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EFFECT OF SOIL MEDIA AND DEPTH OF SEED SOWING ON SEED GERMINATION AND SEEDLING GROWTH OF BAHERA, *TERMINALA BELLERICA*

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ABSTRACT

The study was conducted at National Research Centre for Agroforestry, Jhansi (U.P.) India. Fresh seeds of Bahera were sun dried, depulped and subjected to three soil media [Red soil+FYM (1:1), Black soil+FYM (1:1) and Red+Black soil+FYM(1:1:1)] and three sowing depths (2.0, 3.0 and 4.0cm) for seed germination in April month. Results indicated that maximum seed germination (94%) was obtained in Red soil + FYM mediaat 2.0cm sowing depth. This treatment recorded quickest initiation and completion of germination(11and 21 days respectively). Seedling growth in terms of plant height, collar diameter and canopy spread and number of leaves was maximum under Red soil+FYM and minimum under Black soil+FYM. In general, plant growth reduced with increase in depth of sowing. However, the differences among various treatments were largely non-significant. Total biomass air dry ranged between 10.52 to 13.90g/plant across the treatments at 6 months stage.

Figures : 03 References : 09 Tables : 03
KEY WORDS : Bahera, Soil media, Sowing depth.

Introduction

Bahera (*Terminalia bellerica*)family Combretaceae is native of India. The species has multiple uses and promise under Agroforestry system due to deciduous nature and narrow canopy. Agroforestry is a land use system which envisage growing of woody plants with field crops in spatial or sequential manner so as to produce maximum biomass and meet food, fuel, fruit, fibre, timber and soft wood requirements of human and fodder requirement of livestock.Domesticating a species successfully in croplands warrants through knowledge of nursery raising. Soil media is reported to influence growth of seedlings in nursery[4]. Similarly, depth of seed sowing not only influence germination but also days to initiation and completion of germination[2]. Such, informations are leaching for Bahera, therefore, present investigation was planned.

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Materials and Method

The experiment was conducted during 2005 in the nursery of National Research Centre for Agroforestry, Jhansi. Three growing media viz. Red soil+FYM (1:1), Black soil+FYM (1:1), Red+Black soil+FYM (1:1:1) and three sowing depths viz. 2.0cm, 3.0cm, 4.0cm were taken for the study. The experiment was carried out in Randomized Block Design with 3 replications. Filling mixtures were prepared indesired proportion and filled in 27x18 cm perforated bags. Two seeds were sown in each bag at varying depth as per technical programme. The bags were placed in 50% shade Net house. Plants were watered as and required. Observations were recorded on daily basis for total germination, days to initiate and complete germination. Plant

TABLE-1: **Effect of sowing depth and soil media on Germination performance in Bahera, *Terminalia bellerica***

Treatments		Days taken toinitiate germination	Days taken to complete germination	Germination %
Red soil+ FYM	(1:1)			
	2.0cm	12.33	21.33	94.00
	3.0cm	17.33	27.67	86.67
	4.0cm	21.67	31.00	80.00
Black soil+FYM	(1:1)			
	2.0cm	16.00	25.33	69.33
	3.0cm	20.33	27.00	65.33
	4.0cm	25.00	31.00	56.0
Red+ Black soil+ FYM	(1:1:1)			
	2.0cm	14.67	22.33	76.00
	3.0cm	19.33	27.67	74.00
	4.0cm	20.33	31.33	66.67
CD (P = 0.05)				
Soil media		2.25	NS	6.8
Depth		2.25	5.3	6.8
Soil media x Depth		NS	NS	NS

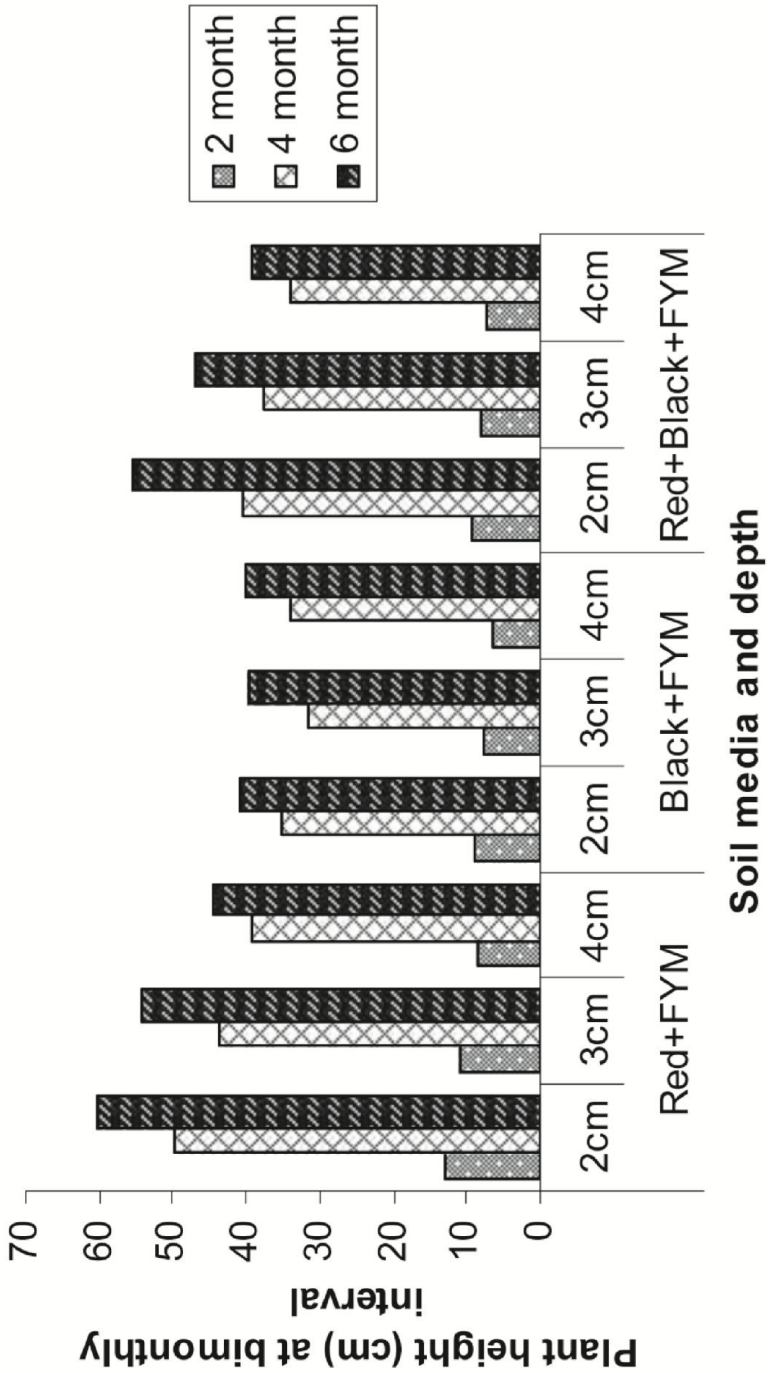

Fig. 1: Effect of soil media and sowing depth treatments on Plant height at bimonthly interval of *T. bellerica*.

growth was recorded at an interval of two months and continued upto 6 months. Results were analysed statistically[8].

Result and Discussion

Germination performance

It is evident from the data (Table-1) that both soil media and sowing depth influenced number of days taken to initiate germination. In general, number of days taken to initiate germination increased with increase in sowing depth irrespective of soil media. Red soil + FYM media showed in early germination while Black soil+FYM late germination. Minimum (12.33) days were recorded to initiate germination when seeds were sown at 2.0cm depth in Red soil+FYM medium which was significantly lower than other treatments. Maximum (16) days were recorded for Black soil+FYM at 2.0cm depth which was closely followed by that in Red+Black soil+FYM soil media. At 3cm sowing depth number of days taken to initiate germination were at par amongst different media treatments. At 4.0cm sowing depth minimum (20.33) days were recorded to initiate germination in Red + Black soil + FYM medium which was at par with that under Red soil + FYM but significantly lower than Black soil + FYM medium (25 days).

In general, number of days taken to complete germination increased with increase in sowing depth from 2.0cm to 4.0cm. Days to complete germination was significantly influenced by sowing depth. However, the differences due to filling mixture were non- significant. Maximum (31.33) days were recorded to complete germination at 4.0cm depth in Red + Black soil + FYM soil media which was closely followed by Red soil + FYM and Black soil + FYM (31days). Minimum (21.33) days to complete germination was recorded when seeds were sown at 2.0cm depth in Red soil + FYM soil media which was significantly lower than rest of the treatment .

Critical perusal of data reveal both, filling mixture and sowing depth significantly influenced germination percentage. Maximum (94%) germination was recorded when seeds were sown in Red soil + FYM medium at 2.0cm depth which was significantly higher than rest of the treatments. Minimum seed germination (56%) was recorded when seeds were sown at 4.0cm depth in Black soil + FYM media which was significantly lower than rest of the treatment. At 2.0cm sowing depth, minimum (69.33%) germination was recorded in Black soil + FYM media which was at par with those sown at same depth in Red + Black soil + FYM media. This is obviously because filling mixtures other than Red soil+FYM had less porosity and higher compactness which physically hindered emergence of seedling. Increase in sowing depth further delayed emergence and in case of deep sowing (4cm) energy required for seedling emergence was probably two high. Quick germination in mango at shallow depthwas reported[7]. Soil media consisting of equal proportion of Red soil, sand, FYM ash was best amongst different soil media tried[3].

Germination percentage

Data on germination percentage of Bahera showed due variation under the influence of different soil media and sowing depth. Maximum seed germination (85.33%) was recorded under mechanical breaking treatment which was significantly higher than rest of the treatments. Minimum (21.3%) seed germination was observed under control. During 2006, the trend of seed germination was almost similar with slight variation in magnitude of germination. Mechanical breaking continued to record maximum (85.67%) germination which was significantly higher than remaining treatments. Minimum (20.67%) seed germination was recorded under control.

In present investigation germination percentage increased under the treatments which facilitated greater imbibition of water.

Plant growth

Observations on plant height and collar diameter have been presented (Figs. 1 & 2). Both filling mixture and sowing depth significantly influenced plant height upto 6 months age.

In general, seedling height was higher in Red soil + FYM media and lowest in Black soil + FYM media. Further, seedling height decreased with increase in sowing depth. At the age of 2 months maximum (12.8cm) seedling height was recorded in Red soil + FYM media at 2.0cm depth of sowing which was significantly higher than rest of the treatments. At this depth Black soil + FYM recorded minimum (8.86cm) seedling height which was at par with that recorded across different sowing media.

Similarly, at the age of 6months, maximum (60.39cm) seedling height was recorded in Red soil + FYM media at 2.0cm depth of seed sowing which was significantly higher than all other

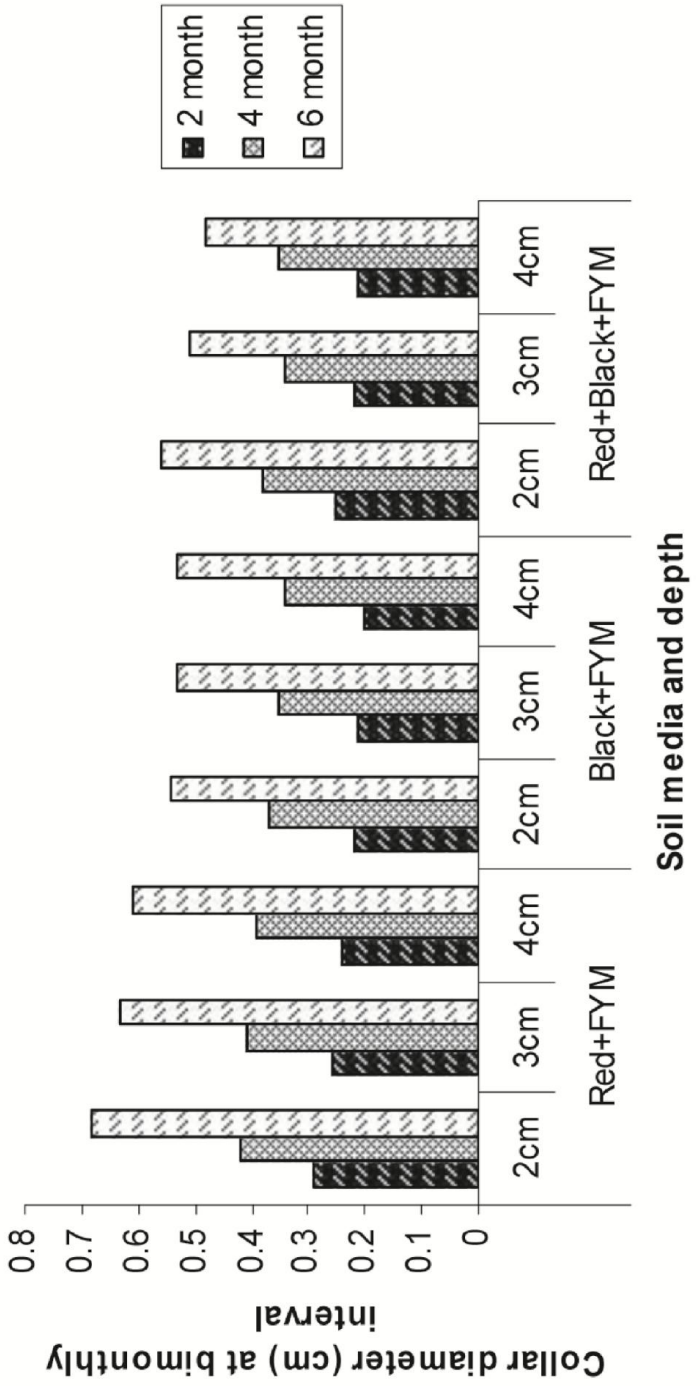

Fig. 2: Effect of soil media and sowing depth on Collar diameter at bimonthly interval of *T. bellerica*

TABLE-2 .: Effect of soil media and depth of seed sowing on plant height and collar diameter (cm) in Bahera, *Terminalia bellerica* at bimonthly interval

Treatments		2 months		4 months		6 months	
Red soil+ FYM	**(1:1)**	**Plant ht**	**Collar-dia**	**Plant ht**	**Collar-dia**	**Plant Ht**	**Collar-dia**
	2.0cm	12.80	0.29	49.62	0.42	60.39	0.68
	3.0cm	10.93	0.26	43.64	0.41	54.25	0.63
	4.0cm	8.64	0.24	39.30	0.39	44.68	0.61
Black soil+FYM	**(1:1)**						
	2.0cm	8.86	0.22	35.13	0.37	40.73	0.54
	3.0cm	7.55	0.21	31.40	0.35	39.81	0.53
	4.0cm	6.44	0.20	33.90	0.34	40.09	0.53
Red+ Black soil+ FYM	**(1:1:1)**						
	2.0cm	9.14	0.25	40.30	0.38	55.54	0.56
	3.0cm	8.08	0.22	37.49	0.34	46.91	0.51
	4.0cm	7.16	0.21	33.92	0.35	39.44	0.48
CD (P = 0.05)							
Soil media		1.0	0.05	4.0	0.03	4.9	NS
Depth		1.0	NS	4.0	NS	4.9	NS
Soil media x Depth		NS	NS	NS	NS	NS	NS

treatments except Red + Black soil media. Plant height showed decreasing trend with increasing soil depth. However, magnitude of variation in plant height due to filling mixture and sowing depth decreased with increase in age.

Findings of the present study indicated better growth in Red soil + FYM media, Black soil + FYM showed poor results. Red + Black soil + FYM medium resulted in average growth. Further plant height decreased with increasing depth of seed sowing. These findings are in accordance with the findings[9] who reported best growth of *Acacia nilotica* seedlings in Red soil + FYM (1:1) soil media. The variation in plant height due to filling mixture and sowing depth is obviously due to differences in compactness of various filling mixture and variation in emergence period of seedlings.

Collar diameter

Collar diameter of seedlings as influenced by soil media and sowing depth was recorded at bimonthly interval and data have been presented (Table-2).

In general, collar diameter at 2 month stage should decreasing trend with increase in soil depth but the difference were non-significant. Maximum (0.29cm) collar diameter was recorded in Red soil + FYM media at 2cm sowing depth which was significantly higher than rest of the media except those sown in Red + Black soil + FYM at 2.0cm depth (0.25cm). Minimum (0.20cm) collar diameter was recorded in Black soil + FYM soil media which was significantly lower than that recorded for Red soil + FYM soil media at 2 and 3cm sowing depth respectively.

In 4 months stage the value of collar diameter of seedlings decreased with increase in sowing depth. Maximum (0.42cm) collar diameter was recorded in Red soil + FYM media at 2.0cm depth of sowing which was significantly higher than rest of the treatments except those recorded in Red soil + FYM media at 3.0cm and 4.0cm sowing depth (0.41 and 0.39cm) respectively. Minimum (0.34cm) collar diameter was recorded in Black soil + FYM soil media at 3.0cm sowing depth. These values were significantly lower than those observed for Red soil + FYM media at different depths and Red + Black soil + FYM at 2.0cm sowing depth.

In 6 months stage the influence of soil media and sowing depth both disappeared so as to record non-significant differences in collar diameter. However, at this age, Red soil + FYM media showed an edge over other media. Collar diameter decreased marginally with increase in depth of sowing. Maximum (0.68cm) collar diameter was recorded in Red soil + FYM media at 2.0cm depth of sowing which was closely followed by those sown at 3.0cm depth in same media. Minimum (0.48cm) collar diameter was recorded in Red + Black soil + FYM media at 4.0cm depth of sowing. The finding of present investigation are in accordance with findings of other worker[5].

Number of leaves per plant

Observation on number of leaves per plant were recorded (Fig. 3).

It is evident from the data that number of leaves per plant should significant variation only at 2 months stage under the influence of soil media and sowing depth. At the age of 2 months, in general, Red soil + FYM (1:1) soil media recorded higher number of leaves than Red + Black soil + FYM media. Number of leaves per plant decreased with increased in seed sowing depth. Maximum (9.16) leaves per plant were recorded in Red soil + FYM media at 2.0cm sowing depth which was significantly higher than rest of the treatments. Minimum (6.63) leaves per plant were recorded in Black soil + FYM at 4.0 cm depth of seed sowing. At 2.0cm sowing depth Black soil + FYM recorded (8.08) leaves per plant was at par .

After 4months of seed sowing, Red soil + FYM media continued to show its superiority over other media. Further, number of leaves per plant showed reverse trend with increase in sowing depth. Number of leaves per plant ranged between 7.33 to 9.95 across the soil media and depth of seed sowing. Maximum (9.95) leaves per plant were recorded in Red soil + FYM media at 2.0cm depth of sowing which was closely followed by that in Red + Black soil + FYM and Black soil + FYM media at the same depth of sowing. At 3.0cm depth of sowing, number of leaves per plant ranged between 8.5 to 7.98 while at 4.0cm sowing depth it ranged between 7.33 to 7.92.

Further, at 6months age, non-significant variations in number of leaves per plant were observed under different treatments. Red soil + FYM recorded maximum (12.67) leaves per plant at 2.0cm sowing depth which was closely followed by that in Red + Black soil + FYM (12.27) soil media at the same sowing depth. At 3.0cm sowing depth, Red + Black soil + FYM recorded maximum (11.91) leaves per plant followed by that in Red soil + FYM (11.83) and Black soil + FYM (11.28). At 4.0cm sowing depth, number of leaves per plant ranged between 11.25 to 11.42 across the soil media. Worker[1] reported due variation in growth of chironjee seedling due to sowing depth.

Total Biomass.

Observation on total (oven dry) biomass (g/plant) at bimonthly interval have been presented (Table-3).

It is obvious from the data total biomass at 2 months age was significantly influenced by sowing media and sowing depth. Maximum (3.18 g/plant) dry biomass was recorded under the treatment Red soil+ FYM media at 2.0cm sowing depth which was significantly higher than rest of the treatments. Black soil + FYM media recorded minimum (2.85g/plant)

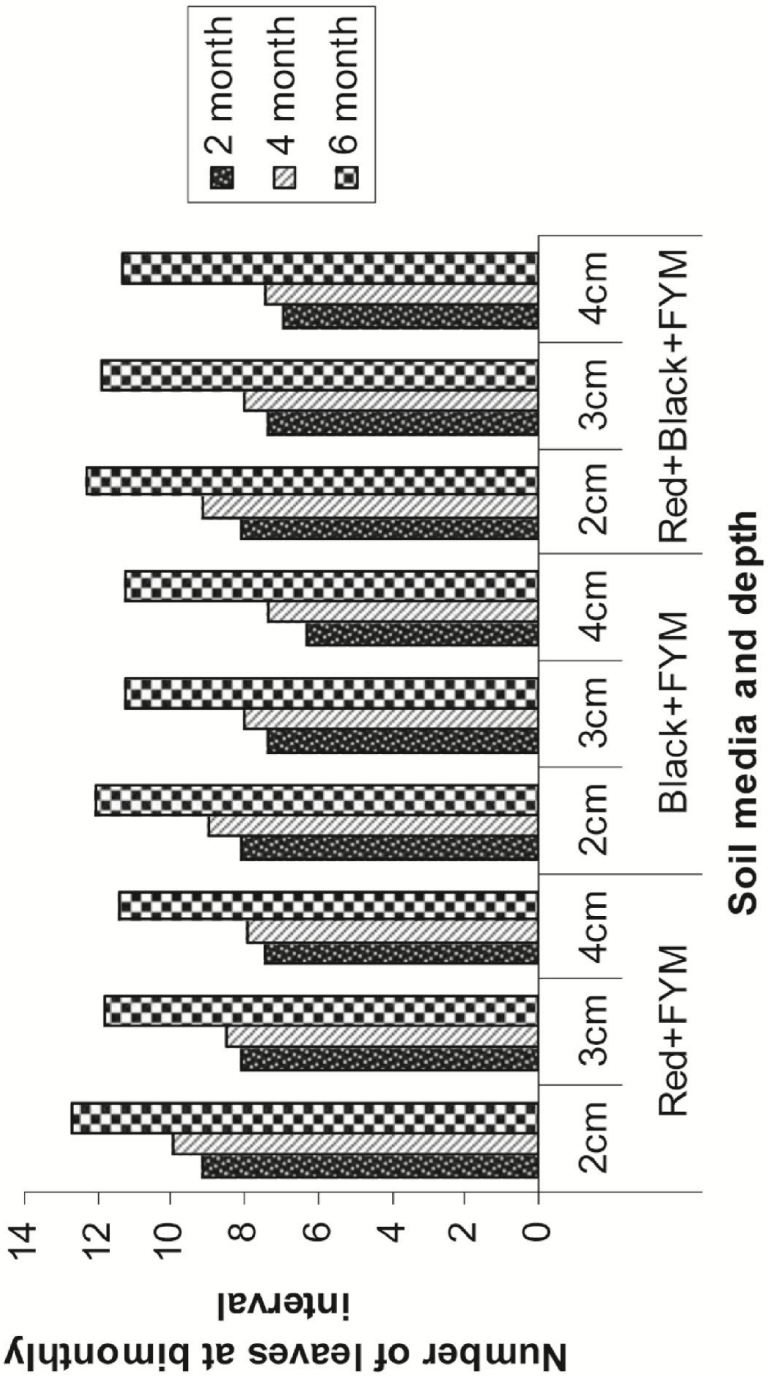

Fig. 3: Effect of soil media and sowing depth on Number of leaves at bimonthly interval of *T. bellerica*

TABLE-3 : Total dry biomass (g/ plant^{-1}) as influenced by soil media and sowing depth at bimonthly interval in Bahera, *Terminalia bellerica*

Treatments		2 months	4 months	6 months
Red soil+ FYM	**(1:1)**			
	2.0cm	3.18	7.34	13.90
	3.0cm	2.94	7.24	12.76
	4.0cm	2.60	6.52	11.61
Black soil+FYM	**(1:1)**			
	2.0cm	2.85	6.95	13.73
	3.0cm	2.69	6.55	12.53
	4.0cm	2.51	6.42	10.52
Red+ Black soil+ FYM	**(1:1:1)**			
	2.0cm	3.01	7.41	13.52
	3.0cm	2.72	6.79	12.36
	4.0cm	2.64	6.48	10.60
CD (P = 0.05)				
Soil media		0.10	0.18	NS
Depth		0.10	0.18	NS
Soil media x Depth		0.10	NS	NS

biomass at this depth which was significantly lower. At 3.0cm sowing depth maximum (2.94 g/plant) biomass was recorded in Red soil + FYM which was significantly higher than that recorded under different media at this depth. At 4.0cm sowing depth maximum (2.64 g/plant) biomass was recorded in Red + Black soil + FYM media which was closely followed by that under Red soil + FYM (2.60 g/plant). However, the differences among the two were non-significant. Minimum (2.51gm/plant) biomass was recorded in Black soil + FYM which was significantly lower than rest of the treatments. Shoot dry weight of *Prosopis juliflora* decreased with increased in sowing depth[6].

After four months of seed sowing soil media and soil depth continue to exhibit significant influenced on total biomass. At this age, maximum (7.41 g/plant) biomass was recorded in Red + Black

soil + FYM media at 2.0cm sowing depth which was closely followed by that under Red soil + FYM at 2.0 and 3.0cm sowing depth (7.34 and 7.24 g/ plant respectively). At 3.0cm sowing depth, maximum biomass recorded under Red soil + FYM treatment which was significantly higher than rest of media. At 4.0cm depth of sowing, minimum (6.42 g/plant) biomass was recorded is Black soil + FYM media which was closely followed by that under Red + Black soil + FYM (6.48 g/plant).

At the termination of study, total biomass values were at par across the treatments. Maximum (13.90 g/plant) biomass was recorded under Red soil + FYM at 2.0cm sowing depth while minimum (10.52 g/plant) biomass was recorded in Black soil + FYM media at 4.0cm depth of sowing.

Conclusion

Red soil + FYM (1:1) was best suited soil media for seed germination seedling growth, biomass yield and root growth of Bahera, while Black soil + FYM (1:1) showed poor response. Seeds of Bahera should be sown at 2.0cm depth for quick and high germination. Shallow seed sowing (2.0cm) can be recommended for better seed germination, seedling growth, root proliferation and biomass yield. Effect of soil media and sowing depth was more pronounced during early growth stages.

Further, variation in soil physical properties of different media particularly compactness of media arising from soil texture. The information available on Bahera soil media and sowing depth is scanty .

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