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Research Article

PERFORMANCE OF SEEDS SIZE ON SEEDLING GROWTH OF FOREST TREE SPECIES IN NURSERY CONDITION

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Abstract: An experiment was conducted at Balsamand Research Farm in Department of Forestry, CCS Haryana Agricultural University, Hisar. Mature seeds of seven tree species *viz.,Ailanthus excelsa, Acacia nilotica, Acacia tortilis, Dalbergia sissoo, Prosopis cineraria, Prosopis juliflora* and *Azadirachta indica* were collected from pluse trees from Balsamand Research Area and nearby places. The seeds of trees species were separated as large, medium and small on visual basis and measure its test weight, seed length, seed breadth and seed thickness and analyzed Germination percentage, Initiation of germination, Shoot length, Root length, Collar diameter, Fresh and Dry root and Shoot weight of seedlings and observed that large seeds of each tree species performed significantly better followed by medium than small seeds of all the tree species under studied.

Keywords: *Tree species, Seed size, Seedling growth*

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Introduction

Size of the seeds may affect the fitness of parent plants and regeneration process [1]. Larger seeds have greater abilities to survive in water stress condition [2]. The seeds may differ in size, weight and density due to production environment and cultivation practices. The seeds size is an important component of seed quality which affects the crop growth performance [3]. The successful establishment of plants obtained from larger seeds had advantages over that obtained from smaller seeds only under adverse conditions. Large seed size is a widely accepted measure of seed quality, seedlings survival, growth and establishment [4]. Reserves food material of seed may depend on seed size which is an important factor for germination and initial growth of seedlings. Germination of seeds depends on the ability of seeds to use reserves material more efficiently. Higher seedling survival, growth and better field performance was observed in larger seeds than smaller seeds[5].Grading of seed on based of size is a common practice in a majority of plant species to regulate the seed germination and seedling growth. Large healthy seeds give healthy seedlings which is important criteria for transplant in the field [6].

Keeping in view the above facts the experiment was conducted to find out the seed size of each tree species for obtaining the healthy seedlings for transplant for better survival in the field condition.

Material and Methods

The pot experiment was conducted at Balsamand Research Farm of Forestry Department, CCSHAU, Hisar. Seeds of different tree species namely *Ailanthus excelsa, Acacia nilotica, Acacia tortilis, Dalbergia sissoo, Prosopis cineraria, Prosopis juliflora* and *Azadirachta indica* were collected from middle age pluse trees from Balsamand Research Area and nearby places, these seeds size were separated as large, medium and small size and the characters of seeds like length, breadth and thickness were measured with the help of vernier caliper as shown in [Tabe-1]. Twenty five seeds of each tree species were selected on the basis of seed size and these seeds were sown in pots filled with well rotten farm yard manure (FYM) and nursery soil in 1:1 ratio.

After recorded the germination percentage,4 plants in each pots were maintained for further studies. Test weights (g), germination (%), initiation of germination (days), fresh and dry root and shoot weight (g), root and shoot length (cm) were analyzed with the help of software package OPSTATE developed by CCSHAU, Hisar and the significant difference were based on P≤0.05.

Results and Discussion

In [Table-2] maximum test weight in all the seed lots i.e., large, medium and small was recorded in *Azadirachta indica* followed by *Acacia nilotica, Prosopis cineraria* whereas minimum was recorded in *Dalbergia sissoo*. Test weight was recorded higher in larger seeds of each tree species than medium and small seed size. Among the tree species test weight was found significantly higher in *Azadirachta indica* followed by *Acacia nilotica, Prosopis cineraria* in all the seed lots whereas, significantly lower test weight was recorded in *Dalbergia sissoo*. The size of the seeds is important factor in the germination and early stage of seedlings growth [7]. Different size of seeds having different levels of food storage may be important factor which influences the germination and growth of the seedlings [8]. Seed weight were significantly affected the seedlings growth of some tropical rainforest tree species [9].

Significantly higher germination percent was recorded in *Prosopis juliflora seeds followed by Ailanthus excelsa, Azadirachta indica* and *Acacia niloticathan Dalbergia sissoo*. Larger seeds of each tree species performed better than medium and small seed size.[10] germination percentage significantly declined with reduction in size and weight of the seeds [11]. Larger seeds of *Cryptocarya alba* germinate in more number than small seeds. Larger seeds have positive effect on germination [12]. Larger seeds had the highest germination percentage than small seeds [13]. Large seeds size gave maximum germination and to produce more vigorous seedlings than small seeds [14]. In case of initiation of germination, seeds of *Dalbergia sissoo* followed by *Azadirachta indica* germinate within 3 days after sowing. Whereas, germination was delayed in *Prosopis juliflora* followed by Prosopis cineraria in large seed size treatment (L). Small seeds (S) of each tree species took more time to germinate after sowing.

Table-1 *Characters of seeds of different tree species*

Treatments/Tree species	Seed length (mm)			Seed breadth (mm)			Seed thickness (mm)		
	L	M	S	L	M	S	L	M	S
Ailanthus excelsa	12.96	9.12	7.96	6.13	5.42	4.91	2.84	2.34	2.04
Acacia nilotica	10.26	8.01	6.46	7.02	7.61	5.31	3.31	2.58	2.47
Acacia tortilis	07.16	6.26	5.63	5.21	4.42	3.68	3.07	2.37	2.18
Dalbergia sissoo	10.26	8.19	6.03	4.73	3.84	2.81	0.69	0.61	0.35
Prosopis cineraria	09.18	7.21	6.19	5.61	4.69	3.87	2.37	2.11	2.05
Prosopis juliflora	06.96	5.91	5.10	4.01	3.44	3.18	2.29	1.71	1.10
Azadirachta indica	16.63	13.27	10.26	-	-	-	9.04	6.99	5.82

Table-2 *Effect of seed size on seed germination of different tree species*

Treatments/Tree species	Test weight (g)			Germination (%)			Initiation of germination (days)		
	L	M	S	L	M	S	L	M	S
Ailanthus excelsa	5.41	4.88	3.36	91	70	37	3	4	7
Acacia nilotica	7.41	6.40	4.77	80	63	42	5	7	9
Acacia tortilis	3.59	2.93	2.10	81	56	35	4	6	10
Dalbergia sissoo	1.15	0.91	0.61	79	51	40	3	4	6
Prosopis cineraria	6.21	5.12	3.31	78	53	35	6	7	11
Prosopis juliflora	3.87	2.72	2.42	94	81	42	6	7	10
Azadirachta indica	26.38	20.89	15.19	94	76	51	3	5	6
Mean	7.72	6.26	4.48	85.29	64.29	40.29	4.29	5.71	8.43
CD at 0.05	0.19	0.23	0.21	6.87	5.69	5.45	2.11	1.04	2.41

Table-3 *Effect of seed size on seedling growth of different tree species*

Treatments/Tree species	Shoot length (cm)			Root length (cm)			Collar diameter (mm)		
	L	M	S	L	M	S	L	M	S
Ailanthus excelsa	20.9	17.4	10.1	31.6	20.1	12.3	5.36	3.21	2.21
Acacia nilotica	23.8	20.1	09.7	45.7	31.6	20.1	1.73	1.52	1.2
Acacia tortilis	27.6	22.8	13.1	47.2	36.4	29.2	3.41	2.48	1.13
Dalbergia sissoo	20.3	15.3	08.7	39.4	30.1	14.4	2.13	1.32	1.03
Prosopis cineraria	18.3	13.9	08.6	65.3	50.9	27.8	2.41	1.86	1.31
Prosopis juliflora	34.7	28.3	17.2	52.6	44.4	25.2	2.16	1.71	1.08
Azadirachta indica	16.2	13.2	08.1	25.9	18.6	14.5	3.86	1.86	1.37
Mean	23.11	18.71	10.79	43.96	33.16	20.50	3.01	1.99	1.32
CD at 0.05	1.21	1.36	0.54	2.58	1.25	1.74	0.98	0.75	0.65

Table-4 *Effect of seed size on fresh and dry weight of seedlings of different tree species*

Treatments/Tree species	Fresh weight (g)						Dry weight (g)					
	Shoot			Root			Shoot			Root		
	L	M	S	L	M	S	L	M	S	L	M	S
Ailanthus excelsa	3.35	2.24	0.98	1.35	1.12	0.36	1.54	1.10	0.46	0.52	0.44	0.19
Acacia nilotica	2.65	1.36	0.89	0.84	0.42	0.24	1.29	0.56	0.36	0.79	0.21	0.16
Acacia tortilis	4.12	3.12	1.12	2.98	1.89	0.31	1.75	1.36	0.49	1.41	1.02	0.21
Dalbergia sissoo	2.25	0.98	0.39	1.25	0.87	0.18	0.94	0.55	0.16	0.59	0.41	0.98
Prosopis cineraria	1.02	0.68	0.35	1.65	0.86	0.62	0.52	0.29	0.14	1.21	0.68	0.32
Prosopis juliflora	3.05	1.09	0.61	2.54	0.97	0.36	1.39	0.35	0.21	1.21	0.51	.24
Azadirachta indica	3.98	2.98	1.71	1.98	0.68	1.05	2.26	1.59	0.78	0.98	0.47	0.45
Mean	2.92	1.78	0.86	1.80	0.97	0.45	1.38	0.83	0.37	0.96	0.83	0.36
CD at 0.05	0.23	0.10	0.11	0.26	0.19	0.12	0.28	0.14	0.18	0.34	0.12	0.18

It is also noted that larger seeds germinate better and earlier than small seeds[15]. Larger seeds of *Azadirachta indica* germinated earlier compared to small seeds [16]. Large seeds germinate early and showed better germination than small seeds. Large and medium seeds of *Pinus thunbergii* had a higher germination rate, germination index, vigor index than small seeds [17].

In [Table-3] In different seeds size of trees species, shoot length, root length and collar diameter were observed maximum in larger seeds than medium seeds and minimum was recorded in small seeds of each tree species similar observation also observed by Uniyal, *et al.,* (2007) that longer shoot and root length were observed in A. indica from larger size seeds. Shoot length was found significantly higher in *Prosopis juliflora* followed by *Acacia nilotica* than *Azadirachta indica* and *Prosopis cineraria*. Larger seeds have greater shoot growth rate reported by Bonfil, (1998) [18]. In case of root length, the root of Prosopis cineraria was found significantly larger than other tree species roots. Collar diameter was recorded significantly higher in *Ailanthus excelsa* and *Acacia nilotica* followed by *Dalbergia sissoo*. Significant difference in seedling height and root collar diameter among the different seed sizes with large seeds having the higher seedling height. Large seeds of *Saraca asoca* attended higher collar diameter as compared to smaller seeds reported by Mirgal, *et al.,* (2016) [19].

In [Table-4] Fresh shoot weight was recorded significantly higher in *Acacia nilotica* followed by *Azadirachta indica* than *Prosopis cineraria*. Fresh root weight was found significantly higher in *Acacia tortilis* followed by *Prosopis juliflora* and minimum was recorded in *Dalbergia sissoo*. Seedlings from large seeds of *Ligularia virgaurea* has significant higher rates of biomass accumulation than seedlings from small seeds [20].

Dry shoot weight was recorded significantly higher in *Acacia tortilis* followed by *Azadirachta indica* as compared with *Prosopis cineraria* and *Dalbergia sissoo*. Dry root weight of *Acacia tortilis* was recorded significantly higher followed by *Prosopis juliflora* than other tree species under studied. Large seeds affect significantly on seedlings dry weight. Dry weight of seedlings of *G.arborea* raised from large size seeds was 2-3 times more than those from small size seeds. Seeds weight was strongly correlated with increase in seed size for *O. paniculataand D. macrocarpus* [21]. Larger seeds of *Saraca asoca* attended higher dry biomass and entire seedling biomass as compared to smaller seeds. Seedlings raised from medium seeds were at par with larger seeds in most of the traits.

Conclusion

It is concluded that large seeds of each tree species under studied have more

advantages followed by medium size seeds than small seeds in terms of all the growth parameters like initiation of germination, completion of germination, shoot length, root length, collar diameter, fresh and dry root and shoot weight of seedlings. it is recommended that seedlings obtained from large and medium seeds are good quality and are used for planting out.

Application of research:

Research Category: Forestry

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Study area / Sample Collection: Balsamand Research Farm of Forestry Department

Cultivar / Variety / Breed name: *Ailanthus excelsa, Acacia nilotica, Acacia tortilis, Dalbergia sissoo, Prosopis cineraria, Prosopis juliflora* and *Azadirachta indica*

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
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