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INFLUENCE OF GRADED SEEDS ON SEED AND SEEDLING QUALITY CHARACTERS DURING STORAGE OF *JATROPHA CURCAS* L.

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ABSTRACT:

Seeds of *Jatropha curcas* were subjected to density grading using specific gravity separator into large, medium and small sizes and their germination percentage was recorded during their storage periods. Graded seeds were treated with different organic and inorganic chemicals and were stored under ambient condition in cloth bag were evaluated for seedling characters at bimonthly intervals. Large sized seeds germinated better (88%) than medium sized (69%) and small sized seeds (43%) and biomass production was higher in seedlings produced from larger seeds. The germination rate was decreased to 50% after 6 months of storage in large and medium sized seeds and before 6 months in small sized seeds. Imidachloprid @1.5ml kg^{-1} + Bavistin @ 2g kg^{-1} with (T_6) and without (T_4) polymer and treatment with bavistin @ 2g kg^{-1}(T_2) recorded the highest germination per cent and other quality parameters after ten months of storage.

KEY WORDS: *Graded seeds, Seed quality, Storage, Jatropha curcas.*

INTRODUCTION:

Jatropha (*Jatropha curcas*) is a medium sized bush type tree in backyards of households and live fence in agriculture fields in India based on their multi-purpose utility. Jatropha is becoming more important in plantation forestry

because of their utility as crops for alternate for fossil fuel, and they are typically propagated from seeds (Daniel and Hegde, 2007). Seed size is, perhaps, the most obvious difference among seeds in a population or lot. Ecologists interested in seed size have generally contrasted functional groups of plants but, recently, some have focused on explaining the large range of seed size found within a functional group. A potentially important theoretical advance was the idea that seed number–seedling survival tradeoffs could explain the coexistence of species, in particular colonization–competition tradeoffs where smaller-seeded species are superior colonizers and larger-seeded species are superior competitors (Coomes and Grubb, 2003). A relationship between seed size and seed germination or vigour in a variety or kind has been recognized and taken advantage to upgrade seed quality (Delouche *et. al.,* 1995).

Generally seed germination controlled by many internal and external factors. Seed size is one among them. Seed size is important parameters, which influences the germination, growth and biomass of nursery seedlings and that trend leads to future crop (Indira *et. al.,* 2000 and Girish *et. al.,* 2001). Respective of the seed size, seeds having different levels of starch and other food storage may be one factor which influences the expression of germination and growth of the plants (Wood et al.1977). The main purpose of seed grading is to understand the better physiological quality of the seeds lot. Grading of seed based upon their size and weight is a common practice in a majority of plant species as it has been found to regulate the germination and subsequent seedling growth in many species. It is considered necessary to know the effect of seed size and weight in the seed germination, so as to get healthy seedlings of plant species for a purpose of transplantation in the field (Arjunan *et. al.,* 1994, Manonmani *et. al.*. 1996 and Ahmad *et. al.,* 2002). Hence, an attempt has been to analyse the effect of size and weight of seed on seed germination of *Jatropha curcas* in different storage periods with organic and inorganic seed treatments.

MATERIALS AND METHODS:

Seed source and experimentation

The seeds of *Jatropha curcas* collected from Coimbatore (11°1’6 N 76°58’21 E), Tamil Nadu were subjected to density grading using specific gravity separator as three categories viz., heavy (G_1), medium (G_2) and small (G_3). The graded seeds were evaluated for seed recovery and 100 seed weight, which were presented in table.1. The graded seeds were stored under ambient conditions and evaluated once in three months for seed and seedling quality characters up to six months. The graded (heavy and medium fractions) and non-graded seeds were treated with inorganic chemicals *viz.*, Bavistin, Imidachloprid , polymer and organic products viz.,Turmeric, Vasambu and Vitamin E along with control as follows;

Control	Polymer + Imidachloprid + Bavistin
Bavistin (2g kg^{-1})	Polymer + Turmeric (5 g kg^{-1})
Imidachloprid (1.5ml kg^{-1})	Polymer + Vasambu (5 g kg^{-1})
Imidachloprid + Bavistin	Polymer + Neem (5 g kg^{-1})
Polymer (1.25ml kg^{-1})	Polymer + Vitamin E (1.25ml kg^{-1})

Statistical analysis

The data gathered were statistically scrutinized as per Panse and Sukhathme, (1985) under F test of significance for understanding the level of significance among the seed treatment and seed quality characters.

RESULTS AND DISCUSSION:

In the present investigation, seeds were graded using specific gravity grader into three categories as heavy, medium and small based on their weight. The results expressed that recovery of seeds retained as heavy seeds was higher (40.5%) and followed by the seeds retained as medium and small seeds were recorded as 46.5% and 12% respectively. Hence, the medium sized seeds were distributed in higher order than the heavy seeds (Table.1). The results revealed that the seed size and weight affect the seed germination and other quality parameters. The seeds retained in heavier fraction (G_1) had recorded higher seed quality characters initially, after six and after twelve months. Hence, heavier fraction (G_1) could be selected a quality seeds, for production of elite seedlings (Table. 2).

According to Leishman (2000), the seed size of a species represents the amount of maternal investment in an individual offspring, or how much 'packed lunch' an embryo is provided with to start its journey in life. Seed size represents a fundamental trade-off, within the strategy of a species, between producing more small seeds versus fewer larger seeds from a given quantity of resource allocated to reproduction. Also Gunaga *et. al.,* (2011) argued that higher and quicker germination in bigger sized seeds could be due to the presence of higher amount of carbohydrates and other nutrients than in medium and small sized seeds. It is evidence from the table 2 that the seed germination significantly declined with reduction in size and weight. The observed results with regard to seed germination are in concurrence with increase in germination with increase in seed size and a weight has reported in *Bassia longifolia* (Suresh *et. al.,* 2003), *Alangium lamarckii* (Ahirwar, 2012) and *Syzygium bankense* (Satyanti, 2009). The similar results have been observed in many tropical forest trees such as in *Pongamia pinnata* (Arjunan et al. 1994), in *Albizia procera* (Khurana and Singh, 2000), in *Albizia lebbeck* (Missanjo *et. al.,* 2013).

Further to improve the longevity of graded seeds under storage, seeds were coated with organic and inorganic chemicals that showed significant variations among the different treatments (Table.3). The treatments such as Imidachloprid @1.5ml kg^{-1} + Bavistin @ 2g kg^{-1} with (T_6) and without (T_4) polymer

and seed treatment with bavistin @ 2g kg^{-1}(T_2) recorded the highest germination per cent and other quality parameters after ten months of storage. However, the treated seeds of T_6 and T_4 showed superior in terms of germination and other quality parameters than control. Venudevan and Srimathi (2014) reported that imidachloprid, bavistin and polymer coated seeds of bael (*Aegle Marmelos*) enhanced the longevity of seeds in storage and germination percentage. The similar findings are reported by different authors in forest tree species *viz.,* Missanjo *et. al.,* (2013) in *Albizia lebbeck* and Kumar (2007) in *Azadirachta indica*. Amico Roxas et al (1994) reported that a positive correlation was found between seed size and seed viability in *Amaryllis belladonna*. Organic and inorganic seed coating enhance the longevity of the tree seeds in storage through protecting the seeds from external atmospheric condition and biotic pressure from pest and diseases attacks.

CONCLUSSION:

The seed is a basic material in tree improvement programme. Even though, seeds collecting from plus trees, we need to rogue out less genetic material from seed orchard to achieve the elite seedlings. Hence this study showed that the retention of heavy fraction *Jatropha curcas* seeds produced quality seedlings even after a year storage. Therefore our findings concluding that using specific gravity grader for grading and screening of large size seeds in seed collection time may helpful for scoring good genetic material in selection trial and save the time, energy and money.

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Table 1: Seed recovery and 100 seed weight of density graded seeds of *Jatropha curcas*

Grades fraction (G)	Recovery %	100 seed weight (g)
Heavy (G_1)	41.5	61
Medium (G_2)	46.5	58
Low (G_3)	12.0	52

Table 2: Influence of specific gravity grading on seed and seedling quality characters of *Jatropha curcas*

Grades fraction (G)	Storage period in months (M)							
	Germination (%)				Shoot length (cm)			
	Initial	After 6 month	After 12 months	Mean	Initial	After 6 month	After 12 months	Mean
Heavy	88	67	25	60	29.0	29.3	28.8	29.0
Medium	69	45	18	44	29.2	25.7	26.9	27.3
Lower	48	32	7	29	27.1	23.5	24.7	25.1
Bulk	70	54	18	44	26.7	27.2	26.7	26.9
Mean	69	50	17		28.0	26.4	26.8	
CD (P=0.05)	G	S	G x S		G	S	G x S	
	3.8	4.4	NS		NS	NS	NS	
Grades fraction (G)	Root length (cm)				Fresh weight 10 seedlings^{-1} (g)			
	Initial	After 6 month	After 12 months	Mean	Initial	After 6 month	After 12 months	Mean
Heavy	9.8	7.9	6.6	8.1	46.0	45.9	34.7	42.2
Medium	8.7	7.7	6.0	7.5	46.4	40.2	35.2	40.6
Lower	8.5	6.2	5.6	6.8	41.5	38.5	33.6	37.9
Bulk	5.8	8.2	6.6	6.9	56.3	48.1	38.3	47.6
Mean	8.2	7.5	6.2		47.6	43.2	35.5	
CD (P=0.05)	G	S	G x S		G	S	G x S	
	NS	0.7	1.5		2.2	1.9	NS	
Grades fraction (G)	Dry weight 10 seedlings $^{-1}$ (g)				Vigour index			
	Initial	After 6 month	After 12 months	Mean	Initial	After 6 month	After 12 months	Mean
Heavy	3.5	3.9	2.5	3.3	3020	2475	558	2018
Medium	3.1	3.4	2.0	2.8	1838	1501	388	1242
Lower	3.5	3.1	1.6	2.7	1356	955	202	838
Bulk	3.5	3.7	1.8	3.0	1937	1913	501	1450
Mean	3.4	3.5	2.0		2038	1711	412	
CD (P=0.05)	G	S	G x S		G	S	G x S	
	0.3	0.3	NS		193.3	167.4	334.7	

Table 3: Influence of organic and inorganic chemical treatments on *Jatropha curcas* graded seeds

Treatments (T)	Germination %						
	Months after storage						
	0	2	4	6	8	10	Mean
T_1	67	62	56	52	50	45	55
T_2	80	78	72	70	68	64	72
T_3	75	70	68	66	62	60	67
T_4	85	82	76	72	70	68	76
T_5	70	68	62	60	58	56	62
T_6	87	82	78	70	70	68	76
T_7	60	55	52	48	47	42	51
T_8	60	50	48	46	42	38	47
T_9	65	58	54	50	44	40	52
T_{10}	70	66	62	60	56	54	61
Mean	72	67	63	59	57	54	62
CD	G	P	T	G x P	P x T	G x T	G x P x T
(P=0.05)	1.82	3.16	4.08	NS	NS	5.78	NS
Treatments (T)	Shoot length (cm)						
	0	2	4	6	8	10	Mean
T_1	28.0	21.2	29.0	30.6	30.0	28.5	27.9
T_2	28.0	26.0	37.0	27.0	25.0	28.0	28.5
T_3	26.0	24.1	35.2	25.0	29.9	28.0	28.0
T_4	27.3	24.0	31.3	31.2	29.7	29.0	28.8
T_5	26.1	25.2	27.5	26.3	25.1	30.1	26.7
T_6	28.0	29.0	34.0	28.8	33.0	29.0	30.3
T_7	26.0	23.5	36.4	28.8	26.2	27.2	28.0
T_8	27.5	23.1	32.0	29.7	31.0	28.0	28.6
T_9	23.4	24.3	30.5	29.0	33.0	26.0	27.7
T_{10}	26.4	22.5	29.5	26.6	25.8	27.5	26.4
Mean	26.7	24.3	32.2	28.3	28.9	28.1	28.1
CD	G	P	T	G x P	P x T	G x T	G x P x T
(P=0.05)	0.38	0.67	0.86	0.94	2.10	1.21	2.97
Treatments (T)	Root length (cm)						
	0	2	4	6	8	10	Mean
T_1	6.0	7.1	5.0	4.2	4.0	6.0	5.4
T_2	7.0	6.3	5.0	5.6	7.2	6.0	6.2
T_3	6.0	6.0	6.1	5.0	7.6	6.4	6.2
T_4	9.0	7.0	5.0	4.7	6.0	6.0	6.3
T_5	6.1	4.0	6.4	4.0	4.0	5.1	4.9
T_6	6.2	7.0	6.0	5.8	6.2	7.4	6.4
T_7	6.5	6.3	5.2	5.0	4.5	7.0	5.8
T_8	5.1	7.0	6.0	4.6	4.3	5.4	5.4
T_9	8.0	5.0	6.0	4.6	7.0	5.5	6.0
T_{10}	6.0	6.0	6.5	4.2	4.1	6.5	5.6
Mean	6.6	6.2	5.7	4.8	5.5	6.1	5.8
CD	G	P	T	G x P	P x T	G x T	G x P x T

(P=0.05)	0.36	0.62	NS	NS	NS	NS	NS
Treatments (T)	**Fresh weight 10 seedlings^{-1}(g)**						
	0	**2**	**4**	**6**	**8**	**10**	**Mean**
T_1	38.0	41.0	42.4	38.1	38.5	53.0	41.8
T_2	36.0	44.0	48.4	45.6	40.1	46.0	43.4
T_3	33.1	44.0	43.1	41.3	41.2	53.2	42.7
T_4	37.0	40.3	53.0	42.0	42.5	51.2	44.3
T_5	40.2	41.1	46.0	37.7	39.5	52.0	42.8
T_6	44.5	44.0	43.1	56.0	33.1	47.5	44.7
T_7	37.5	45.0	41.5	40.0	36.5	56.3	42.8
T_8	38.0	39.3	45.1	37.7	39.2	46.0	40.9
T_9	33.0	39.3	40.9	33.1	40.4	48.0	39.1
T_{10}	39.3	40.0	48.1	45.0	40.5	45.4	43.1
Mean	37.0	42.0	45.3	40.6	39.9	50.4	42.5
CD	G	P	T	G x P	P x T	G x T	G x P x T
(P=0.05)	NS	3.142	NS	NS	NS	NS	NS
Treatments (T)	**Dry weight 10 seedlings^{-1}(g)**						
	0	**2**	**4**	**6**	**8**	**10**	**Mean**
T_1	2.1	2.6	3.1	4.1	3.6	3.2	3.1
T_2	2.4	2.6	2.6	4.5	3.6	3.3	3.2
T_3	2.1	2.1	3.2	4.1	4.1	3.0	3.1
T_4	2.8	2.0	2.5	4.0	4.1	4.5	3.3
T_5	2.6	1.7	3.0	4.0	3.5	3.1	3.0
T_6	3.6	2.5	3.0	4.5	4.0	3.6	3.5
T_7	2.1	2.1	4.0	3.7	4.3	2.8	3.2
T_8	2.1	1.7	3.1	4.1	4.0	2.0	2.8
T_9	2.2	2.1	3.3	4.0	4.2	2.3	3.0
T_{10}	2.3	1.4	3.0	4.6	4.1	4.0	3.2
Mean	2.4	2.1	3.1	4.2	4.0	3.2	3.2
CD	G	P	T	G x P	P x T	G x T	G x P x T
(P=0.05)	NS	0.235	NS	NS	NS	NS	NS
Treatments (T)	**Vigour index**						
	0	**2**	**4**	**6**	**8**	**10**	**Mean**
T_1	2278	1755	1904	1810	1700	1553	1841
T_2	2800	2519	3024	2282	2190	2312	2520
T_3	2400	2107	2808	1980	2325	2064	2287
T_4	3086	2542	2759	2585	2499	2240	2622
T_5	2254	1986	2102	1818	1688	1971	1973
T_6	2975	2952	3120	2422	2744	2475	2786
T_7	1950	1639	2163	1622	1443	1436	1711
T_8	1956	1505	1824	1578	1483	1269	1607
T_9	2041	1699	1971	1680	1760	1260	1748
T_{10}	2268	1881	2232	1848	1674	1836	1959
Mean	2398	2044	2388	1953	1961	1847	2102
CD	G	P	T	G x P	P x T	G x T	G x P x T
(P=0.05)	82.080	142.168	183.53	NS	NS	259.56	NS