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# EFFECT OF DIFFERENT MEDIA COMBINATIONS ON ARIAL ROOT PRUNING TECHNIQUE BY ROOT TRAINERS AS ALTERNATIVE CONTAINERS TO POLYBAGS FOR PRODUCTION OF QUALITY PLANTING MATERIAL IN GRAPE ROOTSTOCKS

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***Key words**: Aerial root pruning, Root Trainers, Media, Polybags, Root stocks.*

**Abstract–**Evaluation of different media on root trainers as alternative to conventional propagation method polybags containing T1-Soil, Sand compost (2:1:1). Root trainers (600cc thickness and 25 cm length) were filled with different media *viz*. T2-Cocopeat + Perlite + Vermicompost, T3- Cocopeat+ Ricehusk + Vermicompost, T4 –cocofibre+Perlite+vermicompost T5-Cocofibre+ricehusk+vermicompost T6-Cocochips + perlite + vermicompost T7-cocochips+rice husk+ vermicompost@ 2:1:1. Among these various treatments copeat+perlite+ vermicompost performed very well and showed significant results, it took less no. of days (10 to 11 days), percent of sprout (95 %) it took less no. days to root (31 days), rooting percentage (95-96%/ ) no. of leaves (20.0) plant survival percentage at nursery (100%) it is followed by treatment Cocopeat + Ricehusk + vermicompost. Root trainers train the roots leads to development of healthy root system comprising of straight deep growing profuse roots. Root trainers can be used van be used as alternate to polybags and can be widely used to prevent formation of defects like spirals and root growth and it helps in significantly saving of cost of production and transportation. These can be reusable hence, environmental hazards associated with accumulation of polybags avoided in the field.

## INTRODUCTION

Grape (*Vitis vinifera* L.) is an important remunerative high value commercial fruit crop of India. At present it covers an area of 138 thousand ha with total production of 1,234.9 thousand tons/ha (NHB. 2019). Due to increase in demand for the export of grape both in national and international market, there is increasing in area 10% for fresh new planting and also due to failure of in-situ grafting 10% requirement has been increasing every year and total 20 % increase in area for planting material and total There is requirement of 4.8 crore planting material/annum.

Hence there is a huge demand for the planting material in grape industry. Hence, there is high mortality of the plants produced in polybags, aerial root pruning method through root trainers is one of the novel technologies to propagate grape rootstocks and it can be good alternative technique to produce quality planting material. The demerits of polybag is when roots reach the lower end of the bag it tear the bag and roots enter into the soil beds in nursery and its root system disturbed while transporting plants from nursery to field. There is possible severe damage to root and soil core of these planting activities. Root trainers (scientifically designed plastic containers) are being considered as an alternative to promote healthy root growth and prevent damage during planting. It is labour-saving, eco-friendly and cost-effective, especially for commercial use. Better morphological plant traits such as height and stem diameters of plants grown in root trainers or plastic containers than those of polybags had equally been reported (Ginwal *et al*., 2001). Root trainers of large size root trainers of 600-800 cc these containers made from polypropylene used in forest tree species for woody plants. Soilless medium containing proportions of both organic and inorganic like coir pith, rock phosphate, and compost is used to fill the container (Soman *et al*., 2013). It reduces some of problems like pests and diseases associated with the use of soil and reduced use of soil fumigants is equally possible (Salisu *et al*., 2017). Air contact of the root tips, self-pruning, and well-aerated of this planting medium helps the plants to experience little stress and these subsequently leads to the emergence of a significant quantity of well-develop lateral roots without deformation as previously reported when the plants are grown in polybags (Adkunle, 2014)

The container size coupled with use of artificial potting media having only half to one third the weight of soil making the container nursery stockvery light. This helps in keeping more number of containers/unit area of nursery. The cost of filling potting media will alsobe quite less. Nutrient and water use efficiency is enhanced considerably. The handling and transportation cost are alsomuch less. The smaller volume required, along with facilities available for reusing root trainers helps in reducing the use of plastic. Seedlings grown in root trainers have more vigorousand rapid root growth than seedlings grown in polybags (Bora *et al*., 2006). Plants raised in root trainers showed better sturdiness (height: diameter ratio) and uniform distribution ofroots than polybag plants. The lateralroots were also found to be significantly higher in root trainerplants than polybag plants. Survival rates at out planting and in the long term are muchhigher. Plants grown in root trainer systems are often ready forplanting out when they are still substantially smaller than thosein conventional polybags. As the root system of root trainer grown stock is of high root growth potential, the stock gets established in the planting site at a much faster rate with early subsequent growth. This enhances post planting survival and further growth and development. Besides, suitable root trainer (container size) Potting media is the important input for containerized seedling production. It is responsible for the healthy and uniform seedling production. Apart from this selection of proper ingredients, it is necessary to maintain the porosity of the potting mixture so that proper development of root takes place. The media should berich enough to sustain seedling for about a year. A good potting medium is characterized by light weight friability, easy blandability, good water holding capacity, drainage, porosity, low bulk density, free from fungal spores and insects and lowinherent fertility etc. It is imperative to determine the size of container or standardize the growing medium to provide best physio-chemical environmental attributes for growth of costeffective production of quality planting material (Gupta *et al*., 2018).

## MATERIALS AND METHODS

The experiment was carried out at ICAR- NRC for grapes at nursery block during 2018-19. The experiment was laid in Complete Randomized Design. Rootstock Dog Ridge and 110 R of Pencil thicknessesto litter bigger size with 3 to 4 buds treated with Rooting Hormone IBA @ 1000, 1500, 2000 ppm depending upon thickness of cuttings. Propagated on propagation in polybags (4×6 inches) Soil+Sand+ compost @ (2:1:1) and root trainer pots of 600 CC thickness and 22 cm length. with different media combination *viz*., 1) Soil + Sand + Compost @2:1:1 2) Cocopeat + Perlite + Vermicompost 3) Cocopeat + Ricehusk + Vermicompost 4) cocofibre + Perlite+vermicompost 5) Cocofibre + ricehusk+ vermicompost 6) Cocochips + perlite + vermicompost 7) cocochips + rice husk + vermicompost @ 2:1:1 220 Cuttings are panted in poly bags and root trainers, these root trainers are embedded in raised beds for a month later they transferred on rot trainer stands, sprinkler irrigation was provided and 19 all Fertilizer is given till 6 months.Growth parameters, such as no. of days to sprout, percentage of sprout (%), No. of days to root, rooting percentage, No. of leaves, percent establishment (%).

Physiological parameters like leaf relative water content and photosynthetic rate were determined at 150 days. Photosynthetic rate of the intact just mature leaves were determined using a portable infrared gas analyzer. Three readings were taken at 15 min intervals and the values were averaged. Relative water content was determined in mature leaves by the method suggested by Weatherley (1950). After 150 days of grafting, tissue bio-chemical analyses were conducted forleaf chlorophyll content was measured by SPAD

## RESULTS AND DISCUSSION

Different combination of media were used for propagation on root trainers pots among them Cocopeat + Perlite + Vermicompost (2;1;1) performed well which is followed by Cocopeat + Rice Husk + Vermicompost (2;1;1) propagated on root trainer pots compare to other media and polybags. This method is successful to produce roots without coiling and very good plant

**Table 1.** Effect of different media combinations in polybags, Root trainers on physical parameters of propagation of Dog ridge and 110 R rootstocks.

| Treatments | No. days taken to sprout | | No. of plants sprouted | | Percent of sprout (%) | | Days to root | | Percentage of rooting (%) | | No of leaves after 160 days | | plant establishment/ survival rate in nursery (%) | | plant establishment in field(%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DR | 110R | DR | 110R | DR | 110 R | DR | 110 R | DR | 110 R | DR | 110 R | DR | 110R | DR | 110R |
| T1 | 16.0 | 16.6 | 121.6 | 116.6 | 52.9 | 52.9 | 41.6 | 42.6 | 63.0 | 61.6 | 11.0 | 10.6 | 54.0 | 46.3 | 54.0 | 42.6 |
| T2 | 10.0 | 11.0 | 215.3 | 210.0 | 95.3 | 95.3 | 31.6 | 31.0 | 96.3 | 95.0 | 25.3 | 26.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| T3 | 10.0 | 12.3 | 213.0 | 210.0 | 95.7 | 95.7 | 31.3 | 30.0 | 96.3 | 95.6 | 20.0 | 19.0 | 97.3 | 95.6 | 97.3 | 94.3 |
| T4 | 12.3 | 12.6 | 151.6 | 147.0 | 66.7 | 66.7 | 37.3 | 36.6 | 91.0 | 90.3 | 16.0 | 15.3 | 86.6 | 83.6 | 86.6 | 83.6 |
| T5 | 15.0 | 16.6 | 148.6 | 143.0 | 66.3 | 66.3 | 37.6 | 36.6 | 92.0 | 89.6 | 15.6 | 14.3 | 85.0 | 82.6 | 85.0 | 82.6 |
| T6 | 16.6 | 17.3 | 101.6 | 98.3 | 44.6 | 44.6 | 36.3 | 35.3 | 75.0 | 74.3 | 15.0 | 14.6 | 73.3 | 68.3 | 73.3 | 68.3 |
| T7 | 16.3 | 16.6 | 104.3 | 97.6 | 44.0 | 44.0 | 39.6 | 40.0 | 73.3 | 73.0 | 15.0 | 13.6 | 73.3 | 74.0 | 73.3 | 74.0 |
| C.D@ 0.5% | 1.1 | 1.2 | 13.1 | 10.8 | 5.4 | 5.4 | 2.3 | 2.5 | 2.4 | 1.4 | 1.8 | 1.7 | 4.3 | 4.8 | 4.3 | 4.3 |

establishment was observed,it was earlier to sprout took 10 to 11 days and shown very good results in plant sprout (95 %), it took less no. of days to root (30-31 days) and rooting percentage (95-96 %) umber of leaves (25-26) survival rate was 100(%) in both nursery and field duringestablishment. andamong media cocofibre+perlite+vermicompost performed poor and polybag raised plants were shown 40 percent mortality when compared with root trainer raised plants. Similarly, (Aminah *et al.*, 2004) also tried six potting media and two sizes of root trainers, potting media used were 100% coconut husk, peat and decomposed oil palm mesocarpfibre on *Shorea leprosula* seedlings. Another three media were prepared, consisting each of the above medium mixed with rice hulls in the ratio of 3:1. These media were filled into two sizes of root trainers (500 and 700 cm(3) and were tested with. Measurements taken at six months after potting showed that increments in height and diameter as well as root and shoot dry weights of S. leprosula were significantly better in plants raised in medium containing 100% oil palm mesocarpfibre compared with the other media tested.

(Gupta *et al.*, 2018) Root characteristics recorded to be highest in. Root trainer (500cc) with potting mixture of Soil: Sand: Sphagnum moss inthe ratio of (1:1:2). This is due to structural peculiarity of root which ultimately resulted in improved morphology and physiology of the root and finally survival of the plants (Bora *et al.*, 2006 and Saroj *et al.*, 2000). Kishanrao2004 better rooting obtained from sand+10 or 20 % cocopeat for hardwood cuttings of both Dogridge and 1613 C. Sand+10 % cocopeat recorded significantly higher percentage of rooting in both varieties.

The Relative water contentand photo-synthetic rates were highest on media combination root trainers + Cocopeat + Perlite + Vermicompost followed by Root trainers + Cocofibre + ricehusk + vermicompost (Table 2). The leaf relative water content (90 to 91 %) and photosynthetic rate (12.2) was notably higher on the both rootstocks Dog Ridge and 110 R which was significantly superior to other treatments (Table 2). The chlorophyll content was also observed highest in the same media combinations. All the chlorophyll fractions were higher in the treatment combination root trainers + Cocopeat + Perlite + Vermicompost on both rootstocks Fig. 1, 2, 3 & 4). These two rootstocks on different media composition induced lower a:b ratio. These two rootstocks also induced a

**Table 2.** Physiological and biochemical content in Rootstocks

| Treatments | Relative water content (%) | | Photosynthetic rate (μmol $m^{-2}$ $s^{-1}$) | |
|---|---|---|---|---|
| | Dogridge | 110R | Dogridge | 110R |
| T1 | 81.0 | 80.6 | 10.7 | 10.8 |
| T2 | 90.3 | 91.0 | 12.3 | 12.5 |
| T3 | 85.3 | 83.6 | 12.2 | 12.2 |
| T4 | 82.0 | 82.6 | 11.7 | 11.8 |
| T5 | 83.0 | 82.6 | 11.5 | 11.2 |
| T6 | 82.3 | 81.3 | 11.5 | 11.4 |
| T7 | 81.0 | 80.0 | 11.3 | 11.1 |
| S.Em± | 0.4 | 0.4 | 0.14 | 0.13 |
| CD @ 5% | 1.4 | 1.3 | 0.4 | 0.4 |
| CV % | 2.9 | 2.9 | 2.2 | 2.1 |

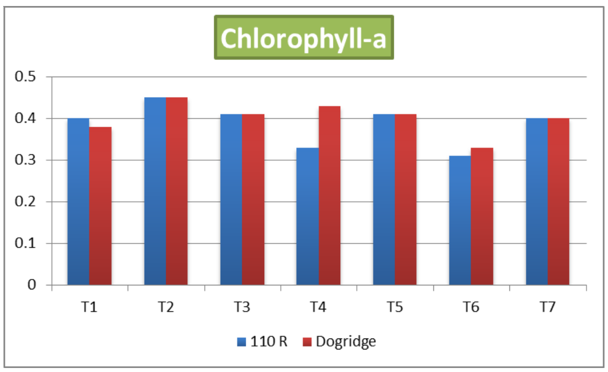


**Fig. 1.** Chlorophyll a content in leaves of rootstocks Dogridge and 110 R

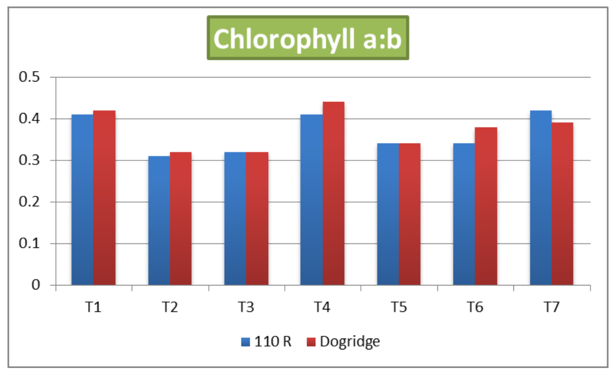


**Fig. 3.** Chlorophyll a:b content in leaves of rootstocks Dogridge and 110 R

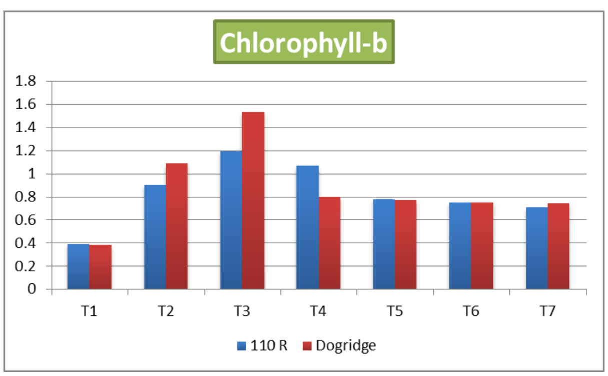


**Fig. 2.** Chlorophyll b content in leaves of rootstocks Dogridge and 110 R

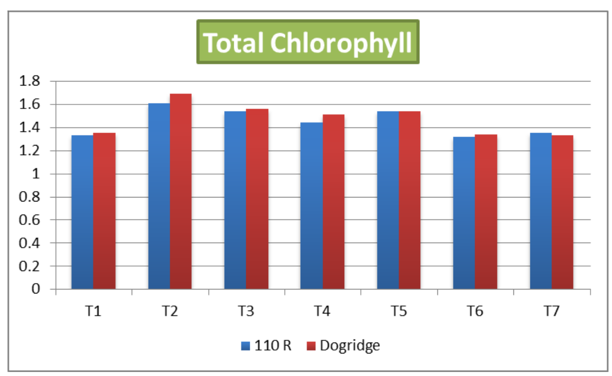


**Fig. 4.** Total chlorophyll content in leaves of rootstocks Dogridge and 110 R

lowerchlorophyll a:b ratio. It is often assumed that low chlorophyll a:b ratios arean expression of large photosynthetic units, thereby increasing the light collecting capacity by a high content of light harvesting chlorophyll a:b proteincomplex, i.e., L4-CP a/b proposed by Alberte *et al*. (1976) and (Verma *et al*., 2010).

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