

## ONION (*Allium cepa*)

Onion is one of the most important commercial vegetable crops in India. Maharashtra, Gujarat, Uttar Pradesh, Orissa and Andhra Pradesh are the major onion growing states. The total annual area is estimated to be about 3 lakhs hectare and production is about 35.37 lakh tonnes. It is grown mainly in rabi season. Three crops viz., Kharif, late Kharif and rabi are taken in Nasik division of Maharashtra whereas

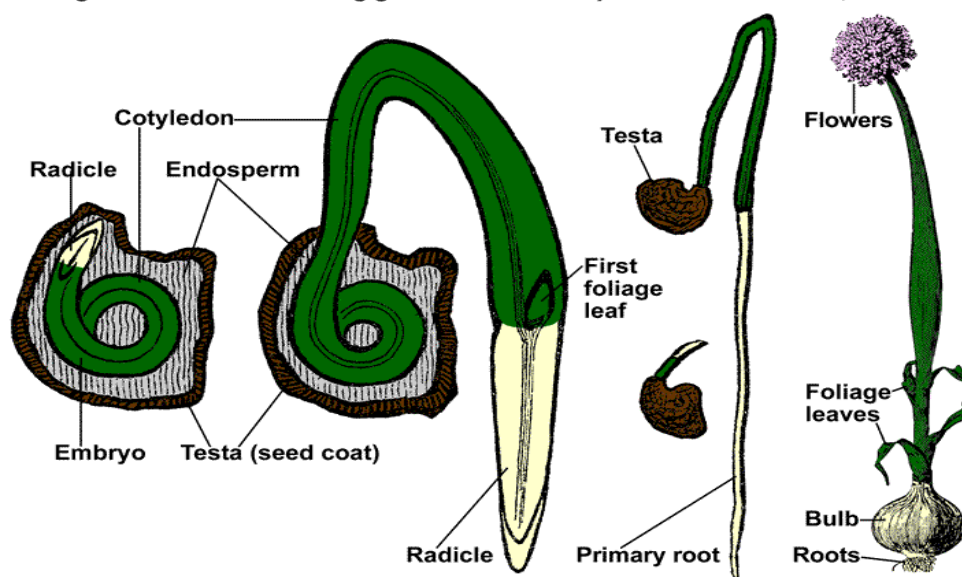


Gujarat, Andhra Pradesh, Rajasthan, Punjab, Haryana, Madhya Pradesh, Karnataka and Tamil Nadu take up two crops that is Kharif and rabi. Kharif onion is a recent introduction in Northern, Eastern and Central India.

### Botany

Onion is the biennial crop and takes two full seasons to produce seeds. In the first year bulbs are formed and in the second year stalks develop and seed are produced. It is [a long-day plant](#). The day length influences bulb onion, but has little effect on induction of seeding. It appears to be [day-neutral](#) for seed production. It requires cool conditions during early development of the bulb crop and again prior to and during early growth of seed stalk. Varieties bolt readily at 10 to 15 degree C. In the early stages of growth, a good supply of moisture is required and temperatures should be fairly cool. During bulbing, harvesting and [curing](#) of seed, fairly high temperatures and low humidity is desirable. Seed production is widely adapted to temperate and sub-tropical regions.

Seed germination and seedling growth of *Allium cepa*



Stages of seed production : BS – FS - CS

### Varieties

<b>A.</b>	<b>RED</b>	
1.	Punjab Selection	PAU, Ludhiana
2.	Pusa Ratna	NBPGR, New Delhi
3.	Pusa Red	IARI, New Delhi
4.	Pusa Madhavi	IARI, New Delhi
5.	N-2-4-1	MPAU, Rahuri
6.	Arka Niketan	IIHR, Bangalore
7.	Arka Kalyan	IIHR, Bangalore
8.	Agrifound Dark Red	NHRDF, Nasik
9.	Agrifound Light Red	NHRDF, Nasik
<b>B.</b>	<b>WHITE</b>	
1.	N-257-9-1	MPAU, Rahuri
2.	Pusa White Round	IARI, New Delhi
3.	Pusa White Flat	IARI, New Delhi
4.	Punjab-48	PAU, Ludhiana
<b>C.</b>	<b>Aggregatum Onion</b>	

1.	CO 5	TNAU, CBE
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- Bellary Red, Rampur local, and Kalyanpur,

### **Season**

The optimum sowing season is middle of June to Middle of July in the plains.

### **Isolation Requirements**

Onion is largely cross-pollinated crop with up to 93 per cent natural crossing but some self-pollination does occur. It is chiefly pollinated by honey-bees. For pure seed production, the seed fields must be isolated from fields of other varieties of onion and fields of the same variety not conforming to varietal purity requirements for certification atleast by 1000 metres for foundation seed production and 500 metres for certified seed production.

### **Method of Seed Production**

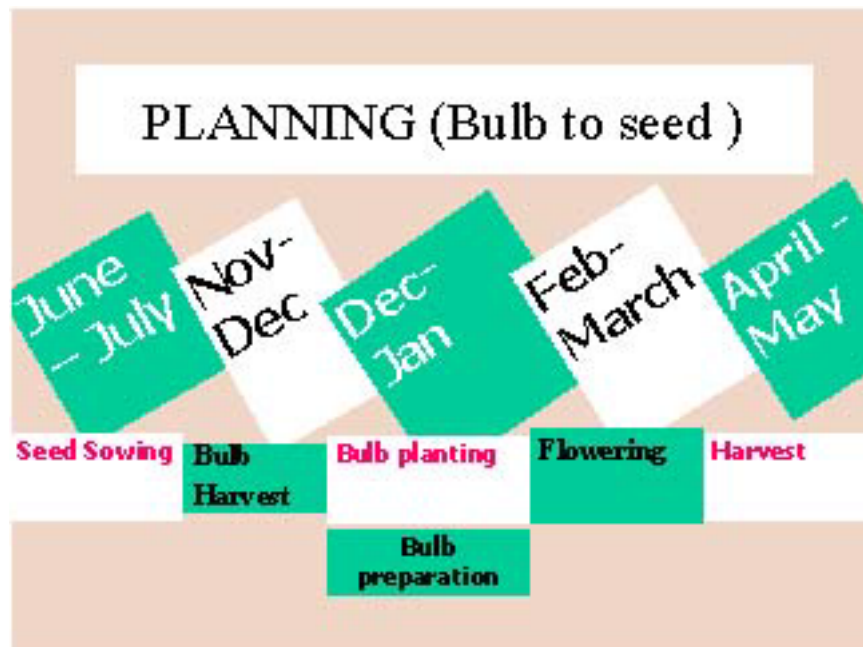
There are two methods of seed production

1. **Seed to seed method:** In this method, the first season bulb crop is left to over-winter in the field so as to produce seed in the following season.

2. **Bulb to seed method:** The bulbs produced in the previous season are lifted, selected, stored and replanted to produce seed in the second year.

Mostly the bulb to seed method is used for seed production because of the following advantages over the seed to seed method.

- a) It permits selections of "true-to-type" and healthy bulbs for seed production.
- b) Seed yields are comparatively very high. The seed to seed method, however, can be practiced for varieties having a poor keeping quality.



## **Bulb to seed method**

### **A. Bulb Production stage**

#### **a) Climatic requirement**

Though it is possible to produce bulbs in different climatic conditions, mild climate is reported to be very good. For better bulb production a temperature of 15.5 to 21°C and about 70% relative humidity required.

#### **b) Land requirement**

Fields in which onion was grown should be selected unless it was of the same variety and was certified. The onion can be grown on various types but it grows best in soils which are able to retain moisture for longer time. Heavy soils do not permit proper bulb development and many times bulbs are misshapen. 6-8 pH range are considered better for onion.

#### **c) Isolation requirement**

Onion is highly cross pollinated crop with upto 93% natural crossing. It is mostly pollinated by honeybees. For pure seed production the seed fields must be isolated from field of other varieties of onion of the same colour at least by 1000

meters for foundation seed and 500 m for certified seed. The isolation distance between colour particularly white and red colour must be much more which needs to be decided.

**d) Seed rate**

8-10 Kg per hectare

**e) Sowing and transplanting time**

Season	Sowing	Transplanting
Kharif	June-July	July-August
Rabi	Oct-Nov	Dec-Jan



In kharif 6-7 weeks old seedling and in rabi 8-9 weeks seedlings should be transplanted. Over aged [nursery](#) should not be planted otherwise premature bolting may be there.

**f) Manures and fertilizers**

FYM	50 tonnes
CAN	400Kg
Or	
Urea	200kg
Super phosphate	300 Kg
Muriate of Potash	100 Kg

Nitrogen should be applied as basal and top dressing in two splits. Top dressing may not be delayed otherwise thick necks may be a problem.

**g) Spacing**

15 x 10 cm. More spacing between plants results in thick necked plants.

**h) Irrigation**

Irrigation should be given at fortnightly interval or weekly interval as the case may be. Field should not be left dry for long otherwise splitting problem is more.

### **i) Weeding**

2-3 weeding and hoeings are done. Stomp @ 3.51 / ha may be applied 3 days after transplanting to manage the weeds economically. One weeding by hand is, however, necessary.

### **j) Plant protection**

Malathion @ 0.1% along with tritone against thrips. 4-5 spraying may be necessary. Indofil M45 @ 0.25% along with tritone against purple blotch and stemphylium blight, 5-6 sprayings may be done.

### **k) Roguing**

Remove off type plants on difference in colour of leaves or plant type. Remove resprouted plants or premature bolters.

### **l) Harvesting**

Harvesting the crops one week after 50% of tops falling and keep in windrow upto 3-5 days for field curing. After that bulbs are cured in shade to remove fields heat before keeping in store. In kharif bulbs are ready for harvesting within 90-100 days after transplanting while tops are still erect. Bulbs are allowed for field curing upto 3-5 days then again cured were in shade or in field depending upon the temperature for 12-15 days. Tops are cut leaving 2.5 cm neck.



## **B. Seed Production Stage**

### **a) Selection of bulb**

True to type bulbs are selected based on colour, size and shape kept in ventilated storage in rabi crop and in kharif crop bulbs are planted after curing for 15 days. 4-6 cm size bulbs are selected for getting good crop.



### **b) Climate**

Conditioning of plants / bulbs is necessary for seed stalks formation. Temperature of 4.5<sup>o</sup>c to 14<sup>o</sup>C are favourable for this conditioning. Longer this prevails, more stalks each plant will produce and more flowers will be in each umbel. Low humidity gives good seed development. While plants are in flowering clear bright sunny days are necessary for good insect activity.

### **c) Bulb rate**

25 quintal / ha

### **d) Spacing**

45 x 30 cm

### **e) Fertilizer and manures**

200 kg urea / ha.50% as basal and rest as top dressing

300 Kg super phosphate (single) / ha

100 Kg muriate of potash / ha

#### f) Irrigation

Irrigation at an interval of 15 days in winter and 7-10 days in summer is necessary for proper seed development. Fields should not be kept saturated for long as this facilitates development of diseases.

#### g) Rouging

Remove plants based on foliage, colour inflorescence and flower characters.

#### h) Plant protection

- 1) Spray Indofil M45 @ 0.25% against purple blotch and **stemphylium** blight.
- 2) Endosulfan @ 0.20% against thrips and head borer.

#### i) Harvesting and curing

When capsules become brown and seeds inside become black the umbels are then cured and dried.





**j) Threshing and cleaning**

Threshing is done manually. Pre-cleaning is done by brushing machine and scalper. Cleaning and grading are done by Air screen cleaner by using 1/14x1/2 as grading screen and then upgrading is done by gravity separators.



**k) Drying and Packing**

Seeds are dried upto 6-8% moisture depending upon packaging requirements. If seeds are required to be packed in Aluminium foil and other moisture proof containers, seed are dried upto 6% otherwise upto 8%.

## I) Seed yield

5-7 q / ha

## Certification Standards

### I. Field Standards

#### A. General requirements

##### 1. Isolation

Onion seed fields shall be isolated from the contaminants shown in column 1 of the Table below by the distance specified in columns 2,3,4 and 5 of the said Table:

Contaminants	Minimum distance (meters)			
	Mother bulb production stage		Seed Production stage	
	Foundation	Certified	Foundation	Certified
	2	3	4	5
Fields of other varieties	5	5	1000	500
Fields of the same variety not conforming to varietal purity requirement for certification	5	5	1000	500

#### B. Specific requirements

Factors		Maximum permitted	
		Foundation	Certified
*	Bulbs not conforming to the varietal characteristics	0.10% (by number)	0.20% (by number)
*	Off types	0.10%	0.20%

*			
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\* Maximum permitted at second inspection at mother bulb production stage.

\*\* Maximum permitted at and after flowering at seed production stage.

## II. Seed Standards

Factors	Standards for each class	
	Foundation	Certified
Pure seed (minimum)	98.0%	98.0%
Inert Matter (maximum)	2.0%	2.0%
Other crop seed (maximum)	5 / Kg	10 / Kg
Weed seeds (maximum)	5 / Kg	10 / Kg
Germination (minimum)	70%	70%
Moisture (maximum)	8.0%	8.0%
For vapour-proof containers (maximum)	6.0%	6.0%

### Problems and Prospects of certification in onion seed production

Following are the problems and remedial measures in certification of onion seed:

#### a. Unawareness about the notified varieties by the farmers

Many improved and notified varieties have not been demonstrated fully with the farmers as such farmers still prefer old varieties. The extension agencies in the state may therefore take up demonstration so as to allow farmers to know about the new improved varieties.

#### b. Unawareness about the advantage of certified seed over truthful seed

In cereals and some other seeds the seed production and distribution programme are properly organized. Farmers have been demonstrated with the advantage of using certified seed. In vegetables particularly in small seed such demonstrations or extension education programmes have not been carried out.

Farmers thus are not aware about the benefits of using certified seed in onion. Extension agencies should arrange state level demonstrations on use of certified seed in onion to make the farmer fully aware of advantages of the certified seed.

**c. No maintenance breeding for improved varieties**

Since varieties when developed by the Universities / institutes do not pass through maintenance breeding later, the varieties do not behave in different characters in the same way as these were at the time of development. The application of certification standards particularly for genetics purity therefore becomes impossible. The Universities / Institutes should continue maintenance breeding of their varieties for maintaining distinctiveness, uniformity and stability.

**d. Most of the parameters of the varieties are influenced by agro climatic conditions**

In onion there are many characters like colour, shape, bolting, neck thickness or doubles which are affected adversely by agro climatic conditions like soil, temperature, rainfall, cultural practices etc. Practical application of certification standards required to be seen at the time of certification where staff cannot have proper judgment. The staff should, therefore, know the details of characters and how and to what extent, they are influenced by adverse weather conditions. Based on that the staff should assess the situation and apply their mind in certifying a crop.

**e. Staff with certification agencies are neither adequate nor they have proper knowledge about the crop.**

Onion is highly cross-pollinated crop and it requires through inspection or check at different stages. If one stage is left it becomes difficult to meet the requirements. For example if inspection is not managed at the time of bulb selection, Similarly if isolation is not checked at the time of **bolting** it becomes a futile exercise later as roughing has no meaning at the time of flowering. This is possible only when sufficient staff having good knowledge about onion is provided.

**f. Unawareness of farmers about pre harvest and post harvest practices of onion seed production.**

The extension agencies as also staff certification agencies are supposed to properly guide for production and post harvest practices for certified seed production initially. Certification staffs presently do not guide. Presently since staff themselves are not aware about pre harvest practices as also post harvest practices, programmes many times fail as such farmers hesitate in going for certified seed production. It is, therefore, necessary for certification staff to guide the farmers initially.

**g. Inadequate infrastructural facilities for storage of bulbs, cleaning, grading and drying**

Bulbs of rabi onion are required to be stored in ventilated godowns which are not available. Seed requires is must which is mostly not available. Similarly for enabling the seed producers to pack the seed in moisture proof containers for long term storage, seeds are required to be dried to 6% moisture where dehumidified driers are required. Such facilities are lacking at any places.

**h. Certification standards are not realistic**

Presently standards which have been fixed are not realistic. The standards need to be fixed based on the type of material being developed by the institutes. The effects of agro climatic conditions on different parameters need to be considered. Isolation distances are not adequate particularly between white and red varieties.

**i. Non availability of adequate quality breeder / foundation seed of a variety**

Even if everyone is ready for taking up certified seed production, adequate quality breeder seed foundation seed with the concerned institute is not available. Because of this problem in fact many good varieties in onion have been lost before going to farmers. The seed production programme, therefore, should be properly planned right from production of breeder seed to certified seed so as to make available quality seed in adequate quantities for improving production and quality.

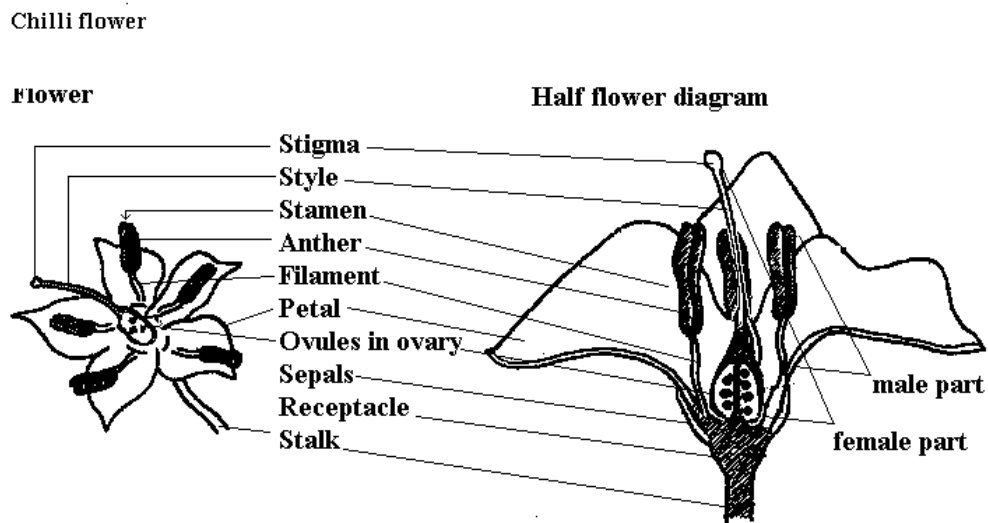
**j. Low price of seed available in the market**

Many times onion seed price in the market are very low compared to quality seed / certified seed. This is mainly because farmers collect seed from premature bolters / takes up *in situ* method where though quality is poor quality is in abundance, Govt. should, therefore give some.

## CHILLI (*Capsicum frutescense*)

Chillies widely used as vegetable and spice is an often cross pollinated crop, where the extend of cross pollination is upto 7 to 36 per cent. It belongs to the family solanaceae. It is also known as hot pepper and botanically it is known as *capsicum annuum*. The quality seed production techniques of chillies comprises of the following steps.

**Botany:** Often Cross pollinated vegetable. The flower is protogynous. Anther dehisces only half to 5 ½ hr after stigma becomes receptive. Anthesis in chilli occurs between 6.00 and 9.00 hr. Flower remains open for 2 to 3 days, receptivity of stigma was the highest at the day of flower anthesis.



**Method of seed production :** Seed to seed

**Stages of seed production :** Breeder seed → Foundation seed → Certified seed.

**Varieties:** K.1, K.2, K.3, Co.1, Co.2, PKM.1, MDU.1, Bagyalakshmi.

**Hybrids:** KT.1, (Pusa Deepti), Solar Hybrid 1, Solar Hybrid 2. Early Bounty, Indira, Lario, Hira, Bharat.

**Season :** June-July, February-March, September- October.

**Land requirement :** There are no land requirement as of previous crops, but the land should be free from volunteer plants. Generally areas affected by wilt or root rot may be avoided. Crop rotation must be followed to avoid endemic Solanaceous pests.

**Isolation requirement :** Minimum isolation distance of 400 M for foundation and hybrid seed and 200 M for certified seed production are necessary.

**Seed rate :** Seed required for one hectare is 500 g to 1 kg for variety; for hybrids - Female = 200 g and male = 50 g

**Nursery :** Sow the seeds in raised nursery bed of 20 cm height, in rows of 5 cm gap and covered with sand. Eight and ten nursery beds will be sufficient to transplant one acre. Apply 2 kg of DAP 10 days before pulling out of seedling.

**Transplanting:** The seedlings of 30-35 days old are ready for transplanting. Transplanting may be done on the ridges in the evening.

**Foliar spray:** To arrest the flower drop, NAA (Planofix) can be sprayed @ 4ml/L. Very light irrigation is also done arrest the flower drop.

**Manuring :** Apply 50 tones of FYM/ha for irrigated crop. Basal 0:70:70 kg of NPK and 50 kg of N at 15 days after transplanting and 50 kg N at 45<sup>th</sup> days after transplanting.

**Roguing:** Field inspection and roughing should be done both for varieties and hybrid at different stages based on the plant height and its stature, flower colour and pod characters. The plants affected with leaf blight, anthracnose and viral diseases should be removed from the seed field.



**Pest and disease management:** The important pest attacking chilli and capsicum are thrips, aphids, pod or fruit borer and mites. The thrips and aphids can be controlled by spraying Dimecron (systemic pesticide), pod borer can be controlled by spraying Nuvacron and the mites can be controlled by spraying Kelthane. The major diseases affecting the plants are die back or fruit rot, powdery mildew and bacterial leaf spot. Spray Dithane M-45 for control of die back, Karathane for powdery mildew and Agromycin for leaf spot disease control.

**Hybrid seed production:** The crossing operation can be performed as per the methods outlined for tomato and brinjal hybrid seed production. However, hand emasculating and pollination is somewhat difficult since the flowers are minute. Hence use of male sterile lines can also be employed for hybrid seed production.

**Harvesting and processing:** Harvesting should be done in different pickings. First and last one or two pickings can be harvested for vegetable purpose. The well ripened fruits with deep, red colour alone should be collected in each picking. After harvest, fruit rot infected fruits are to be discarded. The harvested pods are to be dried



under shade for one (or) two days and then under sun for another 2 or 3 days. Before drying pods are to be selected for true to type and graded for seed extraction. The seeds are extracted from graded dried pods. The pods are taken in gunny bag and beaten with pliable bamboo sticks. The seeds are cleaned by winnowing and dried to 10% moisture content over tarpaulin. Then seeds are processed with BSS 8 wiremesh screens. For large scale seed extraction, the TNAU model chilli seed extractor may be used.

**Seed Yield :** 50-80 Kg/ha

**Seed Certification**

**Number of Inspections**

A minimum of three inspections shall be made as follows:

1. The first inspection shall be made before flowering on order to verify isolation, volunteer plants, and other relevant factors,
2. The second inspection shall be made during flowering to check isolation, offtypes and other relevant factors
3. The third inspection shall be made at maturity and prior to harvesting to verify true nature of plant and other relevant factors

**Specific standards:**

<b>Factors</b>	<b>Foundation</b>	<b>Certified</b>
Off types	0.1%	0.2%
Designated diseased plant	0.1%	0.5%

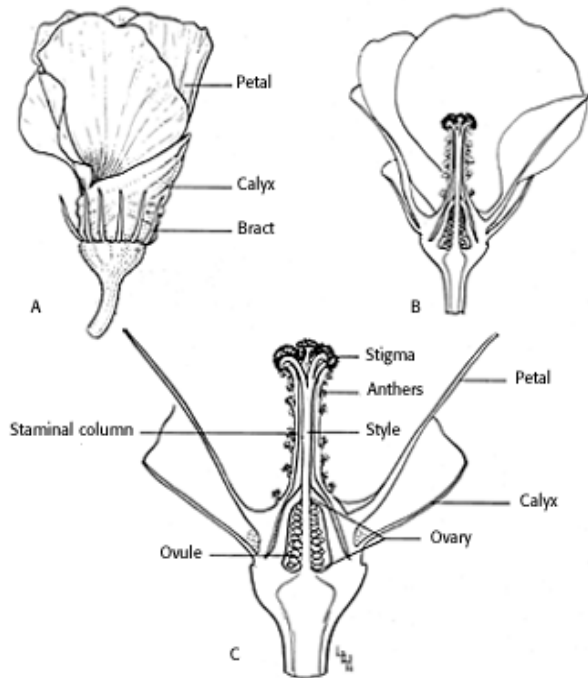
The designated diseases are caused by *Collertotictum capsici* and leaf blight caused by *Alternaria solari*.

**Seed standards (Variety & Hybrid)**

<b>Factors</b>	<b>Foundation</b>	<b>Certified</b>
Pure seed	98%	98%
Inert matter	2%	2%
Other crop seeds	5/kg	10/kg
Weed seeds	5/kg	10/kg
Germination	60%	60%
Moisture content	8%	8%
For VP Container	6%	6%

## **BHENDI (*Abelmoschus esculentus*)**

**Botany:** Anthesis is between 9 and 10 hr and is preceded by maximum anther dehiscence between 8 and 9 hr. The stigma remains receptive on the day of anthesis. Bhendi is an often cross pollinated crop. Cross pollination to an extent of 12 per cent is due to protogynous.



**Method of seed production :** Seed to seed

**Stages of seed production :** Breeder seed → Foundation seed → Certified seed.

**Varieties :** Co.1, MDU.1, Parbhani Kranti, Arka Anamika, Pusa A-4, Pusa Sawani

**Hybrids:**CO2,CO 3, Mahyco hybrid, Shoba

**Season :** June-July, September- October and February- March

**Land requirement :** Select field on which bhendi crop was not grown in the previous season, unless the crop was of the same variety and certified. Field should be free from wild bhendi (*Abelmoschus sp.*)

**Isolation requirement:** Seed field must be isolated from other varieties at least by 400 M for foundation and hybrid seed production and 200 M for certified seed production.

**Seed rate :** Varieties : 8-10 kg/ha

Hybrids : 4 kg/ha (Female); 1 kg/ha (Male)

**Manuring:** Apply 12.5 tons of FYM/ha before ploughing. Apply 150:75:75 kg NPK/ha, of which 50% of the N should be applied as top dressing in two split doses at flowering and 10 days later.

**Planting ratio:** For hybrid seed production, female and male parents are normally planted in the ratio of 4:1.

**Roguing:** Minimum of three inspections for varieties and 4 inspections for hybrids, one at vegetative, two at flowering and one at fruit maturity stages. The roguing should be based on the plant characters, hairiness, fruit character like fruit colour, number of ridges, fruit length etc., and the off type and mosaic attacked plants should be removed from the seed field. Wild bhendi if present should be removed before flowering.

**Pest and disease management:** The major pest attacking bhendi are jassids, aphids and white fly, which can be controlled by spraying Rogar or Dimecron or Endosulphon. The pod borer and red spider mites can be controlled by spraying Endosulphon and Kelthane, respectively. The diseases such as yellow vein mosaic and powdery mildew can be controlled by spraying systemic insecticides and Karathane, respectively.

**Hybrid seed production:** In bhendi, since the flowers are large in size, hand emasculation and pollination is the best suitable method for seed production. The emasculation and dusting can be done as per the methods outlined in tomato. The male and female parents are raised in blocks at the ratio of 9:1 (Female: Male).

**Harvesting:** Fruits should be harvested when they have dried (30-35 days after crossing). The pods which expose hairline crack and turn to brown colour on drying alone are cut using sickle manually.



### **Threshing:**

The pods are dried and threshed using pliable sticks. Separated seeds are winnowed to remove plant debris and dried over a tarpaulin to 10% moisture content. Dried seeds are subject to water floatation in which, good seeds sink while poor seeds float. The floaters are removed, while sinkers are dried under shade followed by sun drying. Then the seed are cleaned, dried and treated with Captan/ Thiram.



**Processing:** Seeds are to be processed with BSS 7 wiremesh sieve.

**Seed Yield:** 1000-1200 Kg/ha

**Specific standards:**

<b>Factors</b>	<b>Foundation</b>	<b>Certified</b>
Off types	0.1%	0.2%
Objectionable weed	None	None
Disease affected plants	0.1%	0.5%

**Objectionable weed:** wild *Abelmoschus sp.*

***A. moschatus***



***A. manihot***



**Designated diseases:** Yellow Vein Clearing Mosaic (Hybiscus virus-1)



## Seed standards

Factors	Foundation	Certified
Pure seed	99%	99%
Inert matter	1%	1%
Other crop seed	None	5/kg
Total weed seed	None	None
Objectionable weed	None	None
Other Distinguishable Varieties (ODV)	10/kg	20/kg
Germination	65%	65%
Moisture	10%	10%
For VP Container	8%	8%

## Questions

- Chilli is an often Cross pollinated vegetable. (**True**/False)
- The flower of chilli is
  - Protandry
  - Terminal
  - Axillary
  - Protogyny**
- \_\_\_\_\_ arrests flower drop in chilli.
  - NAA**
  - GA3
  - MH
  - Ethrel
- Off type allowed during certified seed production in chilli is \_\_\_\_\_
  - 0.5%
  - 0.02%
  - 0.2%**
  - 2%
- Isolation requirement for foundation and certified seed production in chilli is \_\_\_\_\_
  - 400 & 200 M**
  - 100 & 200 M
  - 600 & 200 M
  - 600 & 400 M
- Bhendi is an often cross pollinated crop. (**True**/False)

