

Aqua rooting of semi-hardwood grape cuttings: A rapid cloning technique for rootstocks

Grape cultivation is highly remunerative when it is grown on recommended rootstocks. However, poor rooting and multiplication rate of recommended rootstocks pose serious problem in large scale replanting, covering new areas etc. Moreover, conventional methods pose problems due to spread of diseases and nematodes. Hence, grape rootstock propagation through semi-hardwood cutting in water cups is an efficient technique, which can produce healthy plantlets in bulk. It can be practiced multiple times in a year by effectively using the huge amount of thinned vine segments during pruning/grafting/training of vines.

GRAPE (*Vitis vinifera* L.) is a highly versatile vine crop that can be grown in various climatic conditions, such as tropical, subtropical, and temperate climate. Grape cultivation has been proven to be one of the most profitable horticultural enterprises. In India, it is being grown in an area of over 1.63 lakh hectares, with an annual production of 3.48 million metric tonnes (MT) and productivity of 21.0 MT per hectare (MoAFW 2023). It is one of the most important fruit crops in India and is widely cultivated in diverse agro-climatic zones ranging from temperate regions in Himachal Pradesh and Jammu & Kashmir; Haryana, Punjab and Western UP (Sub-tropical) to tropical areas of central and south India. Maharashtra and Karnataka are the major grape growing states contributing more than 95% acreage and production.

Growing grapes from cuttings is the most popular method for propagating scion varieties and rootstocks, but there are several other simple methods for multiplying plants, which are more efficient and can be undertaken during different seasons of a year when the sprouts are just mature (semi-hardwood). Grape cultivation is highly remunerative when it is raised on recommended rootstocks. Presently, grafted plants for salt, drought, heavy metal, calcareous soil conditions, biotic stresses *etc.* can be mitigated by using efficient rootstocks. Dogridge and 110R have been adopted as the traditional rootstocks in the Indian grape growing areas. These rootstocks are known for their resilience to nematode infestation, salinity and drought stresses. Hence, rootstock plants are required in huge numbers for grafting to replant or covering more area under new grape varieties. Traditionally, rootstocks are multiplied through hardwood cuttings with the rooting success of 60-70% at a given soil and climatic conditions. Obtaining sufficient hardwood cuttings is time consuming as it may take more than 6 months for wood maturity.

The green or semi-hardwood cuttings derived propagation is one of the most efficient vegetative

propagation systems, since establishing *in situ* vineyard give rise to huge number of immature vines after thinning/grafting, which can very well be rooted under controlled condition by giving auxin treatment. This article describes multiplication of Dogridge rootstock using thin (green) semi-hardwood stem cuttings dipped in RO water in disposable water cups.

Green or Semi-hardwood cuttings

These stem cuttings are those which can be collected from mother vines at any suitable time. At present, this technique is the most popular propagation method for several annuals and herbaceous plants that do not mature into woody stems. Green cuttings are quick to root and regrow. Rooting in water makes it an easy and an inexpensive propagation method. Grape being a temperate crop, grows continuously under tropical region. The soft-wood cuttings are excised from soft, succulent new growth of vines just before they begin to harden (typically May through July). Shoots at the semi-hardwood stage are easy to prune and when treated are easy to root under proper controlled growth conditions. Semi-hardwood cuttings are normally obtained from the current season's vine growth after the wood has semi-matured. Many broadleaf evergreens/ vines are currently propagated efficiently by using green/ semi-hardwood cuttings.

Aqua-cup (disposable cup) rooting of semi-hardwood cuttings

This is an innovative method of rooting grape through semi-hardwood cuttings, which otherwise go waste after thinning of the vines/grafting. The merits and demerits of the technique are listed below.

Merits

- It is a cheap, simple and rapid technique for vegetative multiplication of grape varieties/ rootstocks.

- It allows effective use of large quantity of semi-hardwood vine segments obtained after thinning out operations in commercial vineyards and during grafting etc.
- Just matured stem segments root most efficiently in water when given ideal auxin pre-treatment.
- It allows most healthy plant multiplication minimizing risk of spread of fungal pathogens, nematodes etc. in the earth ball.
- Rooted rootstock plantlets allow easy bench grafting and thus application of automation in propagating composite grape plants in bulk.
- Several rounds of propagation can be practiced depending on the tissue maturity of the vine.

Demerits

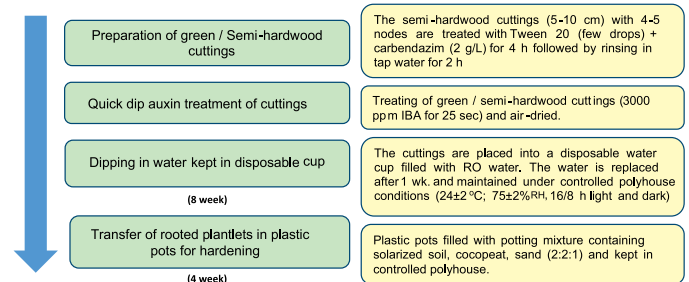
- Requires strict control of humidity, light conditions, and temperature during rooting and after transfer of the rooted plants and/ or for grafting.
- Constant vigil for minimizing the microbial infection during rooting and plant mortality during transfer to plastic pots.
- Costly protected structures are required for achieving good rooting.

Propagation in disposable water cups

The steps involved in propagating 'Dogridge' green/semi-hardwood cuttings in the novel aqua cup setup are described below.

- The healthy vines are selected for making semi-hardwood cuttings (5-10 cm), with 4-5 nodes or leaves. By using a sharp stainless-steel blade, semi-hardwood cuttings are excised.
- Dipping of cuttings in Tween 20 (few drops) + carbendazim (2 g/L) for 4 h followed by rinsing in tap water for 2 h to reduce the microbial spore load.
- Excision of leaves and dipping the cutting base in auxin (solution) as quick dip (25 sec) (Table 1).
- The basal end of the cuttings is air-dried (10 min) and placed into a disposable water cup filled with RO water. The cutting can also be allowed to pass through a small hole made on the disposable lid so that the same stands straight in water.

Aqua rooting...



Propagation of grape rootstock using green cuttings in disposable water cups

- The aqua rooting set up is maintained under controlled polyhouse conditions ($24\pm 2^{\circ}\text{C}$; $75\pm 2\%$ RH, 16/8 h light and dark cycle). The unit is never allowed to expose to direct sunlight or dry hot temperature.
- The RO water in each cup should be changed periodically (7 days) to avoid algal growth.
- Post rooting and spout of the shoot, the cuttings are transplanted in plastic pots filled with potting mixture containing solarized soil, cocopeat, and sand (2:2:1).
- Post transfer, the rooted plants are covered with perforated polybags and sprayed with carbendazim (2 g/L) at fortnightly interval to avoid any fungal growth.

The different auxin treatments through quick dip were effective in inducing roots on semi-hardwood cuttings in grape rootstock 'Dogridge'. The highest plantlet survival post transfer to plastic pots was 80% in polyhouse. Some degree of microbial infection was seen, which could be controlled by spraying systemic fungicide. The auxin treatment having 3000 ppm for 25 sec was most effective for root induction.

The entire multiplication cycle is of 12 weeks and the rooted plantlets are ready for transplanting in field after 4 weeks of hardening in plastic pots maintained under controlled polyhouse conditions.

The grape plants could be effectively produced through semi-hardwood cuttings in Dogridge by using the thinned shoots/vines. This method is most effective in polyhouse conditions and rooting of green cuttings could be made multiple times in a year. This method is easy for raising healthy true-to-the-type rootstock plants in bulk for

Table 1. Rooting of green/semi-hardwood cuttings of 'Dogridge' rootstock in water cups under polyhouse conditions

Treatment	Details	Days to root initiation	Average root length (cm)	Average no. of roots	Rooting (%)	Plantlet survival (%) after transfer*
T ₀	Control	44	1.2	3	25.2	25
T ₁	1000 ppm IBA (Quick dip)	42	3.5	5	42.1	33
T ₂	1500 ppm IBA (Quick dip)	39	4.2	7	67.2	42
T ₃	2000 ppm IBA (Quick dip)	32	5.0	10	71.3	55
T ₄	2500 ppm IBA (Quick dip)	28	6.8	12	74.2	72
T ₅	3000 ppm IBA (Quick dip)	21	7.2	15	83.5	80

*Potting medium (soil: cocopeat: FYM; 2:2:1) filled in plastic pots 4.5" and covered with polythene bags (45 cm) with small perforations.



Vegetative propagation of grape rootstock Dogridge using green cuttings

grafting of any popular scion variety. The different steps involved in grape multiplication through semi-hardwood cutting are depicted above diagrammatically.

CONCLUSION

Rooting of green/semi-hardwood cuttings in grape is a unique method to clone any recommended rootstock in

bulk by using vine segments obtained after vine thinning operation done in vineyards.

For further interaction, please write to:

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Tomato Hybrid Kashi Adbhut (VRNTH-18283) for high temperature: Suitable for high day temperature of $38\pm 2^{\circ}\text{C}$ and night temperature of $32\pm 2^{\circ}\text{C}$. Semi-indeterminate plants, fruit weight 60-30 g with yield potential of 520 q/ha, having TSS 3.7° Brix and acidity 0.25%. Crop duration February to June under north Indian plains. Availability of fruits up to 2nd week of June. Identified by Institute Technology Identification Committee. Proposal for release and notification submitted to U.P. State Government in April 2022.

Tomato Hybrid Kashi Tapas (VRNTH-19095) for high temperature: Suitable for very high day temperature of $38\pm 2^{\circ}\text{C}$ and night temperature of $32\pm 2^{\circ}\text{C}$. Semi-indeterminate plants. TSS 5.4° Brix & acidity 0.38%. Yield potential is 448 q/ha. Fruit weight is 45-40 g. Crop duration February to June under north Indian plains. Availability of fruits up to 1st week of June. Identified by Institute Technology Identification Committee. Proposal for release and notification submitted to U.P. State Government in April 2022.

Source: ICAR-Annual Report 2022-23