J Krishi Vigyan 2022, 11 (1) : 192-197 DOI : 10.5958/2349-4433.2022.00128.3

Growing Media Affects Seedling Growth of Ber (Ziziphus mauritiana var. rotundifolia)

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ABSTRACT

An appropriate growing media is essential for production of good quality plant material. The rooting system in terms of growth and development mainly depend on the growing media. A field experiment to see the effect of growing media on seedling growth of ber (*Ziziphus mauritiana* var. rotundifolia) was conducted during 2018-19 in the nursery at Experimental Orchard of CCS Haryana Agricultural University, Hisar. The media for the study were garden soil and sand with the different proportion of vermicompost, FYM and cocopeat constituting 16 treatments. The experiment was conducted in randomized block design. The results revealed that growing Media T_7 : Garden soil + FYM + VC + CP (3:1:1:1) improved the seedling height, stem girth, intermodal length, number of leaves, leaf area, fresh weight of shoot and root and survival per cent. Media T_7 having Garden soil + FYM + VC + CP (3:1:1:1) found better in improving the available N, P, K (165.7, 33.0 and 267.0 kg/ha).

Key Words: Ber, Growing media, Seed germination, Seedling growth.

INTRODUCTION

Indian jujube (*Ziziphus mauritiana* var. rotundifolia*),* commonly known as ber, is one of the important commercial fruit crop grown in arid zone. It is king of arid fruits also known as *Chinese apple or Indian plum* belonging to the family Rhamnaceae. It is considered as poor man's applesince fruits are easily available at low cost of production and rich source of vitamin C, protein and minerals. Suitable growing media is the pre-requisite or the essential for production of quality fruit seedlings. Conventional soil mix sometimes thought to be a source of soil borne pests and diseases but the main purpose of media can be understood by understanding the relationship between the manure and rooting and it means that manure prompt better rooting (Akanbi and Togun, 2002). The medium formulated with top soil + poultry manure + river sand in 1:2:3 (v/v/v) ratios were found best for seedling qualities of African breadfruit (Baiyeri, 2006).

The FarmYard Manure (FYM) seems to be directly responsible for increasing crop yield as it contains all the essential elements like nitrogen (0.5-1.5%), phosphorus (0.4-0.8%) and potassium (0.5-0.9%). Vermicompost is an eco-friendly natural fertilizer prepared from biodegradable organic wastes and rich in macro and micronutrients (Kaur, 2017). Cocopeat is conserved as a good growing media component with acceptable pH, electrical conductivity and other chemical attributes (Abad *et al*, 2002). To grow ber seeds in the combination of soil and sand, FYM, vermicompost and cocopeat, requires careful examination of the growing media in a proportion or along. Therefore, the present experiment on the effect of growing media on seedling growth of ber (*Ziziphus mauritiana* var. rotundifolia) was planned.

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MATERIALS AND METHODS

The present study was conducted during 2018 in the experimental orchard of Department of Horticulture, CCS HAU Hisar in the nursery section. The geographical location of the field was 29.15˚ North and 75.68˚ East. Hisar falls in the semi-arid region of Haryana felt rainfall greater than > 250 mm.

Preparation of treatments

Garden soil was taken from the Experimental Horticultural orchard. Sand was procured from local source near the orchard. Vermicompost was procured from Department of Agronomy. Cocopeat was purchased from local market, Hisar. The detail of all 16 treatments was as under:

T_1 : Garden soil + FYM (1:1),

T_2 : Garden soil + Vermicompost (1:1)

T_3 : Garden soil + Cocopeat (1:1),

T_4 : Garden soil + FYM + Vermicompost (2:1:1)

T_5 : Garden soil + FYM+ Cocopeat (2:1:1),

T_6 : Garden soil + Vermicompost+ Cocopeat (2:1:1),

T_7 : Garden soil + FYM+Vermicompost + Cocopeat (3:1:1:1)

T_8 : Garden soil,

T_9 : Sand + FYM (1:1),

T_{10} : Sand + Vermicompost (1:1),

T_{11} : Sand + Cocopeat (1:1),

T_{12} : Sand + FYM + Vermicompost (2: 1:1),

T_{13} : Sand + FYM+ Cocopeat (2:1:1),

T_{14} : Sand + Vermicompost + Cocopeat (2:1:1)

T_{15} : Sand + FYM + Vermicompost + Cocopeat (3:1:1:1)

T_{16} : Sand were prepared in three replications and studied in RBD for present investigation.

Media analysis

The available N (kg/ha) was estimated with Alkaline permanganate method as proposed by Subbiah and Asija (1956). For the determination of available phosphorus in soil the Olsen ‘s method (Olsen *et al*, 1954) was used for neutral – alkaline soil in the present study. The available potassium was estimated by using the Flame photometric method, USDA Hand Book No. 60, 1954 (Jackson, 1973).

Observations recorded

Observations were taken at 60, 90, 120, 150 days after sowing of seed and collaboration with Department of Soil Science on seedlings height (cm), stem girth (mm), internodal length (mm), number of leaves per plant, leaf area (cm^2), fresh weight of shoot (g), fresh weight of root (g). Survival percentage was estimated .

Nutrient analysis

Different media analysis (before start of experiment)

Leaf analysis for N, P, K (leaf samples were collected at the end of experiment)

Standard procedure was followed for estimation of N, P and K both in soil and Leaves under the treatments.

Statistical analysis

The randomized block design (RBD) was used to reduce the experimental error among observations of the same treatment by accounting for the differences among blocks (Panse and Sukhatme, 1954).Statistical analysis of the data was worked in OPSTAT available at hau.ac.in (http://14.139.232.166/opstat/default.asp) in randomized block design (Sheoran *et al,* 1998).

RESULTS AND DISCUSSION

Height and stem girth of the seedlings

The data (Table 1) clearly indicate that significantly higher seedling height and stem girth were observed under T_7 - Garden soil + FYM + VC + CP (3:1:1:1) *i.e.* 22.73, 47.90, 71.57 & 106.43 cm and 6.53, 7.70, 9.53 & 11.27 mm, respectively over other treatments except T_{15} (Sand + FYM + VC + CP (3:1:1:1). This treatment was closely followed

Table 1. Effect of different growing media on height and stem girth of ber seedlings

Treatment	Ber seedling height (cm)				Ber seedling stem girth (mm)			
	60 DAS	90 DAS	120 DAS	150 DAS	60 DAS	90 DAS	120 DAS	150 DAS
T_1	16.57	33.77	52.97	75.10	5.23	6.07	7.57	8.77
T_2	16.87	34.30	53.40	75.37	5.47	6.43	8.07	9.40
T_3	15.53	30.63	52.03	72.47	5.07	5.67	7.13	8.40
T_4	17.93	39.47	58.30	83.77	6.03	7.03	8.87	10.37
T_5	17.27	39.33	58.00	80.33	5.83	6.83	8.53	9.93
T_6	18.50	42.57	64.13	92.23	6.10	7.27	9.20	10.83
T_7	22.73	47.90	71.57	106.43	6.53	7.70	9.53	11.27
T_8	14.33	28.17	50.67	69.13	4.73	5.43	6.97	8.07
T_9	15.80	33.67	52.83	74.03	5.10	5.90	7.37	8.53
T_{10}	16.73	34.20	53.07	75.27	5.37	6.23	7.80	9.13
T_{11}	15.43	30.23	51.47	71.87	4.93	5.53	7.03	8.23
T_{12}	17.37	39.37	58.23	80.37	5.80	6.83	8.57	10.07
T_{13}	17.10	36.63	55.20	76.37	5.63	6.53	8.33	9.67
T_{14}	18.23	42.23	62.57	89.00	6.03	7.17	9.10	10.73
T_{15}	19.30	44.47	69.17	96.13	6.50	7.57	9.37	11.10
T_{16}	13.43	22.57	39.23	63.53	4.23	5.03	6.77	7.70
CD at 5%	1.01	1.90	3.29	2.66	0.32	0.30	0.33	0.57

by T_{15} (Sand + FYM + VC + CP (3:1:1:1) and T_6 – Garden soil + VC + CP (2:1:1) with germination of seeds every time of observation taken. The data clearly revealed that garden soil in combination with FYM, vermicompost and cocopeat contributed more in improved in height at different intervals as compared to other treatments. The lowest seedling height and stem girth were observed in T_{16} – sand (13.43, 22.57, 39.23& 63.53 cm and 4.23, 5.03, 6.77 & 7.70 mm) at 60, 90, 120 and 150 days after sowing. This might be due to the fact that FYM, vermicompost and cocopeat in the above media brought improvement in the physical and chemical properties of the rooting medium (Dileep *et al*,1994). The vermicompost containing humid substances lead to higher levels of auxinactivity lead to more cell division and more growth in terms of height and seedling girth (Canellas *et al*, 2002).

Internodal length and number of leaves

The data (Table 2) indicate the significantly higher internodal length under T_7 – Garden soil + FYM + VC + CP (3:1:1:1) *i.e.* 23.37, 28.80, 32.37 & 34.93 and 48.33, 79.67, 112.00 & 150.67 mm, respectively over other treatments except treatment T_{15} (Sand + FYM + VC + CP (3:1:1:1). The data clearly revealed that garden soil in combination with FYM, vermicompost and cocopeat contributed more in improved in internodal length and number of leaves per seedling at different intervals as compared to other treatments. The lowest internodal length and number of leaves per seedling were observed in media T_{16} – sand (16.87, 24.60, 27.33 & 29.63 mm and 25.00, 49.33, 76.00 & 91.33) at 60, 90, 120 and 150 days after sowing, respectively.This might be due to the fact that vermicompost might improve the nutrient availability and improved the physical conditions of the soil along the nutritional availability leading to more internodal length due higher auxin activity (Canellas *et al*, 2002). The availability of plant-available nutrients such as nitrates, phosphates, exchangeable calcium, soluble potassium, and trace metals in vermicompost might

Table 2. Effect of different growing media on internodal length and number of leaves/ plant of the ber seedlings

Treatment	Ber seedling internodal length (mm)				Number of leaves/plant			
	60 DAS	90 DAS	120 DAS	150 DAS	60 DAS	90 DAS	120 DAS	150 DAS
T_1	20.30	26.77	29.40	32.13	28.00	60.67	87.67	117.33
T_2	21.00	27.03	29.53	32.37	33.33	64.33	92.67	122.67
T_3	19.63	26.17	29.07	31.33	27.33	59.00	84.67	113.00
T_4	21.60	27.63	31.03	33.23	37.33	69.67	100.67	132.67
T_5	21.27	27.43	30.43	33.03	35.33	66.33	96.33	128.67
T_6	22.13	28.07	31.83	34.03	42.33	73.33	106.67	140.67
T_7	23.37	28.80	32.37	34.93	48.33	79.67	112.00	150.67
T_8	17.97	25.77	28.70	29.77	26.67	56.67	79.67	107.67
T_9	19.97	26.43	29.30	31.33	27.67	60.33	86.33	115.33
T_{10}	20.70	27.03	29.53	32.23	31.33	62.33	91.67	120.33
T_{11}	18.67	26.13	28.87	30.63	27.33	57.67	82.67	110.00
T_{12}	21.60	27.53	30.73	33.20	36.33	67.33	98.33	130.00
T_{13}	21.13	27.37	30.03	32.73	34.33	64.33	94.33	124.67
T_{14}	21.70	27.97	31.67	33.83	39.33	70.33	103.33	135.33
T_{15}	22.23	28.57	32.20	34.47	45.67	75.67	109.00	145.00
T_{16}	16.87	24.60	27.33	29.63	25.00	49.33	76.00	91.33
CD at 5%	1.01	0.54	0.76	0.78	4.72	6.61	6.97	7.46

enhance the relative proportion of these micro, semi-micro, and macro nutrients, promoting the plant growth in terms of internodal length (Orozco*et al*, 1996; Luján-Hidalgo*et al,* 2015).

Fresh weight of root and shoot

The data related to fresh weight of root and shoot are presented in Table 3 which clearly indicate that significantly higher fresh weight of root and shoot were found in T_7 – Garden soil + FYM + VC + CP (3:1:1:1) *i.e.* 0.77, 3.79, 8.65 & 15.28 g and 4.14, 10.83, 25.09 & 47.34 g, respectively over other treatment except treatment T_{15} (Sand + FYM + VC + CP (3:1:1:1). The lowest fresh weight of root and shoot were observed in T16 – sand (0.44, 1.95, 3.82 & 7.93 g and 2.44, 5.45, 11.61 & 19.85 g) at 60, 90, 120 and 150 days after sowing, respectively. T_6 – Garden soil + VC + CP (2:1:1) with fresh weight of root and shoot *i.e.* 0.72, 3.71, 8.39 & 14.90 and 3.96, 10.60, 24.27 & 43.34 g at 60, 90 and 120 DAS, respectively to which it was statistically at par. The higher nutrient availability resulted into increased biomass production leading to higher fresh weight of root and shoot in ber seedlings. The results were closely relates with findings of Shamet *et al* (1994) and Kaur (2017).

Survival per cent

Survival per cent related to ber seedling at different intervals has been shown in Table 4, which clearly indicate that significantly higher survival per cent was observed under growing media T_7 – Garden soil + FYM + VC + CP (3:1:1:1) over all other growing media at 60 DAS (93.67%), 90 DAS (91.00%), 120 DAS (88.67%) and 150 DAS (84.33%). Better establishment of seedlings are due to higher germination percent under the influence of media Kaur S (2017).The lowest survival per cent was observed in T_{16} - Sand *i.e.* 58.33, 54.67, 40.67 and 32.67 per cent, 60, 90, 120 and 150 DAS, respectively. It is evident from the data that

Table 3. Effect of different growing media on fresh weight of root and shoot in ber seedlings

Treatment	Fresh weight of root (g)				Fresh weight of shoot (g)			
	60 DAS	90 DAS	120 DAS	150 DAS	60 DAS	90 DAS	120 DAS	150 DAS
T_1	0.54	3.14	7.18	12.91	2.91	9.10	21.87	38.61
T_2	0.61	3.26	7.54	13.51	3.15	9.60	22.38	39.93
T_3	0.49	3.08	6.79	12.21	2.79	8.62	20.54	37.14
T_4	0.68	3.55	8.09	14.41	3.53	10.07	23.83	42.78
T_5	0.64	3.43	7.75	14.04	3.35	9.75	23.25	40.45
T_6	0.72	3.71	8.39	14.90	3.96	10.60	24.27	43.34
T_7	0.77	3.79	8.65	15.28	4.14	10.83	25.09	47.34
T_8	0.45	2.80	6.17	9.97	2.56	7.65	17.81	33.48
T_9	0.51	3.11	7.11	12.73	2.88	8.94	21.35	38.08
T_{10}	0.58	3.22	7.40	13.25	3.04	9.36	22.12	39.22
T_{11}	0.45	2.97	6.29	11.49	2.65	7.95	19.30	34.71
T_{12}	0.66	3.46	7.85	14.21	3.40	9.93	23.60	41.28
T_{13}	0.63	3.34	7.65	13.88	3.28	9.63	22.81	40.01
T_{14}	0.71	3.62	8.13	14.55	3.66	10.26	24.02	43.01
T_{15}	0.75	3.75	8.52	15.17	4.03	10.74	24.94	45.52
T_{16}	0.44	1.95	3.82	7.93	2.44	5.45	11.61	19.85
CD at 5%	0.05	0.18	0.23	0.70	0.26	0.53	1.24	2.54

maximum survival percent was observed at 60 days after sowing in all the growing media.

CONCLUSION

The results from the present study revealed that growing Media T_7 : Garden soil + FYM + VC + CP (3:1:1:1) improved the seedling height, stem girth, intermodal length, number of leaves, leaf area, fresh weight of shoot and root and survival per cent.

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Table 4. Effect of different growing media on survival of ber seedlings.

Treatment	Survival (%) in DAS			
	60 DAS	**90 DAS**	**120 DAS**	**150 DAS**
T_1	64.00	62.67	62.00	57.33
T_2	68.00	65.00	63.67	62.00
T_3	62.33	59.33	58.33	55.33
T_4	74.67	71.33	70.33	69.67
T_5	70.67	70.33	68.00	67.67
T_6	80.33	77.33	75.33	73.67
T_7	93.67	91.00	88.67	84.33
T_8	58.67	54.67	52.67	48.67
T_9	63.33	61.33	60.67	56.00
T_{10}	67.67	63.33	62.33	61.33
T_{11}	61.67	58.00	57.33	53.00
T_{12}	72.67	71.00	69.67	68.00
T_{13}	69.33	68.33	66.67	65.00
T_{14}	76.33	74.67	72.67	70.67
T_{15}	86.67	85.00	81.00	76.33
T_{16}	58.33	54.67	40.67	32.67
CD at 5%	5.25	5.01	5.81	4.08

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Received on 5/7/2022 *Accepted on 15/9/2022*