Apical root cutting: A novel technique for the production of quality seed potato

India is the second largest producer and consumer of potato in the world. In the past five decades, potato production has steadily increased from around 8.3 million tonnes in 1980 to 48.6 million tonnes in 2017, an increase of more than 500 percent. In the past ten years, the production has increased more than 60 percent with both area and yield contributing to the increase. The national average potato yield in 2017 was around 24 tonnes per hectare. However, there are wide variations in yield level within India, ranging from 31.5 tonnes per hectare in Gujarat to 10 tonnes per hectare in Assam. Among different constraining factors for yield growth, the limited availability of quality seed material is considered as the most important factor for lower yield levels in eastern states. The high cost of seed (₹ 60,000-75,000 per hectare), which accounts for 40-50% of the total cost of production, has been a key deterrent for small farmers to take up production in many of these states.

In India, potato seeds are produced in Punjab using seed plot technique and aeroponic technology and transported up to 2,000 km to potato growing states of eastern and southern India. The high transportation cost is borne by the poor farmers who have to pay high seed prices as well. To make matters worse, the high price does not
guarantee high quality, thus making it difficult for small and marginal farmers to invest such a large sum in seed purchases which accounts for nearly half of the total cost of production. The spread of aeroponic technology has been limited to Punjab because of its high capital requirement and long gestation period of nearly four years before any return comes in. If a low-cost technology can be made available to produce seed potato at cheaper price then these eastern and southern states have immense potential to increase potato production by improving productivity and lowering cost of production. Potato Vegetable and Flower Research Centre (PVFC) in Dalat, Vietnam is a leader in apical rooted cuttings for producing mini tubers and seed tubers. Recently, this technology has been standardised at ICAR-Central Potato Research Institute Shimla, India for the very first time. The results were remarkable which suggests that the technology can be used for production of quality planting material at low cost by the local growers. The soil and environment in many parts of the eastern and southern regions are suitable for cultivating potato seed in rabi season (October-March) and in some areas like Hassan in Karnataka and Koraput in Odisha, it can be grown in kharif season (July-October) also. Specifically, the north eastern states could be potato seed hub supplying seeds to West Bengal, Odisha and Bihar.

**Introduction to apical cuttings**

Apical cuttings are rooted transplants produced in a glasshouse from tissue culture plantlets. Rather than allowing tissue culture plantlets to mature and produce minitubers, cuttings are produced from the plantlets. Once rooted, the cuttings are transplanted into the field to produce seed tubers. In aeroponic, tissue culture plantlets are used to produce minitubers using capital intensive aeroponic technology in screen houses, whereas in apical cuttings the tissue culture plantlets are used as mother plants in cocopeat for producing cuttings. Apical cuttings are an alternative to minitubers in current production seed systems for potato.

**Principle**

When the apical bud is removed, the lowered IAA concentration allows the lateral buds to grow and produce new shoots. Once the apical dominance has been lifted from the plant, elongation and lateral growth is promoted and the lateral buds grow into new branches which are further used to increase the multiplication rate.

**How it works**

The healthy microplants are used as a mother stocks which are planted either in trays or nursery beds. The first round of cuttings can either be used to expand parent material in the first month of production with the remaining months dedicated to commercial production of rooted cuttings or can be directly used for the production of rooted cuttings. Other plants are used as a stock up to ~3-4 weeks until the first cuttings will be planted in the field. Thus, any new shoots forming after this cut off time will be placed into plugs for transplanting – the commercial product which will continue to be produced over a 1-2 month period. Thus, apical cuttings involve:

i) Production of rooted cuttings (transplants) originating from tissue culture plantlets in the glasshouse.

**Transplanting tissue culture plantlets in the glasshouse**

The variety used for the standardization was Kufri Chandramukhi. The initial tissue culture plants were planted in nursery beds or crates at a spacing of 5-15 × 5-15 cm. The spacing depends whether one will collect minitubers from the residual mother plants, and the size of the minitubers to be produced. Fill the bottom of the crate with cocopeat, vermiculite, sterile sand or soil or mixture thereof, depending on what is available, deep enough to plant the tissue culture plantlets that will serve as mother plants. After 10 days depending upon the plant growth, the first apical cutting was taken which was 2-3 cm long with two true leaves. These cuttings were planted in irrigated pro-trays filled with cocopeat. Once the apical dominance was lifted, the lateral buds grow into new branches which were further used to increase the multiplication rate. In 4-5 weeks, 5 cuttings were taken which increased the multiplication rate at 1:7-8 times, respectively. These rooted apical cuttings are ready for transplanting in the field.

**Cuttings ready for transplanting/commercial sale**

Cuttings can be transported in the same trays they were produced in. Alternatively, they can be planted in the field. The same package of practices of hi-tech seed potato production can be followed for the minituber production.

**Way Forward**

Rooted cuttings have the potential to transform potato seed systems. The rapid and high rate of multiplication will significantly contribute to reducing seed potato shortages. Each cutting produces 7 to 10 tubers, and up to 15+, which are multiplied further for a season or two and then the harvest is sold as seed. This is very high-quality seed, equivalent to basic or certified seed in seed certification systems. This means that the seed that farmers buy is extremely high quality and will produce high yielding crops, encouraging seed multipliers and farmers to keep coming back to buy more. The further refinement in this low cost technology is much needed and is under investigation at ICAR-CPRI, Shimla.

For further interaction, please write to:

**Dr Tanuja Bucketh** (Senior Scientist), ICAR-Central Potato Research Institute, Shimla (Himachal Pradesh) 171 001. E-mail: tanujagbpua@gmail.com

---

**Indian Horticulture**