Effect of seed storage period and growth regulators on seed germination and physiological parameters of jackfruit seedling

Abstract

An experiment entitled "Effect of seed storage period and growth regulators on seed germination and physiological parameters of jackfruit seedling" was conducted in green shade net house at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during the year *kharif*-2019.The treatment comprised three levels of seed storage period (S) *viz*., S_1- 0 day after extraction of seed, S_2- 5 days after extraction of seed and S_3- 10 days after extraction of seed and five seed soaking treatments of growth regulators GA_3for24 hrs (G) *viz*., G_1- GA_3 @100 mg l^{-1}, G_2- GA_3 @ 150 mg l^{-1}, G_3- NAA @ 25 mg l^{-1}, G_4- NAA @ 50 mg l^{-1} and G_5- Control. The experiment was carried out in Completely Randomized Design (Factorial) with fifteen treatment combinationsand repeated thrice. Sowing of fresh extracted seeds of jackfruit recorded minimum number of days (14.89) taken for germination with maximum germination percentage (81.60)andat 90 DAS maximum leaf area (43.38 cm^2), root: shoot ratio (0.22), vigour index-I (41.60) and vigour index-II (3.17). Soaking seed in GA_3 @ 100 mg l^{-1} for 24 hrs recorded significantly, minimum number of days (15.58) taken for germination with maximum germination percentage (76.67) and at 90 DASmaximum leaf area (52.34 cm^2), root:shoot ratio (0.22), vigour index-I (38.08) and vigour index-II (3.13). Treatment combination sowing of fresh extracted seeds and soaking seeds in GA_3 @ 100 mg l^{-1}for24hrsrecorded minimum number of days (12.34) taken for germination with maximum germination percentage (96.67)and at 90 DASmaximum leaf area (59.87 cm^2) vigour index-I (56.03) and vigour index-II (5.37).

Keywords: Seed storage period, Growth regulators, Germination parameters, Physiological parameters

Introduction

Jackfruit (*Artocarpus heterophyllus* Lam.) belongs to the family Moraceae. It is the largest edible fruit in the world. It is a native species of the rain forestsof the Western Ghats of India and the Malaysia. The main jackfruit producer countries are Bangladesh, India, Myanmar, Indonesia, Sri Lanka and Malaysia. The viability of jackfruit seeds lost very quickly even one- or two-weeks delay in sowing will lead to poor germination. Jackfruit seeds are recalcitrant in nature. Recalcitrant seeds are relatively high in moisture content and possess a characteristic feature of losing their viability during desiccation. The recalcitrant

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seeds, imposeserious storage problems due to their desiccation and chilling sensitivity. Storage above critical level of time leads to loss of viability. Recalcitrant seeds are intolerant to drying and long period storage.

Hence, prolonging viability of seeds would facilitate the availability of seeds for various plantation programmesand for use by nursery men and local farmers throughout the year. Realizing the importance of raising jackfruit seedling, for quick germination of seeds and subsequent growth of seedling the pre-soaking treatment of seeds with growth regulators have been taken underthe present experiment.

Materials and Methods

The experiment was conducted in the green shade net house (75 % shade) at the Horticulture Research Farm and Nursery, B. A. College of Agriculture, Anand Agricultural University, Anand during the month July- October, 2019. The experiment was laid out in Completely Randomized Design with factorial concept having fifteentreatment combinations, comprising of three level of seed storage periodviz., S_1- 0 day after extraction of seed, S_2- 5 days after extraction of seed and S_3- 10 days after extraction of seed with five levels of growth regulators (G) *viz.*, G_1- GA_3 @ 100 mg l^{-1}, G_2- GA_3 @ 150 mg l^{-1}, G_3- NAA @ 25 mg l^{-1}, G_4- NAA @ 50 mg l^{-1} and G_5- Control. The treatment was repeated thrice. Fresh Jackfruits were collected from the local farmer field. Seeds were carefully extracted from uniform sizefully ripened and healthy fruits of jackfruit. Healthy seeds were selected and soaked in solution of different concentration of growth regulators for 24 hours as per the treatments before sowing.The ~~H~~healthy seeds were stored in cloth bag at ambient condition. The seeds were stored in different lots for different sowing dates. After treatment seeds were sown in polythene bag size of 7"× 5", previously filled with potting mixture which was prepared by mixing two part of soil, one part of rotted FYM and one part of vermicompost (2:1:1). The polythene bags were placed in flat beds and proper space in green shade net. The bags were watered regularly every day. The observation on number of days taken for germination and germination percentages were recorded. Physiological parameters *viz.*, leaf area at 30, 60 and 90 DAS and root:shoot ratio, Vigour index-I and Vigour index-II at 90 DAS was recorded from 5 randomly selected plants and statically analysed.

Results and Discussion

Effect of Seed Storage Period

Seed storage period showed thesignificant effect on germination parameters. Sowing of fresh extracted seeds(o day after extraction of seed) observed minimum number of days

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(14.89) taken for germination with maximum germination percentage (81.60). This might be due to the presence of more moisture, vigour of seeds and absence of dormancy resulted early germination. Similar, results were also obtained by Prajapati *et al.* (2017) [9]in Kagzilime, Mahasin and Mustafa (2015) [3]in mangoand Merlin and Palanisamy (2000)[4]in jackfruit. Seed storage period also observed significant effect on physiological parameters *viz*., leaf area, root:shoot ratio, vigour index-I and vigour index-II. At 30, 60 and 90 DAS, sowing of fresh extracted seeds (S_1- 0 day after extraction of seed) recorded maximum leaf area (30.25, 39.16 and 43.38 cm^2, respectively) and at 90 DAS, maximum root:shoot ratio (0.22), vigour index- I(41.60) and vigour index- II (3.17). This might be due to freshly extracted seeds have more vigour, high moisture and more nutrient reserve resulted healthy and vigorous seedling.~~This~~Theseresults ~~are~~ close agreement with results of Prajapati *et al.* (2017) [9]in kagzilimeandDeepika *et al.* (2014) [1]in karonda.

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Table 1: Effect of seed storage period and growth regulators on seed germination

Treatments	Number of days taken for germination	Germination percentage
Seed storage period (S)		
S_1 0 day after extraction of seed	14.89	81.60
S_2 5 days after extraction of seed	17.27	67.86
S_3 10 days after extraction of seed	19.93	53.00
S.Em. ±	0.21	0.90
C.D. at 5 %	0.61	2.60
Growth regulators (G)		
G_1 GA_3 @ 100 mg l^{-1}	15.58	76.67
G_2 GA_3 @ 150 mg l^{-1}	17.09	64.11
G_3 NAA @ 25 mg l^{-1}	18.39	68.89
G_4 NAA @ 50 mg l^{-1}	15.85	73.32
G_5 Control	19.90	54.44
S.Em. ±	0.27	1.16
C.D. at 5 %	0.78	3.35
S × G	Sig.	Sig.
C.V %	4.64	5.16

Table 2: Interaction effect of seed storage period and growth regulators on seed germination

S / G	Number of days taken for germination			Germination percentage		
	S_1	S_2	S_3	S_1	S_2	S_3
G_1	12.34	15.68	18.71	96.67	73.33	60.00
G_2	14.68	16.14	20.46	74.00	68.33	50.00
G_3	16.76	18.42	20.00	81.67	71.67	53.33
G_4	12.45	15.43	19.67	94.00	70.97	55.00
G_5	18.19	20.67	20.83	61.67	55.00	46.67
S.Em.±		0.47			2.01	
C.D. at 5%		1.34			5.80	

Effect of Growth Regulators

Growth regulators showed the significant effect on germination parameters.Soaking seeds in GA_3 @ 100 mg l^{-1} for 24 hrs(G_1) recorded minimum number of days (15.58) taken for germination and maximum germination percentage (76.67).This might be due to GA_3increased the activities of hydrolyzing enzymes and α-amylase at initial stage of germination which convert starch into simple carbohydrate and chemical energy which is used in the activation of embryo and facilitated to germination process. Similar, results were also obtained by Panda *et al.* (2018) [6]in kagzi lime, Prajapati *et al.* (2014)[8], Pandiyan *et al.* (2011)[7], Singh *et al.* (2002) [11]and Prakash (1998) [10]in jackfruit. Growth regulators also observed significant effect on physiological parameters *viz.*, leaf area, root:shoot ratio, vigour index-I and vigour index-II. At 30, 60 and 90 DAS, soaking the seeds in GA_3 @ 100 mg l^{-1} for 24 hrs recorded maximum leaf area (32.87, 42.22 and 52.34 cm^2, respectively) and at 90 DAS, maximum root:shoot ratio (0.22), vigour index- I (38.08) and vigour index- II (3.13). It might be due to seed treatment with GA_3 increased cell division and cell elongation which ultimately increased length and width of leaves.Similar, results were also observed byPrajapati *et al.* (2014) [8] in jackfruit and Padma *et al.* (2015) [6] in papaya.GA_3treated seedling recorded higher dry weight of root and shoot that ultimately resulted higher root:shoot ratio.These results are in accordance with results of Harshavardhan and Rajasekhar (2012)[2]who reported maximum root:shoot ratio in jackfruit with GA_3 @ 150 mg l^{-1} seed treatment.

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Interaction Effect of Seed Storage Period and Growth Regulators

Interaction effect of seed storage period and growth regulators showed the significant effect on germination parameters. Treatment combination sowing of fresh extracted seeds with soaking in GA_3 @ 100 mg l^{-1} for 24 hrs(S_1G_1)recorded minimum number of days (12.34) taken for germination with maximum germination percentage (96.67). It might be due to in fresh seeds presence of more moisture and vigour which recorded high germination percentage and growth regulators GA_3 enhance seed germination due to diffusion of endogenous auxin and gibberellins like substances. The Interaction effect of seed storage period and growth regulators showed the significant effect on physiological parameters except root:shoot ratio at 90 DAS. Treatment combination sowing of fresh extracted seeds with soaking in GA_3 @ 100 mg l^{-1} for 24 hrs found maximum leaf area at 30, 60 and 90 DAS (36.97, 45.88 and 59.87 cm^2, respectively) and at 90 DAS vigour index-I (56.03) and vigour index-II (5.37) This might be due to the combined effect of fresh seeds and GA_3 which increased the germination percentage and length of seedling.

Table 3: Effect of seed storage period and growth regulators on physiological parameters of jackfruit seedling

Treatments	Leaf area (cm^2)			Root:shoot ratio	Vigour index-I	Vigour index-II
	30 DAS	60 DAS	90 DAS	90 DAS	90 DAS	90 DAS
Seed storage period (S)						
S_1 0 day after extraction of seed	30.25	39.16	48.38	0.22	41.60	3.17
S_2 5 days after extraction of seed	28.01	37.94	45.85	0.19	29.68	2.26
S_3 10 days after extraction of seed	26.82	36.45	44.11	0.19	22.13	1.25
S.Em. ±	0.31	0.36	0.55	0.004	0.47	0.04
C.D. at 5 %	0.89	1.03	1.60	0.01	1.36	0.11
Growth regulators (G)						
G_1 GA_3 @ 100 mg l^{-1}	32.87	42.22	52.34	0.22	38.08	3.13
G_2 GA_3 @ 150 mg l^{-1}	27.56	38.56	47.24	0.20	27.74	1.92
G_3 NAA @ 25 mg l^{-1}	25.64	35.96	41.33	0.20	34.18	1.63
G_4 NAA @ 50 mg l^{-1}	31.92	40.96	50.70	0.21	34.89	2.92
G_5 Control	23.82	31.55	38.95	0.19	23.04	1.26
S.Em. ±	0.40	0.46	0.71	0.005	0.61	0.05
C.D. at 5%	1.15	1.33	2.06	0.01	1.76	0.14
S × G	Sig.	Sig.	Sig.	NS	Sig.	Sig.
C.V %	4.22	3.64	4.64	7.20	5.82	6.18

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Table 4: Interaction effect of seed storage period and growth regulators on physiological parameters of jackfruit seedling

S / G	Leaf area (cm^2)									Vigour index-I			Vigour index-II		
	30 DAS			60 DAS			90 DAS			90 DAS			90 DAS		
	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3
G_1	36.97	31.70	29.93	45.88	41.41	39.36	59.87	50.27	46.90	56.03	34.37	26.45	5.37	3.00	1.55
G_2	27.93	28.73	26.00	39.08	40.00	36.60	49.87	48.10	43.77	34.59	28.19	20.79	2.63	2.02	1.22
G_3	25.50	25.17	26.27	35.92	36.88	35.07	38.97	42.36	42.67	40.38	30.78	22.28	2.58	1.64	0.89
G_4	36.12	30.10	29.53	44.41	39.15	39.33	56.55	48.23	47.33	50.43	32.90	23.51	4.03	2.95	1.95
G_5	24.73	24.37	22.35	30.53	32.24	31.87	36.67	40.30	39.88	29.07	22.64	18.00	1.75	1.36	0.75
S.Em.±		0.69			0.79			1.24			1.05			0.08	
C.D. at 5 %		1.98			2.29			3.57			3.04			0.24	

Conclusion

Based on the results of the experiment it can be concluded that for getting early and better germination as well as healthy and vigours seedling fresh extracted seed of jackfruit should be treated with GA_3 @ 100 mg l^{-1} for 24 hours before sowing.

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