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Effect of Direct Sowing and Stratification on Germination and Growth of Peach under Sub-tropical Climate of Uttar Pradesh

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ABSTRACT

Background: Availability of quality planting materials is the major impediment in extension of cultivation of low chilling peach in northern plans. Plum suckers are mostly used as rootstocks for raising peach; however nematode infestation is a major problem. Seeds of all peach cultivars do not germinate under subtropical climate of plains of Northern India. Hence, an experiment was carried out at ICAR-CISH, Lucknow on seed germination and subsequent growth of seedlings of low chilling peaches.

Methods: Fully mature seeds of peach cv. Florda Prince, Pant Peach 1 and Sharbati were collected during June. Some of the seeds were sown direct *in-situ* during 1st week of December and remaining seeds were sown in the field after 2 months of stratification in the refrigerator at 7-8°C.

Result: Stratification had significant effect on seed germination and late matured peach cv. 'Sharbati' exhibited higher seed germination. Good linear seedling growth and maximum percentage of buddable seedlings was found in stratified sown seeds of 'Sharbati' peach. Thus the study indicated that harvesting of 'Sharbati' and 'Pant Peach-1' seeds can be done during June and pre-sown stratification is necessary for better germination and growth of seedlings under subtropical climate of Lucknow.

Key words: Low chilling peach, Seed germination, Sharbati, Stratification.

Peach (*Prunus persica* L. Batsch), a fruit of family rosaceae is the most delicious stone fruit grown in temperate and subtropical regions of the world (Singh and Singh, 2002). Peach is propagated by budding as well as grafting on seedling and clonal rootstocks. However, in India, it is mostly raised on seedling rootstock in foot hills of Himachal Pradesh, Uttarakhand and Jammu and Kashmir. The low chilling peach cultivars, most commonly, Florda Prince, Shan-e-Punjab, Saharanpur Prabhat, Sharbati, Pratap, Early Grande *etc.* have gained popularity in subtropical regions of Punjab, Haryana, western Uttar Pradesh and Uttarakhand (Singh *et al*., 2016). For raising rootstocks, seedlings are usually procured from Jammu and Kashmir, Uttarakhand and Himachal Pradesh. Plum suckers, mostly used as rootstocks for raising peach, are available in western Uttar Pradesh, however they are highly infested with root knot nematodes and several species of root-knot nematodes (*Meloidogyne* spp.) are known to be the limiting factor in stone fruit production in warm environments (Pinochet *et al*., 1996). Seeds of peach trees enter dormancy at the time of fruit harvest and seed germination is influenced by seed coat dormancy, inhibition of germination manifested with a hormonal nature and embryo dormancy and therefore, seeds need to be exposed to low temperature and moist environment which provide the stimulus required for overcoming dormancy, increase germination and produce normal seedlings (Setu *et al*., 2020). Therefore, seeds of all peach cultivars are unable to germinate under natural condition in subtropical plains of Northern India due to non-availability of adequate chilling hours necessary for seed germination. Thus, an experiment was carried out to evaluate effect of stratification treatment prior to sowing and direct sowing on seed germination and subsequent growth in different peach cultivars.

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The present experiment was carried out at ICAR-Central Institute for Subtropical Horticulture (CISH), Lucknow, Uttar Pradesh during 2019 and 2020. Planting materials of peach cv. Florda Prince, Pant Peach 1 and Sharbati were procured from GBPUAT, Pant Nagar, Uttarakhand during 2015 and successfully established in the experimental farm of ICAR-CISH. Fully ripe fruits of peach cv. Florda Prince, Sharbati and Pant Peach 1 were harvested from the farm during 15-20 April, 25-29 April and 01-10 May, respectively and seeds were extracted and then stored by packing in aluminum foil for germination studies during December. After removing the pulp, seeds were washed in running water and dried in shade. Some of the seeds were soaked overnight in water and sown direct *in-situ* (without any stratification treatment) on the raised bed during 1st week of December and remaining were soaked in water for 24 hours and spread over the moist sand layer and then kept in the refrigerator at 7-8°C temperature for stratification, moisture was checked

intermittently. The stratified seeds were sown in first week of February. Seedlings attaining pencil size thickness were used for budding. Data with regard to seed germination percent, linear growth, radial, growth of seedlings and percentage of buddable plants were carried out in July-August. The experiment was laid out in randomized block design with two factors (1st factor = Variety: 'Pant Peach-1', 'Florda Prince' and 'Sharbati'; 2nd factor = Sowing method: direct field sowing and stratified seed sowing), replicated three times, having sixty seeds per replication. The data obtained from the experiments were analyzed using the Web Agri Stat Package version WASP 2.0 (ICAR Research Complex for Goa, Ela, Goa-403 402, India). Treatment difference was evaluated using the least significant difference (LSD) at $P \leq 0.05$.

Seed germination percentage has been depicted in Fig 1. Perusal of data revealed significantly maximum seed germination in peach cv. 'Sharbati' (35.00%), regardless of sowing methods. Irrespective of variety, highest germination was observed in stratified seeds (24.00%). The interaction effect exhibited maximum germination in 'Sharbati' (45.0%) followed by Pant Peach-1 (28.00%), when seeds were sown after stratification treatment (Fig 1). Irrespective of variety, mean seedling growth of 74.22 cm was noted in stratified seeds. Maximum linear growth of seedlings was noted in 'Sharbati' peach (113.33 cm), regardless of sowing condition. Among the interaction study, significantly good linear seedling growth was recorded in stratified sown seeds of 'Sharbati' (129.00 cm), while minimum seedling growth was noted in 'Florda Prince' under direct sown condition (0.00 cm) (Fig 2). Irrespective of variety, maximum mean radial growth (11.33 cm) was recorded in stratified seeds though the variance was non-significant. Significant variation in radial growth was recorded among the varieties, regardless of sowing condition, maximum noted in Sharbati (20.28 cm) while minimum in 'Florda Prince' (0.00 cm). Although the interaction effect was non-significant, highest mean radial girth of 20.67 cm in stratified seeds of 'Sharbati' (Fig 3). Irrespective of sowing condition, percentages of buddable seedlings were recorded maximum in 'Sharbati' (59.83%), followed by 'Plant Peach-1' (27.00%). Irrespective of variety, percentages of average buddable seedlings were noted maximum in stratified seeds (34.78%), while it was 23.11% in direct sown seeds. Interaction effect of variety and sowing conditions were also found significant on buddable seedling per cent, maximum buddable seedlings were recorded in 'Sharbati' seeds sown after stratification treatment (68.33%) (Fig 4).

Stratification as well as chemical treatment is necessary to remove physiological seed dormancy for seed germination. In low chilling cultivars most of the cultivars do not germinate as embryo is not fully matured, these results are in agreement with the findings of Sharma *et al.* (2003) who got good seed germination in low chill peach after seed coat removal and got (97.7%) seed germination in 'SRE-6' cultivar. He further observed that seed kept for stratification at low temperature in laboratory, exhibited better seed

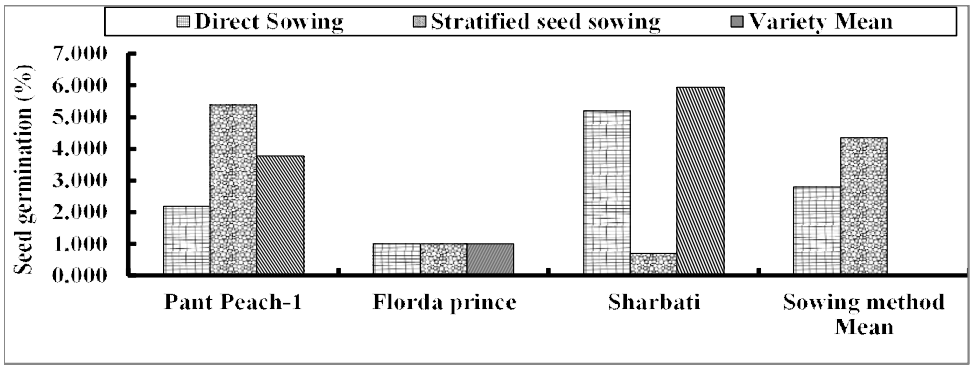

Fig 1: Seed germination as influenced by direct sowing and stratified seed sowing of peach.

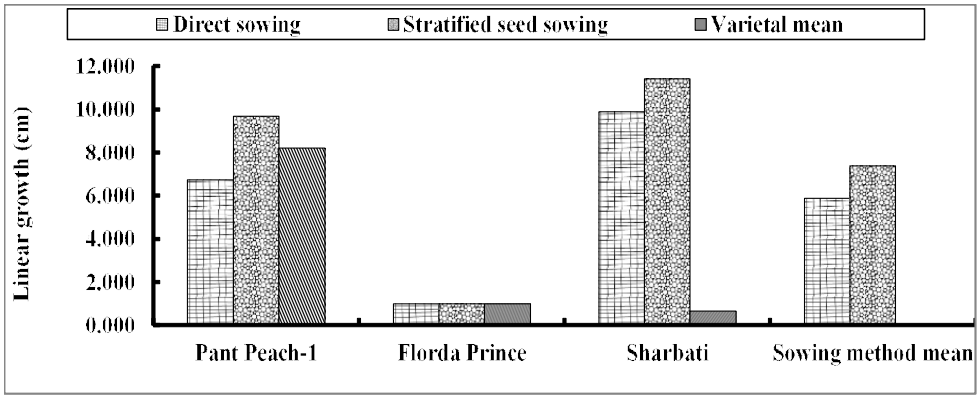

Fig 2: Seedling linear growth as influenced by direct sowing and stratified seed sowing of peach.

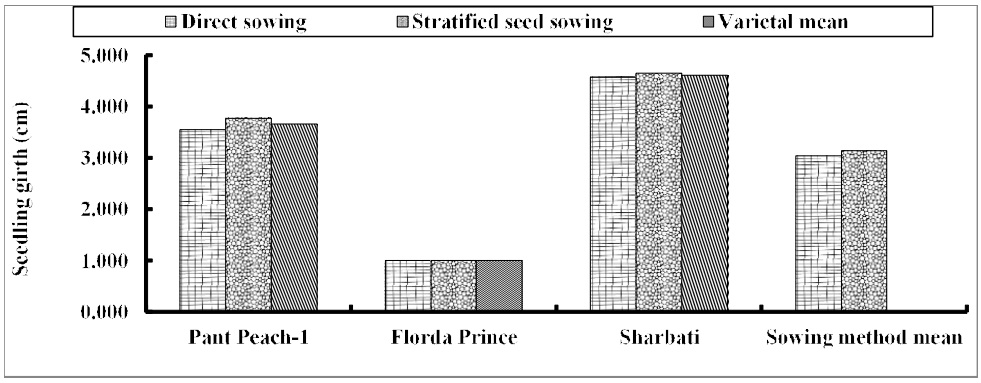

Fig 3: Girth of seedlings as influenced by direct sowing and stratified seed sowing of peach.

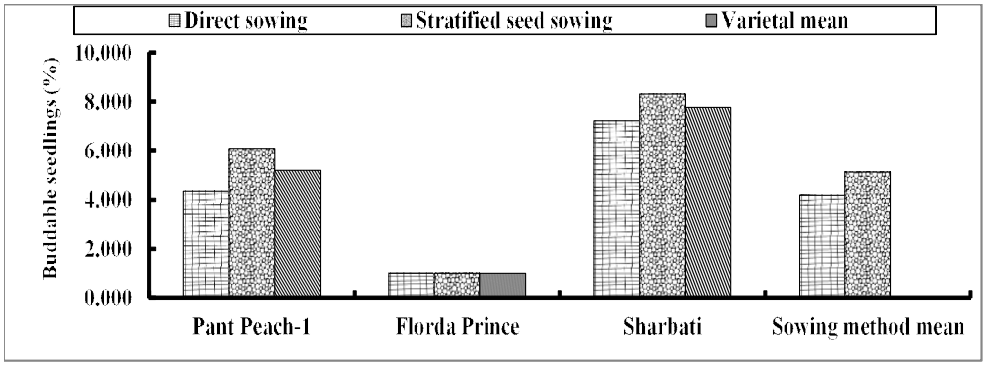

Fig 4: Percentage of buddable seedlings as influenced by direct sowing and stratified seed sowing of peach.

germination than field. Poor germinability of the seed of early maturing peach variety is caused by inadequate endosperm formation and abortion of the embryo, which is known to be a serious handicap in any breeding project aimed at the production of early stone fruit varieties (Braak, 1978) since the flesh of the early ripening types matures before the embryo is fully developed (Hancock *et al*. 2008). Therefore, good seed germination in 'Sharbati' and 'Pant Peach-1' could be attributed to late fruit maturity compared to Florda Prince, resulted in proper embryo growth and development, hence good seed germination and seedling growth, these results are in conformity with Sharma (2005) and Wagner *et al*. (2006). Peach seed stratification under cool temperatures is used for breaking physiological dormancy called rest period. Sharre *et al*. (2019) also reported that freshly harvested seed of desert peach (*Prunus andersonie*) readily germinate without pretreatment if seeds remain moist immediately after cleaning unlike many *Prunus* species. Seed stratification process also affects the seedlings linear and radial growth. Maximum seedling growth and percentage of buddable size were recorded in 'Sharbati' peach which were harvested late, compared to early-ripening peach cv. Florda Prince. Connors (1920) stated that in early ripening peaches, cotyledons had not yet filled the seed coats and considerable transparent endosperm occupied this space during the time of fruit maturity. This situation was quite different from that of late-ripening peaches, in which he described seed maturity as preceding that of the fruits. Weaver and Hough (1959) suggested the presence of auxins in higher concentration while growth inhibitors showed decreasing in concentration with increasing embryo maturity. Therefore, the interaction of auxins and inhibitors might account for differences in seedling growth at the various stages of embryo maturity. Growth responses following stratification also varied considerably with embryo maturity. These results are accordance with the findings of the Martins *et al*. (2014) who recorded good seed germination and seedling growth after stratification of more than 60 days.

CONCLUSION

From the present study, it can be concluded that 'Sharbati' and 'Pant Peach-1' seeds can be harvested in June for better seed germination. For meeting out the chilling requirement necessary for seed germination it can be kept in the refrigerator for low temperature treatment. Stratified seed's seedlings have better germination and growth.

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