

# IMPROVED PRODUCTION TECHNOLOGY OF KING CHILLI AND LARGE CARDAMOM

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## KING CHILLI

Crop name	King chilli
Common/ local name	Raja mircha
Scientific name	<i>Capsicum chinense</i> Jacq.
Family	Solanaceae
Chromosome number	2n=2x=24
Mode of pollination	Self pollination



Naga King chilli is considered as the World's hottest chilli and entered in "Guinness book of world records" (measuring 855,000 Scoville units) beating the "Mexican red savanna habaneros" (577,000 Scoville units). In Nagaland state of India, it is grown in districts of Mon, Kohima and Peren. Traditionally, this chilli is grown for green fruits during summer months in the upland jhum paddy fields as well as kitchen garden and backyard. Its fruits form an essential ingredient of the naga kitchen cuisine; the unripe green fruits are used in the cooking preparations and the dried (red) ones are used mainly as an ingredient in curries and pickles.

### Nutritive value

King chilli is considered to be a good amount of vitamin C 60%. King chilli has 2.50% of vitamin A, 8.0% of calcium and 8% of iron, respectively.

**Table 1. Nutritive values of King chilli.**

Nutrient	Value (%)
Vitamin A	2.50
Vitamin C	60.00
Calcium	8.00
Iron	8.00

**Varietal evaluation**

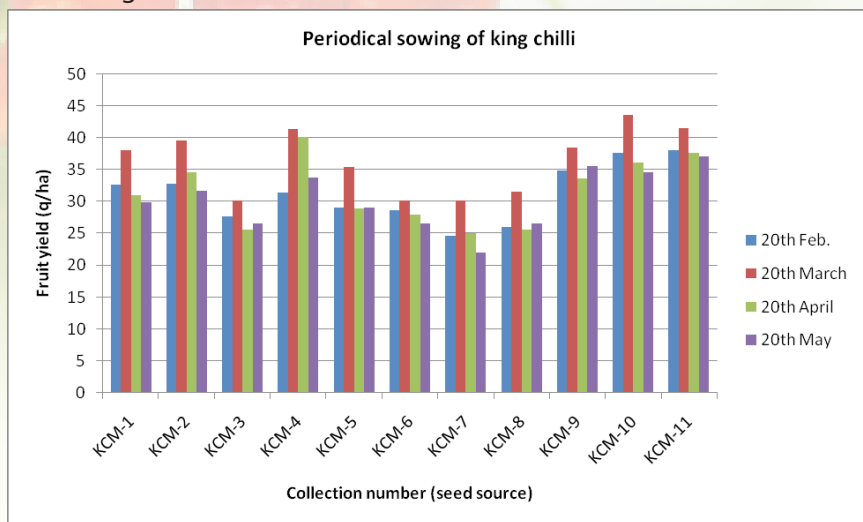
Eleven population of King chilli were collected from different part of the state and varietal evaluation conducted on 2012-13 at KVK Instructional farm, Aboi & farmers field and observed wide range of variability amongst the population. Maximum yield was observed in KCM 10 (43.70 q/ha) line followed by KCM 4 and 11 line, respectively. Minimum in KCM 7 line 27.00 q/ha (Table 2).

**Table 2. Varietal performance of king chilli.**

Sl. No.	Collection No	Yield (q/ ha $\pm$ SD) Fresh wt. basis
1	KCM-1	38.50 $\pm$ 3.1
2	KCM-2	40.10 $\pm$ 2.5
3	KCM-3	31.40 $\pm$ 2.1
4	KCM-4	42.80 $\pm$ 1.3
5	KCM-5	36.00 $\pm$ 1.1
6	KCM-6	29.80 $\pm$ 0.6
7	KCM-7	29.00 $\pm$ 0.8
8	KCM-8	33.00 $\pm$ 1.0
9	KCM-9	39.00 $\pm$ 1.2
10	KCM-10	43.70 $\pm$ 1.3
11	KCM-11	41.00 $\pm$ 0.8

## Sowing time

Sowing of crop at optimum period is very important non- monetary input in obtaining higher yield. Sowing time affected yield and all yield contributing characters significantly as is evident from the data presented in Figure 1. Highest fruit yield was recorded when the crop was planted during 20<sup>th</sup> March followed by 20<sup>th</sup> April and minimum fruit yield resulted in the month of 20<sup>th</sup> February and 20<sup>th</sup> May, irrespective of all the seed sources. Sowing operation for king chilli should be carried out during the month of 20<sup>th</sup> March.



## Genetic variability

The experimental material consisted of 11 seed sources collected from different part of the state. The experiment was laid out in RBD with two replications and ten plants per treatment per replication with a spacing of 60 x 75 cm at the Instructional farm, Krishi Vigyan Kendra, Mon (Aboi): Nagaland during 2013 & 14. Observations were recorded on ten randomly selected plants from each sources in each replication for plant height, number of branches/ plant, days to flowering, number of fruits/ plant, fruit weight, fruit length, number of seeds/ fruit, 100 seed weight and duration of the crop. The mean, coefficient of variation and heritability were calculated as per the standard statistical procedures.

In the mid hills area (Aboi), all the genotypes took 142 to 158 days to 80% maturity and their potentialities also observed number of fruits per plant (38-212), fruit weight (3.5-11.8 g), fruit length (2.7 to 9.1 cm), number of seeds per fruit (41 to 80) and very little differences were observed in test weight. Wider the range of standard deviation (SD $\pm$ ), the more desirable is the character for selection. The standard deviation

of mean ( $SD \pm$ ) value was estimated to be highest for the character of number of fruits per plant (14.44), followed by plant height (11.53). So the lowest standard deviation of mean value was found in case of the 100 seed weight (0.03), table 3.

Table 3 represents highly significant differences amongst the genotypes for all the characters studied. The characters showed high phenotypic coefficient of variation for most of the characters except days to flower, plant height and duration of the crop. The highest variability was observed for number of fruits/ plant. Fresh fruit weight/ plant showed sufficient variability. Duration of the crop and number of seeds/ fruit also exhibited high mean values.

It has been found that these characters have quite high GCV values and also have a good share of respective PCV values. So it could be concluded that selection will be effective considering these characters.

**Table 3. Estimates of mean, phenotypic coefficient of variation and heritability for nine characters in king chilli.**

Characters	Range (Min.- Max.)	Mean ( $\pm SD$ )	PCV (%)	GCV (%)
Plant height (cm)	85.22- 155.13	120.17 $\pm$ 11.53	6.37	6.02
No. branches/ plant	5.22- 10.67	7.95 $\pm$ 2.34	32.85	30.11
Days to flower	63.45- 80.55	72.00 $\pm$ 6.57	16.12	15.77
No. of fruits/ plant	38- 212	125.00 $\pm$ 14.44	39.15	38.21
Fruit weight (g)	3.5- 11.8	7.65 $\pm$ 1.67	45.93	42.30
Fruit length (cm)	2.7- 9.1	5.90 $\pm$ 1.37	32.77	31.21
No. of seeds/ fruit	41- 80	60.50 $\pm$ 6.12	27.80	27.00
100 seed weight (g)	0.42- 0.46	0.44 $\pm$ 0.03	28.82	28.04
Duration of the crop	142- 158	150.00 $\pm$ 7.68	16.43	15.32

## Cultivation practices

### Nursery Raising Techniques

**Seeds-** Seeds are collected from high yielding and well maintained plantation free from diseases. Select healthy, disease free and well matured fruits for extraction of seeds.

**Sowing time-** Seeds are generally sown in the month of March.

**Nursery bed preparation-** Seed- beds are prepared in well drained soil dug to a depth of 30 cm and left for weathering. Raised beds with



15- 25 cm height, 1 m width and convenient length, preferably 6 m, are prepared.

**Soil treatment and mixture-** Treat the soil with ash (2 kg) and locally available dry neem leaf (500 g) with well decomposed cattle manure (25-30 kg/ bed dry) is mixed with soil and surface of bed is made to fine tilth.

**Seed rate, sowing and mulching-** About 35- 45 g of seeds per bed are sown in lines across the bed at a distance of 5 cm. Seeds are covered with fine soil and mulch with paddy straw/ dry grass (10-15 cm thick). Watering is done at regular intervals to keep the surface of the bed moist.

**Seed treatment-** Treat the seeds with bio- fertilizers like Azotobacter and Phosphotika 200 g each in 300 ml water. Mix thoroughly with some vermin-compost or organic manure and soil. Dry in shade for 30 minutes and sow immediately.

Irrigate the nurseries before uprooting the seedlings.

### **Main Field Preparation-**

The site for Naga king chilli cultivation should be ready by the month of April.

**Pit digging-** It should be done during March right after raising the nurseries.

**Pit Size-** 1 ft. x 1 ft. x 1 ft. is dug and kept for about 20-30 days for solarization. Pit to pit distance 3 ft. x 3 ft.

**Soil treatment and mixture-** Mix the soil with bio- fertilizers, Trichoderma and farm yard manure during the time of transplanting.

**Seedling treatment and transplanting-** When the seedlings becomes 6-7 leaves shall be selected for transplanting in the main field. Seedling root dip in bio- fertilizers (200 g Azotobacter and 200 g Phosphotika in about 20 liters of water) is done for about 5-10 minutes and transplanted in the pits.

**Intercultural operations-** Weeding should be done after 30-35 days after planting and earthing up followed by mulching with fallen leaves to conserve the soil moisture.

**Harvesting-** It is harvested at three different stages green, yellow and ripened stages. For long distant market and vegetable purpose harvesting is done at green stage. For drying, pickle and seed purpose it is harvested at yellowing to red stage.

### **Other Important Features**

- Pinching/ Tipping off of the plant- 2 times
- Canopy maintenance
- Harvesting done every week

## Large Cardamom

Name of crop	Large Cardamom
Local name/ vernacular name	Elaichi
Scientific name	<i>Amomum subulatum</i> Roxb.
Family	Gingiberaceae
Order	Scitamine
Chromosome number	2n = 48
Mode of pollination	Cross pollination



### Introduction

Large cardamom is the main cash crop cultivated in the sub-Himalayan state of Sikkim and Darjeeling district of West Bengal. It is also cultivated in parts of Uttarakhand and in some other North Eastern Hill states like Arunachal Pradesh, Nagaland, Mizoram, Manipur, Meghalaya and Assam. Nepal and Bhutan are the other two Himalayan countries where large cardamom is cultivated. Sikkim is the largest producer of large cardamom and constitute lion share of Indian and world market. In Nagaland major large cardamom growing district of Mon followed by Kohima. It is a shade loving plant (Sciophyte) grown in tracts with well distributed rainfall spread around 200 days with a total of about 3000-3500 mm/year. The large cardamom plant is a perennial herb

with subterranean rhizomes with leafy shoots. Stem is a pseudo stem which is called tiller. Inflorescence is spike. Generally, 30 to 40 flowers are observed in a spike. Flowers are yellow, bisexual, zygomorphic & pollinated by bumble bees. There are three petals with a labellum which is mainly for attracting insects for pollination. Stamens possess filament and anther. Anthesis occurs in the morning hours. Ovary inferior with ovules in axile placentation, stigma funnel shaped, fruit is capsule, achinated, maroon in colour with seeds which are whitish in immature stage and dark brown to black in mature stage. Large cardamom is used as a spice and also in several Ayurvedic preparations. It contains 2-3% essential oils, possesses carminative, stomachic, diuretic and cardiac stimulant properties and is also a remedy for throat and respiratory trouble.

### **Crop Varieties**

In Sikkim, there are mainly six popular cultivars of large cardamom viz., Ramsey, Ramla, Sawney, Varlangey, Seremna, Dzongu and Golsey. There are two high yielding varieties released by Indian Cardamom Research Institute, Regional Station in the year 2004 for cultivation in Sikkim are ICRI Sikkim 1 and ICRI Sikkim 2.

### **Primary nursery**

Seeds are generally sown in September-October. Seed beds are prepared in well drained soil dug to a depth of 30 cm and left for weathering. Raised beds with 15- 25 cm height, 1 m width and convenient length, preferably 6 m, are prepared. Well decomposed cattle manure is mixed with soil and surface of bed is made to fine tilth. About 80- 100 g of seeds per bed are sown in lines across the bed at a distance of 10 cm. Seeds are covered with fine soil and mulch with paddy straw/ dry grass (10- 15 cm thick). Watering is done at regular intervals to keep the surface of the bed moist. Germination of acid treated seeds commences after 25-30 days of sowing. When germination is noticed the mulched materials are removed. The inter space between rows is then re- mulched with chopped paddy straw. Shade pandals are immediately erected by using bamboo mats/ reed mats or agro- shade nets. The beds are watered regularly and weeding is done as and when required. When the seedlings attain 3- 4 leaf stage, they are transplanted to secondary beds/ nursery.

### **Secondary nursery**

Secondary nursery can be prepared in polybags or in raised secondary beds. The polythene bags of 15 cm x 15 cm size with perforations at the base are used for planting the seedlings from primary nursery beds. The bags are filled with a potting mixture of soil, sand and cow dung in a 4: 1: 1 ratio. The bags filled with mixture are arranged in rows of

one meter width and in convenient length under shade pandal. The seedlings with 3- 4 leaves are planted in the poly bags in April- May and watered regularly. They become ready for field planting in 10 to 12 months. The beds of 15 cm height and 10 cm width with convenient length are prepared and well decomposed cattle manure is mixed with soil and an even is formed.

Seedlings with 3- 4 leaves are transplanted in beds in May- June at a spacing of 15 cm between them. The inter space is mulched with chopped paddy straw or dry leaves. Overhead pandal is erected for providing shade and soil is kept moist with irrigation. The seedlings once attain a growth of 45- 60 cm height with 2- 3 tillers are planted in main field during June- July for subsequent year.

### **Suckers**

### **Planting materials**

High yielding disease free plantations are selected. The plantation should have more than 800 kg/ ha of yield for at least 3 years. The nursery should be about 500 m away from the main plantation to avoid occurrence of pests and diseases. The irrigation facility should be available in the nursery. It should be easily accessible by road.

### **Selection of site**

Large cardamom grows well in forest loamy soils with gentle to medium slopes. Luxuriant growth is found nearby perennial water sources. However, waterlogged condition is detrimental to plants. It performs well under partial shade (50%). *Alnus nepalensis* is most common shade tree and *Alnus nepalensis*- cardamom is a very good agroforestry system for sustainable production. The other species of shade trees are *Terminalia myriocarpa*, *Bucklandia* spp., *Macaranga denticulata*, *Edgeworthes gardneri*, *Viburnus eruberens*, *Maesa Cheria*, *Symplocos* spp., *Albizia lebbeck*, *Erythrina indica*, *Eurja tapinica*, *Schima wallichii* etc.

### **Land preparation**

The land selected for planting is cleared of all under growth, weeds etc. Old large cardamom plant, if any may also be removed. Pits of 30 cm x 30 cm x 30 cm size are prepared on contours at spacing of 1.5 m x 1.5 m from the centre of pits. Pits are left open for watering for a fortnight and then filled with topsoil mixed with cow dung compost/ farmyard manure (FYM) @ 1-2 kg/ pit. Pit making and filling operation should be completed in the third week of May before the onset of pre- monsoon showers.

## **Planting**

Planting is done in June- July when there is enough moisture in soil. A mature tiller with 2- 3 immature tillers/ vegetative buds is used for planting. For better production, quality planting material is to be raised in nurseries or to be planted by scooping a little soil from the centre of the pits and planted up to collar zone. Deep planting should be avoided. Staking is needed to avoid lodging from heavy rain and wind, and mulching is done at the plant base.

## **Soil Base Making and Mulching**

A soil base with gentle slope from the plant is beneficial for application of inputs to the plants, viz., farm yard manure (FYM), vermicompost, neem cake, mustard cake etc. If the land is not terraced, soil base may be made by cutting top soil from the upper half and to be placed on the lower half followed by mulching. Mulching at the plant base with easily degradable organic materials is good for conserving both moisture and soil. Mulch improves the soil condition and the soil fertility. Dried organic matter, leaves, weeds etc can be used as mulching materials.

## **Manures/ Fertilizers**

For sustainable good yield and to compensate the nutrient loss from the soil, replenishment of nutrients is very essential. Well- decomposed cattle/ manure/ compost or organic products @ 2 kg/ plant and mustard cake @ 500 g/ plant at least once in two years in April- May, are beneficial. If all the crop residues are recycled in the plantation and FYM/ organic materials etc are applied, application of inorganic fertilizers may not be necessary. However, in plantations with high productivity, fertilizers @ 20: 30: 40 kg N, P and K per hectare may be applied in two splits, full P in April and half N and K in April and September.

## **Watering**

Large cardamom plants cannot thrive well under water stressed conditions. In first year of planting, watering is required at least once in 10 days during September- March. Water harvesting pits made in between four plants of nearby rows during rainy season can support the water requirement of the crop in dry season to some extent and is cheap.

## **Shade Management**

It is noticed that heavy shade or less shade hinders crop growth and production. About 50% shade is found ideal. The lopping o branches of shade trees are very important and should be done before onset of monsoon during June- July. But at the same time over- exposure to



direct sunlight causes yellowing of leaves. Therefore judicious shade management is very important for good growth, timely flowering and better yield.

### **Weed Control**

Weed control in plantation is important operation for maximum utilization of available soil moisture and nutrients by plants. Three rounds of weeding are required for effective control of weed growth in initial two to three years. Weeding is generally done by using a sickle or by hand depending upon the intensity of weed growth. From around the plant base weeds are pulled out by hand and in inter- space needs only slash with sickle. Clean weeding is not advised. While weeding dried shoots and other thrashed materials are used as mulch around the plant base.

### **Harvesting**

The ideal time of harvesting is when seeds of top most capsules turn brown. The tillers are cut at a height of 30- 40 cm from the ground and left for 10- 15 days for full maturity. The spikes are harvested by using special knives known as "*Elaichichhuri*". The spikes are heaped and capsules separated and dried. The cured capsules are rubbed on wire mesh for cleaning and removal of calyx (tail).

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