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Storage of Pre-treated Ash Gourd Seeds

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ABSTRACT Pre-treated seeds are better in performance compared to untreated seeds. Though there was a gradual decrease in quality parameters like, percentage germination, speed of germination and vigour index. Seeds pre-treated with growth regulators can be safely stored for a period up to five months. This clearly indicates that pre-treated seeds can be directly supplied to farmers for immediate use. Seeds treated with GA_3 25 ppm and KNO_3 are not safe for storage.

Key words: Storage potential, pre-treatment, Benincasa hispida, seed invigoration

Freshly harvested ash gourd (Benincasa hispida Thunb.) seeds generally exhibit dormancy [1]. Such fresh seeds cannot be used by the farmers of Kerala, until four months as they do not show the minimum germination percentage (60 %). Similarly, the seed production centres cannot sell the seeds until four months, even if there is high demand from farmers. Breakdown of dormancy in natural course is gradual during storage. Invigoration, as any pre-sowing management practices, adopted to break seed dormancy, improve seed quality and to boost productivity of crops. Seed dormancy in ash gourd is endogenous in nature and can be broken by giving an after ripening period for two months followed by treating seeds with growth regulators [2]. The farmers cannot be advised to use the seeds after growth regulator treatment. Unless the storage potential of invigorated seeds is studied. Storage of GA and NAA treated seeds of okra variety Pusa Sawani for 30 days did not show any deleterious effect on growth and yield [3]. It was reported that tomato seed invigorated with 1 per cent KNO_3 showed enhanced performance even after storage [4]. If the treated seeds could be stored without any deleterious effect, such treated seeds can be directly supplied to farmers for cultivation. Hence an experiment was conducted to study the storage potential of pre-treated ash gourd seeds.

MATERIALS AND METHODS

The experiment was carried out at the Department of Olericulture, College of Horticulture, Vellanikkara under Kerala Agricultural University. Popular ash gourd variety of Kerala, KAU Local, was grown for seed production as a rainy season crop during 2004, adopting the recommended cultural operations [5]. Fully matured, uniform fruits were harvested 120 days later from sowing, seeds extracted and cleaned manually in the month of October. The shade dried seeds were given an after ripening period for two months by storing them in moisture proof 700 gauge polythene cover and treated with the following chemicals:

T_1- GA_3 (25 ppm) for 24 hours

T_2- GA_3 (50 ppm) for 24 hours

T_3-GA_3 (100 ppm) for 12 hours

T_4- NAA (25 ppm) for 24 hours

T_5- NAA (50 ppm) for 24 hours

T_6- 1 per cent KNO_3 for 12 hours

T_7- Control (untreated seeds).

After treatment, the seeds were dried to 8 per cent moisture and stored in 700-gauge polythene

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cover at ordinary room temperature. Seed samples were drawn from the cover and evaluated at monthly intervals under laboratory conditions, starting from the month of storage up to six months. The experiment was laid out in completely randomized design (CRD) with 7 treatments in 3 replications.

The germination percentage was recorded in 3 replications of 50 seeds each in B.P. at 25°C and 96 per cent RH after 10 days. From the samples sown for seed evaluation, number of seedlings emerged was recorded daily until the tenth day of the emergence of first seedling. Cotyledons slipping out of the seed coat was taken as the criteria for emergence of seedling. From the mean germination percentage recorded on each counting date, speed of germination was calculated using the following formula [6]:

$$\text{Speed of germination} = \frac{X1}{Y1} + \frac{X2-X1}{Y2} + \ldots + \frac{Xn - X(n-1)}{Yn}$$

Where, Xn = % germination on n^{th} day

Yn = number of days from seed sowing

Five normal seedlings were carefully evaluated at random from the test sample, at the end of the germination test period, on the 10^{th} day, measured the root and shoot length, and the mean was computed. Vigour index was calculated as germination per cent x mean length of root and shoot and expressed as whole number [7].

Electrical conductivity of seed leachate was estimated [8] using a digital conductivity meter (Type CM 180) with cell constant of electrode one and expressed as mmhos/cm. Data were statistically processed by analysis of variance for completely randomised design [9].

RESULTS AND DISCUSSION

The pre-treated seeds showed significant difference in germination percentage, speed of germination, vigour index I and electrical conductivity from untreated seeds, during storage.

Germination per cent

The overall mean germination percentage of pre-treated seeds within each month was highly significant except at 2 and 6 months from storage (MFS) (Table 1). At 1 MFS, NAA 50 ppm treated seeds recorded the maximum (94.67%) germination which was on par with all other treatments except untreated seeds, which showed a germination of 66.67 per cent. At 3 MFS, seeds treated with GA_3 100 ppm and KNO_3 1 per cent showed the highest germination (84.00%), which was on par with untreated seeds (77.33%). At 4 MFS, the maximum germination was recorded by GA_3 100 ppm (77.33%), which was on par with NAA 25 ppm (72.00%), NAA 50 ppm (68.00%) and seeds treated with GA_3 25 ppm (66.67%). At 5 MFS, seeds treated with NAA 25 ppm had the maximum germination (76.00%), which was on par with all other treatments except those treated with GA_3 25 ppm (50.67%). All the treated seeds showed maximum germination during 1 MFS (Table 1). The seeds treated with GA_3 50 ppm, GA_3 100 ppm and NAA 25 ppm recorded more than 60 per cent germination, which is the minimum requirement, during all sampling periods. Seeds treated with NAA (50 ppm), KNO_3 (1%) and untreated seeds recorded more than 60 per cent germination up to 5 MFS. Seeds treated with GA_3 100 ppm, NAA 25 ppm and KNO_3 (1%) recorded higher germination compared to untreated seeds during all the months.

Considering the effect of seed treatment when averaged over months, seeds treated with GA_3 100 ppm recorded maximum germination (79.33%), which was on par with seeds treated with NAA 25 ppm (76.44%) (Table 1). Seeds treated with GA_3 25 ppm exhibited the minimum germination (64.89%). All the treatments except GA_3 25 ppm showed enhanced germination, when compared with untreated seeds. Thus the pre-treated seeds can be stored for a period of five months without loss of viability. Beneficial effects of different seed treatments on storage of seeds were reported using different chemicals [10], in mung bean using iodine and by [11], in onion, pepper and parsley by using butylated hydroxytoluene.

Speed of germination

The speed of germination of different treatments within each month was found to be significant (Table 2). The seed treated with NAA 25 ppm was found to have maximum speed of germination during 1 MFS and 2 MFS (16.31 and 15.21,

Table 1. Effect of storage on germination per cent of invigorated seeds

Treatment	Germination (%) at different months from storage						
	1	2	3	4	5	6	Mean
GA_3 (25 ppm) for 24 hours	92.00 (9.61)	76.00 (8.74)	54.67 (7.43)	66.67 (8.19)	50.67 (7.15)	49.33 (6.90)	64.89 (8.00)
GA_3 (50 ppm) for 24 hours	92.00 (9.62)	81.33 (9.04)	62.67 (7.95)	65.33 (8.11)	64.00 (8.03)	66.67 (8.18)	72.00 (8.49)
GA_3 (100ppm) for 12 hours	88.00 (9.41)	81.33 (9.85)	84.00 (9.18)	77.33 (8.81)	74.67 (8.67)	70.67 (8.43)	79.33 (8.92)
NAA (25 ppm) for 24 hours	90.67 (9.55)	82.67 (9.09)	70.67 (8.43)	72.00 (8.51)	76.00 (8.74)	66.67 (8.19)	76.44 (8.75)
NAA(50 ppm) for 24 hours	94.67 (9.76)	77.33 (8.82)	64.00 (8.02)	68.00 (8.27)	65.33 (8.10)	56.00 (7.48)	70.89 (8.41)
1% KNO_3 for 12 hours	90.67 (9.54)	84.00 (9.20)	84.00 (9.18)	65.33 (8.11)	68.00 (8.27)	49.33 (7.05)	73.56 (8.56)
Control (untreated seeds)	66.67 (8.19)	82.67 (9.12)	77.33 (8.82)	64.00 (8.03)	73.33 (8.59)	56.00 (7.52)	70.00 (8.33)
Mean	87.81 (9.38)	80.76 (9.00)	71.05 (8.43)	68.38 (8.29)	67.43 (8.22)	59.26 (7.68)	

C.D. for
months: 0.39; for treatments: 0.28; treatment within months: 0.69; (Figures in parenthesis are arc sine transformed values)

respectively). Though having maximum value, these treatments were on par with all other treatments except untreated seeds, which showed a minimum values of 12.15 and 12.82 during 1 and 2 MFS. At 3 MFS seeds treated with KNO_3 (1%) had the highest value (18.01), which was on par with, untreated seeds (16.04) and seeds treated with GA_3 100 ppm (15.91). The speed of germination in untreated seeds was minimum (11.99) during 4 MFS. All other treatments showed superior performance. At 5 MFS and 6 MFS, $GA_3$100 ppm seed

Table 2. Effect of storage on speed of germination of invigorated seeds

Treatment	Speed of germination (%) at different months from storage						
	1	2	3	4	5	6	Mean
GA_3 (25 ppm) for24 hours	15.92	13.30	11.05	12.94	10.69	9.75	12.28
GA_3 (50 ppm) for 24 hours	15.31	14.25	12.36	14.64	11.85	11.36	13.29
GA_3 (100 ppm) for 12 hours	15.51	14.75	15.91	14.81	14.20	12.16	14.45
NAA (25 ppm) for 24 hours	16.31	15.21	14.53	13.97	13.38	10.81	14.04
NAA (50 ppm) for 24 hours	15.50	13.13	13.65	13.69	12.09	10.97	13.17
1% KNO_3 for 12 hours	15.88	14.77	18.01	13.06	13.19	8.31	13.87
Control (untreated seeds)	12.15	12.82	16.04	11.99	13.44	10.16	12 77
Mean	15.23	14.03	14.51	13.50	12.69	10.50	

C.D. for
months: 1.10; treatments: 0.93; treatment within months: 2.23

treated had maximum speed of germination (14.20 and 12.16, respectively). The overall mean speed of germination during different months showed significant difference (Table 2). Seeds treated with GA_3 100 ppm, NAA 25 ppm and KNO_3 (1%) showed higher speed of germination during all the sampling periods from 1 to 6 MFS. Seeds treated with GA_3 and NAA each at 50 ppm recorded higher values during all the months, except at 3 MFS. But GA_3 25 ppm treated seeds showed lower speed of germination at 3 and 5 months from storage, compared to untreated seeds.

The overall mean speed of germination was significantly different for different treatments when averaged over months (Table 2). The highest speed of germination was recorded with GA_3 100 ppm (14.45), which was on par with seeds treated with NAA 25 ppm (14.04) and KNO_3 1% (13.87). Seeds treated with GA_3 50 ppm (13.29), NAA 50 ppm (13.17) and untreated seeds (12.77) were on par. Minimum speed of germination was shown by GA_3 25 ppm treated seeds (12.28).

Vigour index I

Seeds treated with GA_3 50 ppm recorded maximum (1720) vigour index I during 1 MFS, which was on par with all other treatments except control (1138) (Table 3). At 2 MFS seeds treated with GA_3 100 ppm recorded maximum vigour index I (1695), which was on par with GA_3 50 ppm (1637), GA_3 25 ppm (1407) and control (1399). At 3 MFS, KNO_3 1% (1889) was superior in performance and the least value (857) of vigour index I was recorded by GA_3 25 ppm. The NAA 25 ppm treated seeds showed the highest value of 1362 and 1273 at 4 and 5 MFS, respectively. At 6 MFS, GA_3 100 ppm treated seeds having highest value (1246) was on par with seeds treated with NAA 25 ppm (1181) GA_3 50 ppm (1103) and NAA 50 ppm (1037). Untreated seeds recorded the minimum value (770) at 6 MFS. All the treated seeds except those treated with GA_3 25 ppm exhibited superior or similar vigour index I compared to untreated seeds (Table 3) during all the periods of experimentation. Considering the treatments, averaged over months, seeds treated with GA_3 100 ppm had maximum vigour index I (1426), which was on par with NAA 25 ppm (1320), GA_3 50 ppm (1318) and KNO_3 1% (1314) (Table 3). Minimum vigour index I was recorded by GA_3 25 ppm (1061) that was on par with untreated seeds (1143).

Rate of germination and seedling growth was reported [12] as the most consistent and sensitive measures of the progress of deterioration in corn. In the present study also there was an overall decrease in the germination percentage, speed of germination and vigour index I during storage. Similar results were reported earlier in ash gourd during storage [13].

Table 3. Effect of storage on vigour index I of invigorated seeds

Treatment	Vigour index I at different months from storage						
	1	2	3	4	5	6	Mean
GA_3 (25 ppm) for 24 hours	1416	1407	857	1149	753	793	1061
GA_3 (50 ppm) for 24 hours	1720	1637	1173	1262	1011	1103	1318
GA_3 (100 ppm) for 12 hours	1466	1695	1644	1301	1204	1246	1426
NAA (25 ppm) for 24 hours	1581	1292	1233	1362	1273	1181	1320
NAA (50 ppm) for 24 hours	1713	1155	1068	1058	1132	1037	1194
1% KNO_3 for 12 hours	1497	1378	1889	1151	1193	778	1314
Control (untreated seeds)	1138	1399	1185	1169	1194	770	1143
Mean	1505	1423	1293	1207	1107	987	

C.D. for
months: 96.41; treatment: 125.35; treatment within months: 307.09

Electrical conductivity of seed leachate

Electrical conductivity from seed leachate showed significant difference between different treatments, months and different treatments within each month. Maximum electrical conductivity was recorded by KNO_3 1%, and NAA 50 ppm remained lowest throughout the period of storage (Table 4). All the treated seeds, except those with KNO_3 1% recorded a low electrical conductivity value compared to untreated seeds, during all periods of studied seed storage.

It was reported that electrolyte leakage is not a suitable test for seed quality in muskmelon [14]. When a seed is said to be deteriorated in storage, it should have low germination per cent, vigour and a high electrical conductivity. But in the present study all the seed quality parameters except electrical conductivity, showed a gradual decrease (Tables 1&3), whereas, in electrical conductivity, there was no such gradual increase (Table 4). No correlation could be obtained with seed leachate electrical conductivity and seed quality. So it cannot be taken as a suitable test for seed quality in ash gourd. This was in accordance with the earlier reports of [13] in ash gourd.

Considering the effect of seed pre-treatment, when averaged over months, all the growth regulator treatments except GA_3 25 ppm showed enhanced germination percentage, when compared with untreated seeds. Seeds treated with GA_3 25 ppm had lower germination percentage, speed of germination and vigour index I compared to untreated seeds. Thus the treated seeds (except GA_3 25 ppm), can be stored for a period of five months without loss of viability. Though no reference related to the effect of seed treatment using growth regulators on storage of seeds has been reported, seed treatment with other chemicals for maintaining viability and vigour was reported by many workers like, in cucumber and squash [15], in bottle gourd [16] and in gourds [17]. Electrical conductivity of seeds treated with KNO_3 was high and all other seed quality parameters were found to be low during all the months of study. This clearly indicates the seeds treated with KNO_3 1% and GA_3 25 ppm cannot be stored. Leaching of toxic metabolites, germination advancement, anti-pathogenic effect, repair of biochemical lesions, quenching and counteraction of free radicals, prevention of lipid peroxidation, etc. could be the probable reasons to decrease the rate of deterioration of invigorated seeds during storage [18]. Thus by the present study, it is proved that the effect of treatments is retained in seeds until five months of storage and such pre-treated seeds, having superior quality, can be supplied to the farmers for immediate sowing.

Table 4. Effect of storage on electrical conductivity of invigorated seeds

Treatment	Electrical conductivity (mmhos/cm) at different months from storage						
	1	2	3	4	5	6	Mean
GA_3 (25 ppm) for 24 hours	42.65	40.55	41.70	44.10	46.40	46.15	43.59
GA_3 (50 ppm) for 24 hours	41.55	43.20	49.45	51.85	50.65	50.90	47.93
GA_3 (100 ppm) for 12 hours	41.25	40.15	42.55	43.00	42.50	43.50	42.15
NAA (25 ppm) for 24 hours	46.10	44.36	37.80	45.25	46.75	48.15	44.72
NAA (50 ppm) for 24 hours	31.90	36.75	33.80	35.60	40.40	40.65	36.52
1% KNO_3 for 12 hours	78.05	70.90	72.00	68.90	72.05	70.55	72.08
Control (untreated seeds)	63.90	60.15	57.65	59.00	56.40	57.90	59.17
Mean	49.34	48.00	47.85	49.67	50.74	51.11	
C.D. for							

months: 1.31; treatments: 1.30; treatments within months: 3.46

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