at the time of planting, again on 3<sup>rd</sup> day and then once in a week. The critical stage is bulb formation stage and there should not be any moisture stress during the period. Otherwise the yield will be drastically reduced.



#### Harvesting and yield:

In order to increase the harvest quality of onion, irrigation should be stopped 15 days before harvesting and sprayed with 500 ppm (500 mg/lit) of Maleic Hydrazide. This will prevent sprouting of the bulbs in storage by which they can be stored even for 6-7 months. Onions should be harvested one week after 50% top fall. After lifting the bulb the tops should be cured in shade for 10-15 days before storage to remove field heat. If the produce is meant for export, then proper sorting and grading should be done according to grade specifications of the importing country. The bulbs should be stored in a well ventilated room.

#### Pest and diseases:

To control onion thrips which causes tip drying, systemic insecticides like Dimethoate or Methidathion is sprayed @ 1 ml/lit. Onion smut is a fungal disease which appears as elongated dark areas at the base of the seedling. Raised black lesions appear near the base of the scales on plants and start entering into bulbs. It can be controlled by spraying Bavistin 0.1 per cent. Bacterial soft rot (*Erwinia* sp.) can cause considerable loss in storage. It usually begins at the neck of the bulb, later the bulb loses its firmness and gives an offensive smell. Application of streptomycin @ 0.02% 30 and 20 days before harvesting and proper drying can help to minimise the storage loss.

### Abstract of information on vegetable production

Crop	Seed rate (g/10 sq.m.)	Spacing	Fertilizer (g/10 sq.m.)			Duration days	Yield (kg/10 sq.m.)
			N	P	K		
Tomato	0.4	75 x 60 cm	150	100	50	135	35-40
Brinjal	0.4	75 x 60 cm	100	50	30	150	30-35
Chillies	1.0	30 x 30 cm	75	35	35	200	2
Bhendi	8.0	45 x 30 cm	40	50	30	100	15
Amaranthus	2.5	15 x 15 cm	75	25	25	25-45	10
Bellary onion	1.0	45 x 10 cm	150	150	75	130	18
Bottle gourd	3.0	2.5 x 2.0 cm	16	12	12	100	15
Pumpkin	1	2.5 x 2.5 m	16	12	12	150	25
Cowpea	20	45 x 45 cm	25	15	20	100	15
French beans	80	45 x 10 cm	100	100	50	90	15

#### For further reading...

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*Flower bud initiation in Lady's finger*



*Notes...*

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