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Quality nursery plant production in apple by altering shoot growth formation pattern

With the rapid adoption of vertical planner orchard planting systems particularly Tall Spindle for apple high density planting plantation, apple growers need to utilize feathered nursery plants to ensure early production, which help to cover the substantial increased cost for establishment of high density orchard. However, mostly the planting material produced and sold, is un-branched, 60-90 cm, small caliper plant with one-year-old tops which do not suit to the demand of commercial apple orchardists utilizing high density planting system. The country is spending a lot of money for import of feathered nursery plants from other countries. Moreover, being a large canopy size, feathered nursery plants are difficult to carry/transport as they require specific care during packaging and transportation. Therefore, in present scenario, it has become necessary to develop a nursery management technique to stimulate development of feathers on one year old nursery plant so that apple nurseries can produce the high quality well-feathered plants suitable for advanced high density orchard planting system.

THE quality of nursery plants has a big impact on the early production and profitability of high density orchards. Therefore, starting an orchard with high quality nursery plants is the first key to a successful apple high density planting. Now-a-days, vertical planner orchard planting system with conic shaped canopy viz. Tall Spindle, Vertical Axis, Slender Pyramid, SolAxe, HYTEC *etc.* are dominating system for apple high density planting throughout the world. These systems are specially designed for apple high density and utilize high quality feathered nursery plant for planting and for boosting the productivity.

Ideal nursery plants for vertical planner orchard planting systems

High quality apple nursery plants suitable for vertical planner orchard planting system should be at least 6 feet tall with dominant straight leader to achieve desired height after planting and have at least 14 mm trunk diameter to produce significant yield during second year. Further, it should have 6-8 feathers which are induced at desirable height (more than 70 cm from ground) and distributed along the leader at regular intervals, with appropriate length (10-40 cm) and crotch angle (45º). Moreover, it should have an abundance of healthy roots to support plant canopy during the first year.

Advantage of feathered nursery plant

High quality feathered nursery plants of apple with large caliper and high root volume will quickly establish, grows to desired height and fill their allotted space in orchard and consequently improve total light interception in early life of orchard. Furthermore, feathers form flower buds in the second year of nursery cycle as well as during first year in orchard and it will produce significant yield during second year which will help to cover the cost of establishment. Moreover, early cropping controls vegetative vigour of apple plants and consequently results in optimum growth for flowering and fruiting. Additionally, with the use of well-feathered nursery plants, canopy management after planting will become easy and cost effective.

Technology gaps

Most of the apple varieties do not produce satisfactory lateral branching in the nursery. Generally apple varieties with strong apical dominance produce laterals on three year old wood as they follow fixed growth pattern and produced preformed shoot. Fixed growth involves the elongation of preformed stem units after rest period. Furthermore, the numbers of the preformed leaf primordia vary among genotypes. Therefore, to produce syllepsis branches/feathers (branches generate from a lateral meristem without a dormancy period while the leader is growing- neoformed shoot) in desired numbers, significant intervention is needed for simultaneous initiation of feathers in nursery plants. First and foremost requirement for production of high quality feathered plant is a two year nursery cycle, whereas in India apple nurseries are producing one year old maiden nursery plant with 60-90 cm height and 4-6 mm trunk diameter. These plants are not suitable for establishment of most of the high density

One year old nursery plant

First application of BA at 15 cm (new growth)

Bud swelling—15-20 days after spray

Initiation of feathers 20-25 days after first spray

Initial feathers growth

Advancement in feathers growth

Advancement in feathers growth

Fully developed feathers

Second year nursery cycle- dormant 2 years old feathered nursery plants

Evenly distribued feathers with wide crotch angle

Flowering during second year

Fruiting during second year

apple orchard planting systems. If apple grower's use such type of plant, the plants will come into bearing after 4 or 5 year, often the carrying costs from the very high investment of high density orchards devastate the potential returns and negate the benefit of the high density planting for profitability. Keeping in view of the above technical gap, ICAR-Central Institute of Temperate Horticulture, Srinagar developed nursery management technique to stimulate feathering on one year old nursery plants during the second year of nursery cycle.

Technique

Plant one year old grafted apple nursery plants with 60-80 cm height during the end of December (prefer) or last week of February at 90 (within row) × 60 (in row) cm spacing. Remove lateral branches if any present on plant. Apply 600 ppm 6-benzyladenine to produce 6-8 feathers nursery plant and 1000 ppm to produce 10-14 feathers nursery plant during second vegetative growth on the apical section of the central shoot when it produce 12-15 cm new growth in standard type varieties and on 15-20 cm new growth in spur type varieties using hand sprayer until run-off. Apply 3-4 sprays at one week interval in standard/vigorous growing varieties and 4-5 sprays at two week interval in spur/slow growing varieties. Follow routine fertilizer, irrigation, weeding and pest and disease programme. In addition, apply two foliar application of urea at 15 days interval starting from first week of September.

Performance

- This technology has produced well feathered nursery plants {6-12 evenly distributed feathers with optimum length (10-40 cm), moderate vigour (2.7-2.9 trunk to mean feather diameter ratio) and wide crotch angle more than 48°-55°), two year old nursery plants with 1.6-1.9 m height and 12-15 mm plant caliper (10 cm above graft union).
- Through this technology, the grafted plants under high density planting starts bearing during second year.
- From one kanal nursery area (500 m^2) with production potential of approximately one thousand two year old apple nursery plants, nurserymen can earn additional income of ₹ 1.5-2.0 Lakh than growing one year old grafted maiden nursery plant.

Treatment costs: Treatment costs vary from ₹ 2.7 to 7.5 /plant for 10 ml spray solution and ₹ 4.05 to 11.26 / plant for 15 ml spray solution.

Preparation of benzyladenine (BA) solution: Dissolve required quantity of BA in small quantity of IN NaOH (40 g in one litre water) then add required amount of water.

Preparation of ppm (part per million) solution

600 mg in 1 litre = 600 ppm

1 g in 1 litre = 1000 ppm

Some basic considerations

- Spray under slow drying condition *i.e.* late evening or early morning (best temperature 18-28°C),
- Do not spray on wet foliage,
- Do not spray on unhealthy and stressed plants,
- Ideally there should be no rain at least 6 hour after BA spray,
- Add 400 µL per litre silicon based adjuvant in spray solution if rainfall is predicted,
- Rewetting- within 1-2 days of spray application can increase effectiveness.

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– Editor