

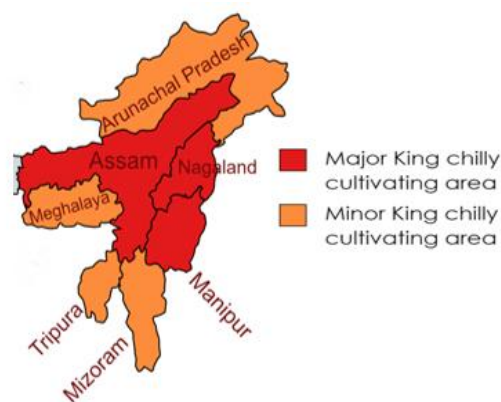
A Short Review on India's Hottest Chilli: Naga King Chilli

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ARTICLE ID: 03

Naga King chilli (*Capicum chinense* Jackquin) belongs to family Solanaceae. It is known as King chilli in Nagaland and Bhut Jolokia in Assam holds a special place among the hottest chillies in the world. The King chilli is primarily cultivated in the states of Nagaland, Assam, Manipur and to a lesser extent in Mizoram, Arunachal Pradesh, and Meghalaya (Baruah *et al.*, 2014). Nagaland state got its certificate of geographical indication registration (GI tag) of King chilli in December, 2008 (Anon., 2008). Naga King chilli was recorded hottest chilli in the world in September, 2006 by Guinness World Records measuring 10,01,304 Scoville Heat Units. (Kalita, 2007; Verma *et al.*, 2013). Capsaicin and dihydrocapsaicin are responsible for pungency in King chilli. It is short perennial crop and grows to a height of about 1.0-1.5 meter. King chilli exhibits a remarkable variation in terms of colours, sizes and fruit textures. Colour of King chilli is light green to dark green at immature stage and as they mature, colour change into light red, bright red and even chocolate hues. The texture of these fruits can range from crumpled to semi-smooth, sometimes appearing gloomy with fleshy tissue. The shape of fruit is sub-conical to conical with length of 5-9 cm and width of 2-3 cm. Their surface is characterized by roughness, wrinkles and spikes (Jamir *et al.*, 2022). It is consumed as fresh vegetable, dried, flakes, powdered form, sauces and pickles (Kanaujia *et al.*, 2020). King chilli has been employed in diverse medicinal treatments, including alleviating headaches, addressing night blindness, spondylitis, digestive disorders and mitigating chronic congestion (Sarwa *et al.*, 2012). King chilli holds promise for diverse medicinal applications such as pain



relief, cancer prevention, weight reduction, gastrointestinal benefits, anti-inflammatory properties, antioxidant activity etc. This makes king chilli for commercial capsaicin extraction with potential utility in pharmaceutical industries (Malakar *et al.*, 2019). It is not only used as food items but also used as an antivenom for spider and snakes' bites. It is also used as defence spray (Meetei *et al.*, 2016). Demand of King chilli is very high both in domestic and international markets because of its extra powerful pungency and captivating aroma (Bhagowati and Changkija, 2009). Therefore, the present article is focused on A short review on King chilli.

Climate and soil

King chilli requires a warm climate for cultivation. King chilli thrives well in temperature ranges from 20°C to 30°C. King chilli thrives in monsoon climatic conditions with consistently high humidity levels. The rainfall requirements for cultivation range from 1200 to 4000 mm per annum. Water logging even for a short duration causes leaf yellowing and shedding. King chilli requires partial shade for optimum growth and development. Hence cultivation should be done under permanent shade trees or in agro-shade net (Vimera *et al.*, 2012). King chilli prefers well drained, fairly fertile and rich in organic matter and slightly acidic soil. The elevated foothill conditions with fertile land and abundant rainfall make the region suitable for cultivating of King chilli. (Sharma, 2014) Nagaland is quite conducive to commercial cultivation of King chilli. The monsoon season, characterized by high humidity, provides an ideal environment for the King chilli cultivation in Nagaland (Kanaujia and Ningthoujam, 2017).





Different types of local cultivars of King Chilli

Cultivars

Different types of local cultivars of King chilli are cultivated in various parts of NEH region. There is no released variety of King chilli (Bhagowati and Changkija, 2009; Jamir *et al.*, 2022).

Nursery raising

Nursery of King chilli should be raised under low-cost polyhouse. A net area of 100 m² is required to raise the seedlings of one hectare land. Size of nursery bed should be kept 1 m width and convenient length with 15 cm height. For raising healthy nursery, beds are dug out and mixed FYM or pig manure @ 3 kg/m² area. Thereafter, beds must be treated with *Tricoderma* powder @ 10 g/m² area to kill the harmful pathogen in the soil. Beds should be prepared thoroughly. Normally 400-500 g seed is required for planting one hectare land. Seed should also be treated with *Tricoderma* powder @ 6 g/kg of seed. Sowing should be done in 15th January-15th February under low-cost polyhouse. Seed should be sown in line about a 5 cm spacing to prevent overcrowding. Line to line distance is kept 8-10 cm. Line sowing prevents damping off disease. After sowing, lines are covered with fine FYM and applied water immediately with rose can. Mulch the beds with paddy straw to conserve moisture. Irrigate the nursery beds in the evening till seedlings are ready for transplanting. Regular weeding is important to get healthy seedling of King chilli (Kanaujia *et al.*, 2020).

Field preparation

King chilli is transplanted in pits. About 30 x 30 x 30 cm size pits are dug out during 1st week of March. Pit to pit distance is kept 1.2 x 1.2 m. During final preparation, pits should be filled with mixture of top soil, biofertilizer, *Tricoderma* and FYM (Vimera *et al.*, 2012).

Transplanting

Seedlings of King chilli are ready for transplanting in 7-8 weeks after sowing when they attain 5-6 leaves. One week before transplanting, irrigation should be reduced. This will facilitate hardening of seedling to tolerant transplanting shock. Before planting, seedlings should be dipped for 30 minutes in 2 kg *Azotobacter* and 2 kg Phosphotika in 20 litres of water. There is wide variation in planting time of King chilli in Nagaland. To increase yield and quality, appropriate planting time is very important. Best planting time of King chilli under foot hill conditions of Nagaland is 20th March (Ningthoujam *et al.*, 2017).

Manures and fertilizers

King chilli being heavy feeder and exhaustive crop like other solanaceous crops responds very well to applied nutrients application but chemical fertilizer application in Nagaland is negligible resulting low yield of crop. Integrated application of 45:30:30 kg NPK ha⁻¹ + 10 t FYM ha⁻¹ + Biofertilizers (*Azotobacter* and Phosphotika) give maximum yield and quality of King chilli (Vimera *et al.*, 2012). Whereas in organic system, application of FYM @ 20 t ha⁻¹ give maximum yield and quality of King chilli (Ningthoujam *et al.*, 2017).

Plant growth regulator

Application of Naphthalene Acetic Acid (40 ppm) as pre-harvest increase fresh yield and capsaicin content of King chilli. Ethrel (250 ppm) application increase vitamin C content in King chilli. Fruits treatment with calcium chloride (0.5%) increase shelf life of King chilli (Rongsennungla *et al.*, 2012.).

Intercultural operations

After transplanting the seedlings, irrigation should be given every day for 3-4 days and subsequently on alternate days for 8-10 days for better establishment. Generally, King chilli is grown as rainfed crop. But irrigation must be applied soon after transplanting, flowering and fruiting stage. Weeds compete for nutrients, moisture, sunlight and space with crop plant and ultimately results poor yield and quality of the crop. First weeding should be done at 30-40 days after transplanting the crop and repeated at regular intervals (Kanaujia *et al.*, 2020).

**Fruiting stage****Fruiting stage**

Harvesting and yield

King chilli takes about 60-70 days from transplantation to the harvesting stage. Harvesting starts from June and continue over a period of about 3 months as all the fruits do not mature at the same time. Harvesting should be done weekly intervals. Harvesting is carried out at three distinct stages: green, yellow, and fully ripened. Green stage harvesting is done long distance markets and vegetable purposes, while the yellow to red stage is suitable for drying, pickling, and seed extraction (Kanaujia and Ningthoujam, 2017). Each plant gives



about 50-100 number of fruit (1.0-1.5 kg fresh fruit). Fruit weight is about 6-10g. On an average, King chilli gives yield about 80-120 q/ha (Vimera *et al.*, 2012). However, the price of green King chilli varies seasonally, ranging from a reasonable Rs.300-400/kg during the season to higher prices (Rs.600-800/kg) in the off-season (Malangmeih and Rahaman, 2016).

Post-harvest management

Freshness is highly valued for King chilli consumption. Regrettably, a substantial quantity of King chilli goes to waste in the fields due to the lack of proper processing and preservation techniques. King chilli is highly perishable nature and has short shelf life. The Shelf life of this crop is about 3-5 days as a result of which considerable post-harvest losses are incurred (Rongsennungla *et al.*, 2012). The shelf life rapidly deteriorates during storage, transportation and marketing (Edusei *et al.*, 2012; Chitravathi *et al.*, 2015). To address this challenge, pre-harvest applications of plant growth regulators and other chemicals have been recognized for enhancing growth, yield, quality and shelf life of King chilli (Katwale and Saraf, 1990). After harvest, King chilli fruits remain biologically active, exhibiting changes in respiration rate, color, firmness and water content. Notably, shriveling and wilting have a pronounced impact on the visual quality of these fruits (Meetei *et al.*, 2016). Nevertheless, the improper handling, packaging, and storage practices by many super markets and retailers often lead to a loss of freshness and a reduced shelf life. To overcome this issue, modified atmosphere packaging (MAP) has used for enhancing quality and extending the shelf life of fresh King chilli (Azlin *et al.*, 2014). Post-harvest treatments, such as low-temperature storage and appropriate packaging, can mitigate these physiological changes, preserving quality and extending the storage life of King chilli fruits (Chitravathi *et al.*, 2015; Manolopoulou *et al.*, 2010; Rahman *et al.*, 2012). Fruits treatment with calcium chloride (0.5%) and packed in non-perforated bags and stored under refrigeration at 5°C increase shelf life upto 10 days (Rongsennungla *et al.*, 2012.). Nevertheless, cold storage facilities can prolong the product's preservation to 8-10 months (Naik *et al.*, 2001).

Packaging and storage structures

Packaging plays a crucial role in the marketing of King chilli and is essential to safe guard the produce during storage, transportation and various marketing stages. The keeping quality of King chilli can also be effectively increased by use of different packaging materials. Effective packaging not only enhances ease of transportation and storage but also appeals to

consumers, leading them to be willing to pay higher prices (Rahman *et al.*, 2012). Exporters typically employ new gunny bags or low-density polyethylene film pouches (Sharma, 2014). Lower storage temperature results in longer storage life of King chilli (Rona *et al.*, 2003). Fruit treatment with calcium chloride (0.5%) and packed in non-perforated bags and stored under refrigeration at 5°C increase shelf life upto 10 days (Rongsennungla *et al.*, 2012).

Marketing

King chilli is mainly sold as fresh during harvest season in weekly market in the state. Market dynamics show that the highest prices for Naga King chilli are typically observed in the months of July and August, while lower prices prevail from September to January in all markets. Prices can reach as high as Rupees 600 to 800/kg in July but drop to as low as Rupees 300-400/kg during the period from September to January (Malangmeih and Rahaman, 2016). The quality and availability of the chilli are highest at the beginning of the harvest season, leading to price increases as the season progresses. The captivating aroma of the King chilli combined with its extreme pungency makes it an exclusive export commodity from the NE region of India. The Directorate of Horticulture has tied up marketing linkage with ITC Ltd. (Indian Tobacco Company), Spices Limited, Spices Board and ICCOA (International Competence Center for Organic Agriculture) for marketing of dried King chilli outside the state. This improvement in the marketing system is essential for the success of this crop (Sharma *et al.*, 2010)

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