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Effects of Seed Treatment on Seed Quality and Seed Health Parameters of Buckwheat (Fagopyrun Esculentum L) During Storage

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Research Article

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ABSTRACT

The present investigation is planned to investigate the "effects of seed treatments on seed quality and seed health parameters of buckwheat genotypes during storage at seed testing laboratory, Department of Genetics and plant Breeding SHUATS, Prayagraj, U.P during 2019-2020. The experiment consists of five genotypes viz, IC-18040(G1), IC-18289(G2),IC-18757(G3), IC-18881(G4), IC-18889(G5). Seeds were treated with neem oil 5 ml/kg (T1) and carbendazim at 2g/kg (T2) and seeds alone with control (untreated T0) and packed in a cloth bag and maintained for 9 months under ambient conditions. The result clearly shown that seeds of IC-18289(G2) treated with neem oil were found high germination percent (80%), root length (10.19 cm), shoot length (8.29 cm), seedling length (18.48 cm), fresh weight (0.59 g), dry weight (0.37 g), Vigour index I (1478.40), Vigour index –II (2.96) viability (58) and seed infection (least infection (least seed infected) (2.30).

INTRODUCTION

Buck wheat is gluten – free pseudo cereal which has potential as functional food due to high biological value. Buckwheat occupies a special place amongst cultivable crops due to its nutritional, dietetic and therapeutic properties. Due to its high nutritive and medicinal value, medical scientist and researcher are interested in developing this as pharmaceutical plant [1]. The grains are rich in vitamins, especially those of vitamins B group. One of the notable features of buckwheat is the high biological value of its protein, although its digestibility is relatively low. Buckwheat is often raised as a leafy vegetable crop in many areas of the Indian sub - continent. The leafy tender shoots of the plants are harvested and dishes prepared from them [2]. Buckwheat is useful as a green manure crop for renovation of low productivity land because it grows well on such land and produces a green manure crop in a short time [3]. Starch is the major storage component of buckwheat grains. It is accumulated in the endosperm as an energetic material necessary for the plant growth. In the whole grain of buckwheat, starch content varies from 59% to 70% of the dry mass, demons trating fluctuations under variable climatic and cultivation conditions [4] .

However, current results of starch analysis in buckwheat grains of three Polish varieties have shown that the starch content lies in a narrow range, i.e . from 63% to 66% dm .

Amylose content of buckwheat starch granules fluctuates between 15% and 52% and its degree of polymerization varies shown that the starch content lies in a narrow range, i.e . from 63% to 66% dm. Amylose content of buckwheat starch granules fluctuates between 15% and 52% and its degree of polymerization varies from 12 to 45 glucose units (Campbell 1997). From the nutritional point of view, there exist three fractions of starch: rapidly digestible starch (RDS), slowly digestible starch (SDS), and resistant starch (RS). Resistant starch is not absorbed in the small intestine and is partly or completely available for fermentation by microflora in the large intestine.

MATERIALS AND METHODS

The experiment was carried out to study the "Effect of different seed treatments on seed quality and seed health parameters during storage in buckwheat (Fagopyrum esculentum L.)"

The present investigation was carried out at the Laboratory of Seed science and Technology in the Department of Genetics and Plant Breeding, Naini Agricultural University, Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj (U.P.).

Plan of laboratory experiment was conducted in the following headlines:

Tri-monthly laboratory experiment was conducted to determine the seed quality parameters of different treated buckwheat genotypes during storage (9 months) (year 2019-2020).

Treatment details

1. Control (untreated) (T0)

2. Neem oil @ 5ml/kg (T1)

3. Carbendazim @2g/kg (T2)

RESULT AND DISCUSSION

Seed germination (%)

Seed germination percentage after 9 week of storage revealed that the genotype G2 registered significantly superior values (80.00%) than other genotype G1 (79.45%). The percentage of seed germination after 9 month of storage as influenced by the seed treatments, T1-Neem oil @ 5ml/kg (81.13%), followed by T2-Carbendazim @2g/kg (75.86%) and minimum was T0-Control (untreated) (75.05%) [5]. The treatment combination (G2T1) reflected superior value of germination after 9 month of storage **(Table 1).**

Root length (cm)

The root length after 9 months of storage as affected by seed treatments revealed that all treatment are found statistically at par with each other. The treatments, T1-Neem oil @ 5ml/kg (11.74), followed by T2-Carbendazim @2g/kg (8.50) and minimum was T0-Control (untreated) (7.22) **(Table 2)**.

The genotype G2 registered significantly superior values (10.19) than other genotype G1 (9.69). The treatment combination(G2T1) reflected superior value of root length length after 9 month of storage.

Seedling length (cm)

The average seedling length after 9 month of storage as affected by seed treatments revealed that all treatment are found statistically at par with each other. The treatments, T1-Neem oil @ 5ml/kg (21.01), followed by T2-Carbendazim @2g/kg (16.31) and minimum was T0-Control (untreated) (13.99). The genotype G2 registered significantly superior values (18.48) than other genotype G1 (17.32). The treatment combination (G2T1) reflected superior value of seedling length after 9 month of storage **(Table 3).**

Fresh weight (g)

The average fresh weight after 9 month of storage as affected by seed treatments revealed that all treatment are found statistically at par with each other. The treatments, T1-Neem oil @ 5ml/kg (0.70), followed by T2-Carbendazim @2g/kg (0.46) and minimum was T0-Control (untreated) (0.41) [6].

The genotype G2 registered significantly superior values (0.59) than other genotype G1 (0.58). The treatment combination (G2T1) reflected superior value of fresh weight after 9 month of storage **(Table 4)**.

Dry weight (g)

As affected for dry weight after 9 months of storage as affected by seed treatments revealed that the treatments, T1-Neem oil @ 5ml/kg (0.70), followed by T2-Carbendazim @2g/kg (0.46) and minimum was T0-Control (untreated) (0.41). The genotype G2 registered significantly superior values (0.59) than other genotype G1 (0.58). The treatment combination (G2T1) reflected superior value of dry weight after 9 month of storage **(Table 5)**.

Vigour Index-I

As affected for seedling vigour index-I after 9 month of storage as affected by seed treatments revealed that the treatments, T1-Neem oil @ 5ml/kg (1704.23), followed by T2-Carbendazim @2g/kg (1239.55) and minimum was T0-Control (untreated) (1051.38). The genotype G2 registered significantly superior values (1478.40) than other genotype G1 (1376.07). The treatment combination (G2T1) reflected superior value of seedling vigour index-I after 9 month of storage **(Table 6)**.

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Table 1. Effect of different treatments on Germination % of various genotypes of Buckwheat (Fagopyrum esculentum L.).

Genotypes (G)	3 Month			Mean (V)	6 Month			Mean (V)	9 Month			Mean (V)
	Treatments (T)				Treatments (T)				Treatments (T)			
	T0	T1	T2		T0	T1	T2		T0	T1	T2	
G1	96.75	98.50	97.00	97.42	80.50	88.00	91.50	86.67	77.25	82.80	78.30	79.45
G2	98.75	98.00	97.50	98.08	92.50	93.25	87.50	91.08	78.25	82.85	78.90	80.00
G3	96.00	98.25	93.25	95.83	78.25	92.00	91.50	87.25	74.00	80.08	74.20	76.09
G4	93.50	96.50	98.50	96.17	75.25	91.00	75.50	80.58	72.50	80.00	73.00	75.17
G5	91.25	97.75	97.75	95.58	77.25	84.00	84.50	81.92	73.25	79.90	74.90	76.02
Mean (T)	95.25	97.80	96.80		80.75	89.65	86.10		75.05	81.13	75.86	
	F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%	
Genotype (G)	S	0.705	1.472		S	0.738	1.542		S	0.594	1.241	
Treatments (T)	S	0.546	1.140		S	0.572	1.194		S	0.460	0.961	
(G x T)	S	1.221	2.550		S	1.279	2.670		NS	1.030	2.150	

Table 2. Effect of different treatments on Root length (cm) of various genotypes of Buckwheat (Fagopyrum esculentum L.)

Genotype (G)	3 Month			Mean (V)	6 Month			Mean (V)	9 Month			Mean (V)
	Treatments (T)				Treatments (T)				Treatments (T)			
	T0	T1	T2		T0	T1	T2		T0	T1	T2	
G1	11.25	13.80	12.40	12.48	9.10	11.60	10.95	10.55	7.95	11.12	10.00	9.69
G2	13.57	13.90	13.60	13.69	10.85	12.45	11.85	11.72	8.77	12.00	9.80	10.19
G3	7.41	14.80	11.58	11.26	7.00	12.07	8.10	9.06	6.20	11.95	7.25	8.47
G4	12.90	13.40	13.02	13.11	9.15	11.80	10.45	10.47	7.50	11.50	8.70	9.23
G5	10.07	14.70	13.00	12.59	8.10	12.74	9.05	9.96	5.70	12.12	6.75	8.19
Mean (T)	11.04	14.12	12.72		8.84	12.13	10.08		7.22	11.74	8.50	
	F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%	
Genotype (G)	S	0.417	0.871		S	0.430	0.898		S	0.358	0.748	
Treatments (T)	S	0.323	0.675		S	0.333	0.696		S	0.278	0.580	
(G x T)	S	0.723	1.509		S	0.745	1.556		S	0.621	1.296	

Table 3. Effect of different treatments on Shoot length (cm) of various genotypes of Buckwheat (Fagopyrum esculentum L.)

Genotype (G)	3 Month			Mean (V)	6 Month			Mean (V)	9 Month			Mean (V)
	Treatments (T)				Treatments (T)				Treatments (T)			
	T0	T1	T2		T0	T1	T2		T0	T1	T2	
G1	9.30	11.51	10.20	10.34	8.30	9.90	9.50	9.23	6.90	9.95	7.50	8.12
G2	9.40	11.50	10.75	10.55	8.90	10.02	9.30	9.41	7.08	9.90	7.90	8.29
G3	9.63	11.90	10.80	10.78	8.00	10.02	9.00	9.01	6.95	8.90	7.95	7.93
G4	8.75	11.42	9.90	10.02	7.90	10.00	8.90	8.93	6.80	8.70	7.80	7.77
G5	8.35	10.90	9.80	9.68	7.90	10.00	9.05	8.98	6.08	8.90	7.90	7.63
Mean (T)	9.09	11.45	10.29		8.20	9.99	9.15		6.76	9.27	7.81	
	F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%	
Variety (V)	S	0.255	0.532		S	0.188	0.393		S	0.187	0.390	
Treatments (T)	S	0.198	0.412		S	0.146	0.305		S	0.145	0.302	
(G x T)	NS	0.442	0.922		NS	0.326	0.681		S	0.324	0.676	

Table 4. Effect of different treatments on Seedling length (cm) of various genotypes of Buckwheat (Fagopyrum esculentum L.).

Genotype (G)	3 Month			Mean (V)	6 Month			Mean (V)	9 Month			Mean (V)
	Treatments (T)				Treatments (T)				Treatments (T)			
	T0	T1	T2		T0	T1	T2		T0	T1	T2	
G1	22.30	24.90	23.77	23.66	17.45	21.70	19.95	19.70	14.03	20.02	17.90	17.32
G2	22.87	25.41	23.80	24.03	18.85	22.47	20.85	20.72	15.85	21.90	17.70	18.48
G3	17.04	26.70	22.38	22.04	15.90	22.09	17.40	18.46	13.15	20.85	15.20	16.40
G4	19.60	24.70	22.20	22.17	17.00	21.60	20.00	19.53	14.30	20.20	16.50	17.00
G5	18.82	26.12	22.90	22.61	16.00	22.74	17.95	18.90	12.60	22.07	14.25	16.31
Mean (T)	20.13	25.57	23.01		17.04	22.12	19.23		13.99	21.01	16.31	
	F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%	
Genotype (G)	S	0.375	0.783		S	0.408	0.853		S	0.458	0.957	
Treatments (T)	S	0.290	0.607		S	0.316	0.660		S	0.355	0.741	
(G x T)	S	0.650	1.356		S	0.707	1.477		S	0.794	1.658	

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Table 5. Effect of different treatments on Fresh weight (g) of various genotypes of Buckwheat (Fagopyrum esculentum L.)

Genotype (G)	3 Month Treatments (T)			Mean (V)	6 Month Treatments (T)			Mean (V)	9 Month Treatments (T)			Mean (V)
	T0	T1	T2		T0	T1	T2		T0	T1	T2	
G1	0.90	0.98	0.98	0.95	0.60	0.80	0.70	0.70	0.50	0.70	0.55	0.58
G2	0.90	1.05	0.98	0.98	0.58	0.95	0.66	0.73	0.47	0.80	0.50	0.59
G3	0.50	1.00	0.55	0.68	0.35	0.90	0.40	0.55	0.30	0.68	0.35	0.44
G4	0.80	1.10	0.85	0.92	0.50	0.98	0.55	0.68	0.42	0.65	0.50	0.52
G5	0.58	0.95	0.60	0.71	0.40	0.75	0.45	0.53	0.35	0.68	0.40	0.48
Mean (T)	0.74	1.02	0.79		0.49	0.88	0.55		0.41	0.70	0.46	
	F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%	
Genotype (G)	S	0.038	0.080		S	0.072	0.150		S	0.022	0.045	
Treatments (T)	S	0.030	0.062		S	0.056	0.116		S	0.017	0.035	
(G x T)	S	0.066	0.139		NS	0.124	0.259		S	0.038	0.078	

Table 6. Effect of different treatments on Dry weight (g) of various genotypes of Buckwheat (Fagopyrum esculentum L.)

Genotype (G)	3 Month Treatments (T)			Mean (V)	6 Month Treatments (T)			Mean (V)	9 Month Treatments (T)			Mean (V)
	T0	T1	T2		T0	T1	T2		T0	T1	T2	
G1	0.055	0.088	0.060	0.068	0.038	0.078	0.040	0.052	0.022	0.058	0.026	0.035
G2	0.066	0.088	0.070	0.075	0.040	0.074	0.046	0.053	0.028	0.052	0.030	0.037
G3	0.050	0.092	0.052	0.065	0.030	0.072	0.032	0.045	0.020	0.055	0.028	0.034
G4	0.048	0.092	0.050	0.063	0.035	0.074	0.040	0.050	0.020	0.052	0.022	0.031
G5	0.045	0.090	0.050	0.062	0.038	0.068	0.040	0.049	0.018	0.065	0.020	0.034
Mean (T)	0.053	0.090	0.056		0.036	0.073	0.039		0.022	0.056	0.025	
	F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%	
Genotype (G)	S	0.004	0.008		S	0.003	0.006		S	0.002	0.004	
Treatments (T)	S	0.003	0.006		S	0.002	0.005		S	0.002	0.003	
(G x T)	NS	0.007	0.014		NS	0.005	0.010		S	0.004	0.008	

Vigour index-II

As affected for seedling vigour index-II after 9 month of storage as affected by seed treatments revealed that the treatments, T1-Neem oil @ 5ml/kg (4.57), followed by T2-Carbendazim @2g/kg (1.92) and minimum was T0-Control (untreated) (1.63). The genotype G2 registered significantly superior values (2.96) than other genotype G1 (2.78). The treatment combination (G2T1) reflected superior value of seedling vigour index-I after 9 month of storage **(Table 7)**.

Seed viability (%)

The maximum seed viability percent after 9 month of storage as affected by the treatments T1-Neem oil @ 5ml/kg (65.80), followed by T2-Carbendazim @2g/kg (54.00) and minimum was T0-Control (untreated) (46.00) which revealed the least value. The treatment combination (G2T1) reflected superior value of seedling vigour index-I after 9 month of storage [7] **(Table 8).**

Seed infection %

The minimum seed infection percent after 9 month of storage as affected by the treatments T1-Neem oil @ 5ml/kg (0.73), followed by T2-Carbendazim @2g/kg (3.08) and minimum was T0-Control (untreated) (3.22) which revealed the least value. The treatment combination (G2T1) reflected minimum value of seedling vigour index-I after 9 month of storage **(Table 9)**.

CONCLUSION

An investigation was carried out with an objective of studying the influence of different seed treatments on seed quality of five genotypes IC-18040, IC-18289, IC-18757, IC-18881 and IC-18889 of buckwheat. Two treatments viz., Neem (T1), and Carbendazim (T3) with the untreated control (T0) stored for nine months. The seed quality parameters like germination percentage, root length, shoot length, seedling length, seedling fresh weight, seedling dry weight, seedling vigour index I, seedling vigour index II seed viability and seed health test were determined.

Among the genotypes, the (G2) IC- 18289 recorded higher germination percentage, root length, shoot length, seedling length, seedling fresh weight, seedling dry weight, seedling vigour index, seedling vigour index II, seed viability under ambient condition throughout the storage period of 9 months,

Among the seed treatments neem (T1) followed by carbendazim (T2), recorded higher seed quality parameters throughout the storage period in all genotypes.

Table 7. Effect of different treatments on Vigour index-I of various genotypes of Buckwheat (Fagopyrum esculentum L.)

Genotype (G)	3 Month			Mean (V)	6 Month			Mean (V)	9 Month			Mean (V)
	Treatments (T)				Treatments (T)				Treatments (T)			
	T0	T1	T2		T0	T1	T2		T0	T1	T2	
G1	2034.88	2433.98	2323.52	2261.42	1404.73	1909.60	1825.43	1707.40	1083.82	1657.66	1401.57	1376.07
G2	2212.67	2502.89	2308.60	2341.00	1456.16	1887.48	1761.83	1697.38	1240.26	1814.42	1396.53	1478.40
G3	1635.84	2623.28	2086.94	2112.09	1244.18	2032.28	1592.10	1610.64	973.10	1669.67	1127.84	1247.88
G4	1832.60	2383.55	2186.70	2132.09	1279.25	1965.60	1510.00	1573.73	1036.75	1616.00	1204.50	1277.89
G5	1858.48	2559.76	2232.75	2217.59	1480.00	2120.51	1570.63	1721.41	922.95	1763.39	1067.33	1239.89
Mean (T)	1914.89	2500.69	2227.70		1372.86	1983.09	1652.00		1051.38	1704.23	1239.55	
	F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%	
Genotype (G)	S	1.705	3.560		S	2.038	4.256		S	2.205	4.604	
Treatments (T)	S	1.321	2.758		S	1.579	3.297		S	1.708	3.566	
(G x T)	S	2.953	6.166		S	3.530	7.372		S	3.819	7.974	

Table 8. Effect of different treatments on Vigour index-II of various genotypes of Buckwheat (Fagopyrum esculentum L.)

Genotype (G)	3 Month			Mean (V)	6 Month			Mean (V)	9 Month			Mean (V)
	Treatments (T)				Treatments (T)				Treatments (T)			
	T0	T1	T2		T0	T1	T2		T0	T1	T2	
G1	5.02	8.60	5.87	6.50	3.06	6.86	3.66	4.51	1.70	4.80	2.04	2.78
G2	6.39	8.67	6.79	7.31	3.09	6.22	3.89	4.34	2.19	4.31	2.37	2.96
G3	4.80	9.04	4.85	6.23	2.35	6.62	2.93	3.93	1.48	4.40	2.08	2.59
G4	4.49	8.88	4.93	6.06	2.63	6.73	3.02	4.03	1.45	4.16	1.61	2.33
G5	4.44	8.82	4.88	6.08	3.52	6.34	3.50	4.46	1.32	5.19	1.50	2.58
Mean (T)	5.03	8.80	5.46		2.93	6.56	3.40		1.63	4.57	1.92	
	F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%	
Genotype (G)	S	0.208	0.435		S	0.220	0.459		S	0.025	0.052	
Treatments (T)	S	0.161	0.337		S	0.170	0.356		S	0.019	0.040	
(G x T)	S	0.361	0.753		NS	0.381	0.796		S	0.043	0.090	

Table 9. Effect of different treatments on Seed infection % of various genotypes of Buckwheat (Fagopyrum esculentum L.)

Genotype (G)	3 Month			Mean (V)	6 Month			Mean (V)	9 Month			Mean (V)
	Treatments (T)				Treatments (T)				Treatments (T)			
	T0	T1	T2		T0	T1	T2		T0	T1	T2	
G1	0.96	0.22	0.90	0.69	2.41	0.46	2.00	1.62	3.28	0.64	3.14	2.35
G2	0.98	0.20	0.92	0.70	2.50	0.42	2.10	1.67	3.19	0.68	3.02	2.30
G3	0.95	0.26	0.98	0.73	2.40	0.48	2.18	1.69	3.25	0.70	3.14	2.36
G4	0.90	0.30	0.92	0.71	2.38	0.52	2.12	1.67	3.16	0.78	3.10	2.35
G5	0.96	0.34	0.90	0.73	2.30	0.58	2.02	1.63	3.22	0.84	3.00	2.35
Mean (T)	0.95	0.26	0.92		2.40	0.49	2.08		3.22	0.73	3.08	
	F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%		F-test	S. Em. (±)	C.D. at 5%	
Genotype (G)	S	0.004	0.009		S	0.006	0.014		S	0.007	0.015	
Treatments (T)	S	0.003	0.007		S	0.005	0.011		S	0.005	0.011	
(G x T)	S	0.008	0.016		S	0.011	0.024		S	0.012	0.025	

In the both seed treatments the seeds treated with neem were found to be recorded higher for germination as well as for all the other growth parameters and quality parameters too.

The minimum seed infection was found in (G2) followed by (G1) after storage of 9 months as affected by the treatments T1 - Neem oil 5ml/kg (0.730),followed by T2 - Carbendazim @2gm/kg (3.08) and T0 – control (3.22)

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