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Popular Article



Standardization of Long-day Onion (Brown Spanish) Cultivation under the Mid-hill Conditions of West Kameng District, Arunachal Pradesh

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ABSTRACT

Long-day onion cultivars require extended photoperiods for bulb initiation and are generally restricted to temperate regions. Field evaluations conducted at ICAR–Central Institute of Temperate Horticulture (ICAR–CITH), Regional Station, Dirang, Arunachal Pradesh, demonstrated that the long-day cultivar 'Brown Spanish' is well adapted to the mid-hill agro-climatic conditions (1,800–2,600 m amsl) of West Kameng district. The standardized production schedule comprising September–October nursery raising, October–November transplanting, and April–May harvesting produced high-quality bulbs with excellent uniformity, an average bulb weight of ~250 g, bulb diameter of 8–12 cm, and a very low incidence of double bulbs (<10%). The crop also generated substantial green leaf biomass during the vegetative stage, providing an additional source of income through its utilization in traditional cuisines. Furthermore, harvested bulbs exhibited superior storage quality, remaining free from sprouting and rotting for nearly four months under ambient storage conditions. The study highlights the commercial potential of long-day onion cultivation for enhancing off-season onion production, reducing market dependency, and improving the livelihoods of tribal farmers in the Eastern Himalayan mid-hills

Keywords: Long-day onion, Brown Spanish, West Kameng, Mid-hill agro-climate, Off-season onion production

INTRODUCTION

Bulb formation in onion (*Allium cepa* L.) is primarily regulated by the interaction of photoperiod (day length), day and night temperature, the agro-climatic region of cultivation, and the genetic constitution of the cultivar. Among these factors, photoperiod is the principal environmental factor governing bulb initiation, while temperature influences the rate of bulb development and subsequent maturation.

Long Day Onion

Long-day onion cultivars are adapted, highly cultivating at northern regions of the United States, Canada, and northern European nations (Netherland) to higher latitudes and temperate or hilly regions, where prolonged summer photoperiods promote bulb initiation (Brewster et al., 2008). These cultivars generally require approximately 14–16 hours of daylight to initiate bulb formation. Both leaves and bulbs are harvested for consumption depending on the growing season and cultivar. Under short-day (Nov to Feb) conditions, vegetative growth is favoured, resulting in greater leaf biomass, whereas long-day conditions promote bulb initiation in particular to Long day varieties. In India, true long-day conditions are confined to the northern Himalayan region, including Ladakh, Jammu & Kashmir, Himachal Pradesh, and Uttarakhand, where maximum summer day lengths range from approximately 14.0 to 14.9 hours. In contrast, the north-eastern Himalayan region, including the higher elevations of West Kameng district, Arunachal Pradesh, experiences a maximum photoperiod of approximately 13.5–13.8 hours. Under these conditions, selected long-day or intermediate-day cultivars can be successfully cultivated when sown during October–November, producing bulbs with desirable attributes such as high sweetness, superior keeping quality, and extended storage potential.

Onion exhibits a distinctive biennial growth habit. During the first growing season, the plant remains vegetative and, upon exposure to the appropriate photoperiod and temperature, initiates bulb development for economic harvest. Following exposure to low-temperature conditions, bulbs replanted in the second growing season undergo floral induction, leading to flowering and seed production. This unique developmental pattern distinguishes onion from most annual vegetable crops and highlights the critical role of environmental cues in regulating its growth and reproductive cycle.

Maharashtra contributes nearly 45% of the national production and about 10% of the global onion output, making it the backbone of the Indian onion industry. Kharif, late kharif and rabi seasons are the three main seasons of the onion production in India (Short day cultivars). 2024-25 data says onion area surged from 15.41 lakh hectares in 2023-24 to 19.68 lakh hectares with production of 307.67 lakh tonnes (Press release -first advance estimation of 2025-26 area and production of horticulture crops-

https://www.pib.gov.in/PressReleaseDetail.aspx?PRID=2241379&lang=1®=3&utm_source=chatgpt.com). In India, onions are cultivated during the Kharif, late Kharif, and Rabi seasons (Fig. 1). Approximately 95% of the country's onion production is derived from short-day and intermediate-day cultivars grown predominantly in Maharashtra, northern Karnataka, Gujarat, Andhra Pradesh, and Madhya Pradesh (NHRDF-2022). These regions, located between 8° and 35° N latitude, experience favourable photoperiods of 10–13 hours that promote efficient bulb initiation and high productivity. Long-day onion cultivars are not cultivated commercially in India on a significant scale. Their cultivation is confined to temperate and high-altitude regions such as Arunachal Pradesh, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, and Ladakh, where summer day lengths exceed 13.5–14.9 h and day temperature ranging from 15 to 28 °C. Consequently, long-day onions contribute less than 1% of the national onion area and production, and no separate official statistics are maintained by the Government of India. In contrast, more than 95% of India's onion production

is derived from short-day and intermediate-day cultivars adapted to the tropical and subtropical plains.

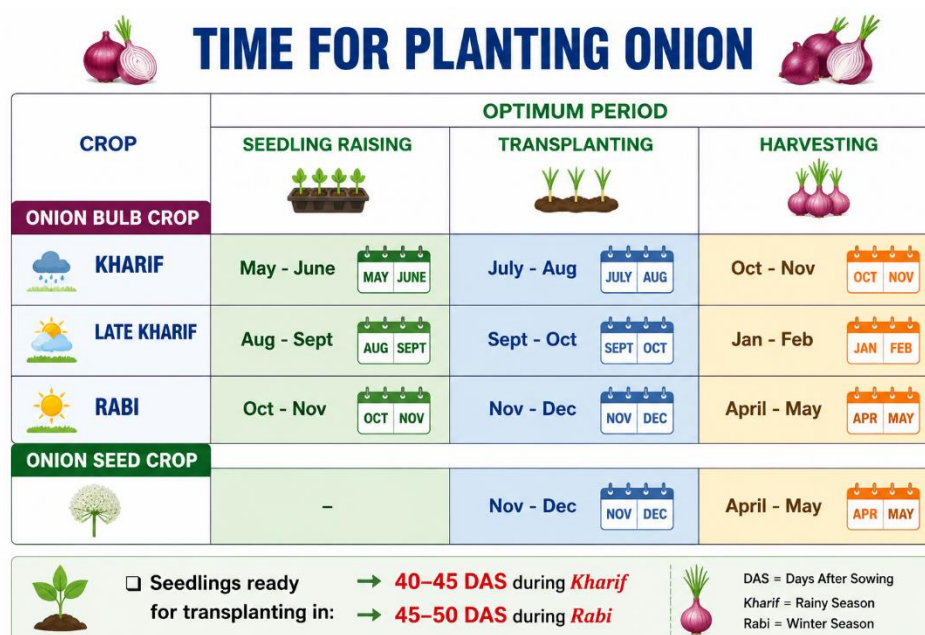


Fig. 1 Seasons for the commercial production of the onion in India.

Adaptation and Commercial Potential of Long-day Onion Cultivars in the Mid-hills of Arunachal Pradesh

Long-day onion cultivars have traditionally been cultivated in temperate regions where extended photoperiods are essential for bulb initiation and development. However, field evaluations conducted at the ICAR–Central Institute of Temperate Horticulture (ICAR–CITH), Regional Station, Dirang, Arunachal Pradesh, demonstrated that the long-day cultivar 'Brown Spanish' exhibits excellent adaptation to the mid-hill agro-climatic conditions of the Eastern Himalayas. The experimental site is situated at an altitude of 1,800–2,600 m above mean sea level (approximately 6,000–8,500 ft) and represents a unique transitional ecosystem between tropical foothills and the higher temperate Himalayas.

The crop requires approximately 150–180 days from sowing to bulb maturity under these conditions. The most suitable production schedule consists of nursery raising during September–October, transplanting in October–November, and bulb harvesting during April–May. During the vegetative phase (November–February), the crop produces abundant succulent green leaves, providing an additional source of income for farmers. Onion leaves are highly preferred by local consumers and are widely used in traditional cuisines, particularly in the preparation of momos, soups, noodles, and other indigenous dishes.

Bulb initiation commences towards the end of February, while vegetative growth continues simultaneously for a short period. During March, leaf elongation gradually ceases, and assimilates are redirected towards bulb enlargement, resulting in rapid increases in bulb diameter and weight. The bulbs exhibit excellent market characteristics, including a creamy-white to light orange skin

colour, uniform shape, and a very low incidence of double bulbs (<10%). Under protected cultivation, individual bulbs attain an average weight of approximately 250 g, with bulb diameters ranging from 8 to 12 cm, demonstrating the cultivar's high yield potential under mid-hill conditions.



Arunachal Pradesh encompasses three distinct agro-climatic zones: the lower foothills, characterized by tropical conditions; the mid-hills, represented by districts such as West Kameng; and the higher Himalayan region, including Tawang, where severe winters prevail. Among these regions, the mid-hill areas of West Kameng, including Dirang, Rupa, Nyukmadung, Sangti, and Chug, were found to be highly suitable for long-day onion cultivation. Although these locations do not experience prolonged snowfall, winter temperatures typically range between 1–2°C during the night and 12–15°C during the day, with relative humidity approaching 99% at night and 75–80% during daytime, creating favourable conditions for vegetative growth, bulb initiation, and bulb development.

An additional advantage observed during the evaluation was the exceptional storage behaviour of the harvested bulbs. Onion bulbs are generally susceptible to sprouting and rotting during storage, particularly under ambient conditions. In contrast, bulbs harvested from the mid-hill environment of Dirang remained free from sprouting and rotting for nearly four months under ordinary room-temperature storage without any specialized storage facilities. Although minor moisture loss and slight dulling of the outer scales were observed over time, bulb firmness, cooking quality, taste, and consumer acceptability remained excellent throughout the storage period, indicating superior post-harvest keeping quality.

The unique environmental conditions prevailing in the mid-hills of Arunachal Pradesh provide a natural advantage for the cultivation of long-day onions. The crop also integrates well into existing farming systems through intercropping with leafy mustard (Lai Patta), pea, maize, tomato, chilli,

and temperate fruit orchards such as apple, pear, peach, and persimmon. Since the onion crop occupies the field primarily from October to May, it effectively utilizes the otherwise underexploited winter growing period. During this season, cultivation of many solanaceous vegetables is severely restricted by frost unless protected cultivation is adopted, making long-day onion an attractive alternative crop.

Currently, onions available in the local markets during winter are transported mainly from Assam and southern Indian states, resulting in high retail prices ranging from ₹80–120 kg⁻¹ because of transportation costs. Moreover, these short-day onions are relatively more pungent and are less preferred by the local Monpa tribal communities, who favour onions with a milder flavour. Recognizing this production gap and market opportunity, ICAR–CITH Regional Station, Dirang, initiated research programmes to standardize the production technology and seasonal calendar for long-day onion cultivation under the mid-hill conditions of West Kameng district. Based on multilocation field evaluations and on-farm demonstrations, October to May was identified as the optimum growing season for the long-day cultivar 'Brown Spanish'.

The successful adaptation of long-day onions to the Eastern Himalayan mid-hills presents a promising opportunity to reduce dependence on imported onions from other states while improving regional self-sufficiency. Expansion of long-day onion cultivation across suitable mid-hill regions would not only stabilize off-season onion availability but also enhance farm profitability through the dual-purpose utilization of both green leaves and mature bulbs, thereby providing an economically sustainable production system for the tribal farming communities of Arunachal Pradesh.

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