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Short communication

Abscisic acid treatment for delaying bulb sprouting in short day onion

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ABSTRACT

Enhancement of shelf-life is imperative to stabilize the supply chain of onion when the price fluctuations are due to short of supply amid huge postharvest losses. Sprouting has been a major hurdle to alleviate postharvest losses. The screening of available onion cultivars for abscisic acid (ABA), a growth hormone associated with sprouting could be helpful to categories them for storability potential. Twenty two different varieties were analyzed for initial ABA contents and their sprouting up to five months. Results revealed that the highest ABA content was recorded in Bima Red (80.61 ng/g) followed by Phule Safed (60.63 ng/g). Whereas, the lowest ABA contents were observed in Palam Lohit (9.84 ng/g), followed by Agrifound Rose (11.39 ng/g). Despite, comparatively lower ABA contents, sprouting was not observed in Bhima Kiran, N-2-4-1 and Pusa Madhvi up to five months. It was observed that, the dormancy of onion during storage could not be attributed to the initial ABA content.

Key words: ABA, onion, sprouting, storage

Being a daily need in kitchen, year-round availability of onion for households is very important. Its medicinal properties, *viz*. thiosulfinates, thiosulfonates, allicin, aliin, ajoene and many other biochemical components (Corzo-Martinez *et al.,* 4) further increases its demand. India is the second largest producer of onion (166.54 lakh tonnes) in the world and besides fulfilling the domestic requirement, it exported 18.22 lakh tonnes of onion worth Rs. 2,294 crores during 2011-12 (NAFED, 9). In India, onion is grown under three crop seasons, *i.e*., *kharif*, late *kharif* and *rabi.* Among three planting seasons the main crop in *rabi* which contributes about 60% of total production is being used for storage and use in lean period. Ironically, huge postharvest losses to the tune of 40-50% have been reported across in *rabi* crop up to six months of storage (Murkute and Gopal, 7). Among postharvest losses, bulb sprouting, *i.e.* resumption of growth of dormant leaf primordial of stored onion a bulb is a complex issue and needs urgent attention to stabilize market prices and supply chain (Murkute *et al*., 8).

Normally the sprouting of onion bulbs during storage is characterized by specific changes in development and it may be possible to extend the storage duration if the biochemical changes involved in the dormancy could be determined (Benkeblia *et al*., 1). Abscisic acid (ABA), a growth inhibitor (Thomas and Isenberg, 10) is believed to be associated with the dormancy of bulbs in onion (Matsubara and Kimura, 6). However, several studies have substantiated that the response of ABA varies among cultivars and initial indigenous concentration (Yamazaki *et al*., 13). The available literature about ABA mainly deals with long day onion and its response. Therefore, the screening of available short day onion cultivars for ABA content *vis-à-vis* sprouting behavior was important to formulate strategies for future crop improvement programmes.

An experiment was carried out with twenty two different varieties of onion (Fig. 1) cultivated during *rabi* season of 2012-13 at Directorate of Onion and Garlic Research (DOGR), Rajgurunagar. Standard agro-practices as recommended by DOGR were used for cultivation. Well cured and healthy bulbs were selected for recording observations on sprouting and ABA analysis. The emergence of leaf primordia from neck was regarded as sprouting. ABA estimation was carried out using composite sample on fresh weight basis. Onions were sliced to take the about 5 g bulbs portion above the basal disc near the sprout primordia. The samples were prepared as per the documented procedure (Chope *et al*., 2). Endogenous ABA contents were quantified by ELISA with Phytodetekt ABA Test Kit (Agdia Indiana, USA), according to the manufacturer's instructions. Statistical analysis was done for completely randomized design (CRD).

The highest sprouting (Fig. 1) was observed in Bhima Red (86.67%) followed by in Bhima Dark Red (73.33%) and Arka Niketan (73.33%). However, five months after storage there was no sprouting observed in B. Kiran, N-2-4-1 and Pusa Madhavi. The highest ABA content was recorded in Bima Red

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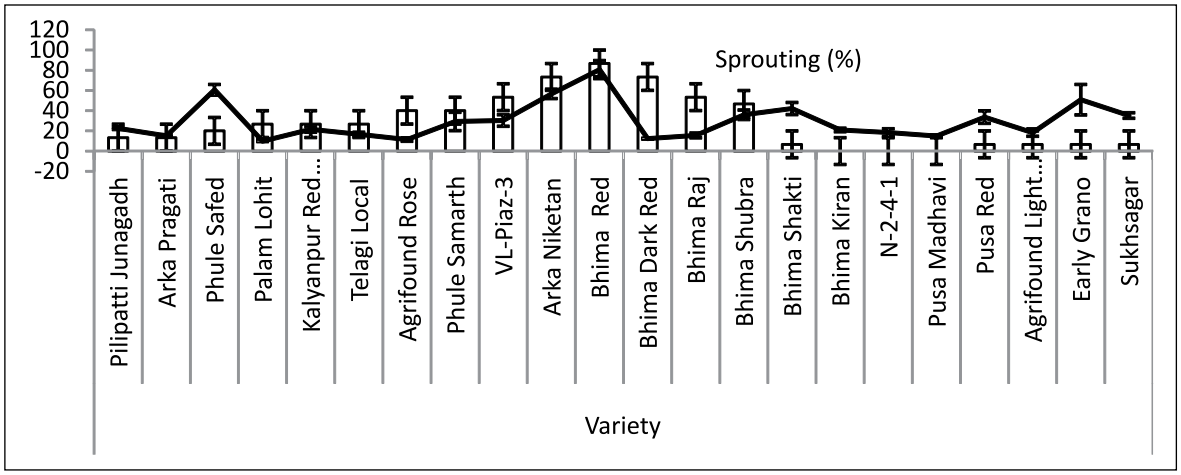

Fig. 1. ABA contents (ng/g FW) and bulb sprouting (%) in onion varieties.

(80.61 ng/g) followed by Phule Safed (60.63 ng/g) and Arka Niketan (56.56 ng/g). Whereas, the lowest ABA contents were observed in Palam Lohit (9.84 ng/g). In general, ABA content was found inversely proportional to the sprouting. Chope *et al*. (2) found that the initial ABA concentrations in cvs Renate (42.3 ng/g FW) and Ailsa Craig (29.8 ng/g FW) were significantly higher than cv. SS1 (8.2 ng/g FW), which had the lowest storage life than other two cultivars. While correlating the decrease in ABA concentration with the growth of sprout, it was suggested that ABA play a role in suppression of cell elongation rather than cell division (Chope *et al*., 3). Gibberellin induced hydrolase synthesis is known to be inhibited by ABA (Tittle and Spencer, 11), which arrests the development of growing embryo. Thus, higher indigenous ABA contents provide higher storage potential has been corroborated by the present attempt.

Despite non-significant ABA content in Early Grano (50.85 ng/g) and Arka Niketan (56.56 ng/g), a significantly huge difference in sprouting, from 6.6% (Early Grano) to 73.33% (Arka Niketan) was observed (Fig. 1). Similarly, the higher ABA contents of other varieties could not be translated in reduction of sprouting losses as compared to Bhima Kiran, N-2-4-1 and Pusa Madhvi who have comparatively lower ABA, *i.e*. 20.62, 18.35 and 14.93 ng/g FW, respectively, which did not show sprouting over storage period. Apart from type of cultivar, plant tissue, the environmental factors also influence absolute ABA concentration (Mitsubara and Kimura, 6). The lower sprouting incidence of light red onion cvs N-2-4-1 and Bhima Kiran, have been attributed to the lower respiration rate (Tripathi and Lawande, 12). It was revealed that the temperature has profound impact on sprouting and low and high temperature prohibit sprouting and encouraged at intermediate temperatures (Ernst *et al*., 5). Thus, the biochemical changes that are taking place during the storage period are affected by storage environment, respiration rate and other factors and the nutrients required for the dormant sprout to grow are dependent on the biochemical processes linked to the sprouting (Chope *et al*., 2). Therefore, it could be inferred that the sprouting of onion cultivars is dependent on the time required for depletion or assimilation of indigenous ABA to a minimum level than mere the initial concentration.

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