Seed Research, Vol. 36(1): 37-41, 2008

Effect of Priming on Seed Viability and Vigour in *Cashew* (*Anacardium occidentale* L.)

C. MINI AND JOSE MATHEW

Cashew Research Station, Kerala Agricultural University, Madakkathara 680 651, Thrissur
minichandran123@rediffmail.com

ABSTRACT Study conducted at Cashew Research Station, Madakkathara under Kerala Agricultural University, India during 2003 and 2004 to explore the possibility of extending the storage life of cashew seeds by priming with various chemicals and growth regulators. It was found that priming of cashew seeds results in extension of seed viability. Untreated seeds and seeds soaked in water for 12 hours were always inferior and exhibited poor germination percentage and vigour index. Cashew seeds could be stored up to 13 months with more than 70 per cent germination and up to 17 months with 60 per cent germination by priming after one month of storage with thio urea 5000 ppm for 24 hours at ambient temperature.

Key words: Priming, seed viability, seedling vigour, cashew

Extended viability of cashew seeds even beyond one year with the retention of the ability to produce vigorous rootstocks is a prerequisite for commercial production of cashew (*Anacardium occidentale* L.) grafts. However viability of cashew seeds was found to decrease progressively during storage and most often the seeds of a particular year cannot be used during the succeeding year. A study conducted at Kottarakkara [1] in Kerala to determine the period of viability of seed nut revealed that there was progressive decrease in percentage germination as the period of storage increased and the germination was less than 50 per cent after 6th month even under metallic bin storage. Another study [2] revealed that the germination percentage was highest during the first month after harvest and the viability was lost completely only after 12 months of storage at room temperature. A study was conducted in this context at Cashew Research Station, Madakkathara under Kerala Agricultural University, India during 2003 and 2004 to explore the possibility of extending the storage life of cashew seeds by priming with different chemicals and growth regulators.

MATERIALS AND METHODS

Seed nuts of the popular early cashew variety of Kerala, 'Madakkathara-1, which is also a preferred root stock variety, released from Kerala Agricultural University were used for the study. The seeds were collected during the harvesting season of January, dried to 8 per cent moisture and stored in polythene bags of 300-gauge thickness for one month. After one month of storage the seeds were taken out and soaked using various chemicals separately for 24 hours.

T_1 - GA_3 200 ppm

T_2 - GA_3 400 ppm

T_3 - Thio urea 5000 ppm

T_4 - Thio urea 10000 ppm

T_5 - KH_2PO_4 2500 ppm

T_6 - KH_2PO_4 5000 ppm

T_7 - Kinetin 20 ppm

T_8 - Kinetin 40 ppm

Received November 2007 Revised March 2008 Accepted May 2008

T_9 - Water soaking

T_{10} - NaCl 10 per cent

T_{11} - NaH_2PO_4 500 ppm

T_{12} - NaH_2PO_4 1000 ppm

T_{13} - Water soaking for 12 hours

T_{14} - Control (No treatment)

The primed seeds were dried back to original weight and stored again in polythene bags at ambient room temperature for 19 months along with untreated seeds. The experimental area was located between 10° 15′ and 10° 35′ latitudes and 75° 15′ and 76° 25′ longitudes, at an altitude of 30m above mean sea level and comes under warm humid tropical climate. The maximum and minimum temperatures were 36.1 and 25.1°C, respectively, with 68.59 per cent relative humidity during the field study.

Sample seeds were drawn from the seed lot at bi-monthly intervals and the data on germination and seedling vigour were evaluated under ambient conditions, starting from the first month of storage up to two years. The experiment was laid out in completely randomised design (CRD) with 14 treatments in two replications.

Seeds were sown in polythene bags filled with mixture of soil : sand : FYM in 1:1:1 ratio. Germination per cent was worked out [3] based on normal seedlings at 28 days after sowing. At the end of the germination test period, on the 28th day, five normal seedlings were carefully uprooted at random from the test sample, measured the root and shoot length and the mean was computed. The length between collar region and tip of the root was measured as root length and the length between collar region and tip of the leaf was measured as shoot length and the mean value was expressed in centimeter. Vigour index-I was calculated as germination per cent x mean length of root and shoot and expressed as whole number [4]. Germination per cent values were transformed to arc sine values and vigour index to square root values for statistical security and monthly data on seed quality parameters were analyzed by standard MSTAT-C package in completely randomised design [5] and the treatments were ranked according to their mean performance.

RESULTS AND DISCUSSION

Significant differences were observed for germination percentage and vigour index of seedlings indicating the important role of priming for maintaining viability and vigour of cashew seeds (Tables 1 & 2).

Germination

During one month after storage, seeds were primed with GA_3 200 ppm, 400 ppm and thiourea 500 ppm recorded the highest germination per cent (99). But these treatments were on par with all other treatments except KH_2PO_4 5000 ppm, kinetin 20 ppm and 12 hour water soaking. All the treatments were on par at three months after storage.

After five months of storage, seeds primed with 5000 ppm thiourea recorded the maximum (96.8) germination percentage and seeds treated with NaH_2PO_4 500 ppm, recorded the lowest (89.3). After seven months of storage, all the treatments were on par. From nine months of storage onwards, seeds, primed with thiourea 5000 ppm always recorded the highest germination showing a gradual decrease from 91.3 per cent after nine months to 26 per cent after 19 months. Seeds soaked in water for 12 hours recorded the lowest germination of 74.5 after 9 months of storage, whereas the untreated seeds recorded the lowest germination percentage from 10 to 19 months of storage. Though seeds primed with GA_3 400 ppm and thiourea 10000 ppm were having high germination percentage from 1st to 15th month after storage, but from 15th month of storage onwards, these seeds recorded poor germination percentage. Seeds primed with GA_3 200 ppm were superior till 13 months of storage only. Even after 17 months of storage, seeds primed with 5000 ppm thiourea had 60 per cent germination, but these seeds had only 26 per cent germination after 19 months of storage. Untreated seeds had 98.5 per cent germination at one month, gradually reduced to 57.8 per cent by 11th month, less than 10 per cent from 15 month and it showed only one per cent germination at 19 months after storage.

Vigour index

Seeds primed with 5000 ppm thiourea exhibited

Table 1. Germination percentage as influenced by various priming treatments under ambient conditions of storage

Treatments	Months after storage									
	1	3	5	7	9	11	13	15	17	19
GA_3 200	99 (1.47)	97 (1.41)	95 (1.35)	86.8 (1.22)	85 (1.19)	83 (1.16)	65.5 (0.94)	38 (0.66)	14.8 (0.39)	2.5 (0.15)
GA_3 400 ppm	99 (1.47)	97 (1.41)	95.8 (1.36)	90.5 (1.26)	89 (1.23)	87.5 (1.21)	74.5 (1.04)	61.5 (0.9)	31.8 (0.59)	20 (0.44)
Thio Urea 5000 ppm	99 (1.47)	98 (1.44)	96.8 (1.39)	92.8 (1.31)	91.3 (1.28)	89.8 (1.25)	81.3 (1.12)	74.5 (1.04)	60 (0.88)	26 (0.52)
Thio Urea 10000 ppm	97.8 (1.42)	95.3 (1.36)	92.8 (1.3)	91.3 (1.27)	88.8 (1.23)	86 (1.19)	70 (1.0)	54.5 (0.84)	21 (0.47)	9.3 (0.31)
KH_2PO_4 2500ppm	98.8 (1.46)	97.3 (1.41)	93.8 (1.32)	88.5 (1.23)	87.3 (1.21)	79 (1.11)	47 (0.76)	35.5 (0.64)	22.3 (0.48)	9.3 (0.31)
KH_2PO_4 5000 ppm	95.3 (1.36)	93. 5 (1.32)	93 (1.30)	88.5 (1.23)	86.3 (1.2)	82 (1.14)	61 (0.9)	34 (0.61)	16.3 (0.41)	10.5 (0.28)
Kinetin 20 ppm	96.3 (1.39)	95.8 (1.37)	94 (1.33)	90.3 (1.27)	86 (1.2)	80.5 (1.12)	57 (0.86)	33 (0.61)	15.5 (0.34)	3 (0.16)
Kinetin 40 ppm	97.8 (1.43)	95.8 (1.37)	93.8 (1.32)	89.8 (1.25)	88.3 (1.23)	86.5 (1.2)	45 (0.74)	24 (0.51)	13.5 (0.37)	2 (0.14)
Water	96.8 (1.41)	95.8 (1.37)	92.3 (1.29)	87.8 (1.22)	85 (1.18)	79 (1.10)	51.5 (0.80)	19 (0.45)	5.3 (0.22)	2 (0.14)
10% Salt	97.8 (1.43)	95.5 (1.37)	94.3 (1.33)	93 (1.31)	87.5 (1.21)	82 (1.14)	53 (0.82)	20 (0.46)	11.0 (0.33)	2.3 (0.14)
NaH_2PO_4 500 ppm	98.8 (1.46)	96.3 (1.39)	89.3 (1.24)	91 (1.27)	83 (1.15)	84 (1.16)	51.5 (0.81)	33 (0.61)	29.8 (0.57)	4.3 (0.2)
NaH_2PO_4 1000 ppm	97.5 (1.42)	96.0 (1.37)	94.3 (1.33)	93 (1.31)	85 (1.18)	78 (1.09)	45 (0.73)	14.5 (0.39)	9.8 (0.32)	4.8 (0.2)
12 hr water soaking	96.8 (1.39)	94.8 (1.34)	90 (1.26)	90 (1.25)	74.5 (1.05)	66 (0.87)	19.8 (0.46)	8.0 (0.28)	5.0 (0.2)	1.0 (0.1)
Control (no treatment)	98.5 (1.45)	93 (1.31)	89.8 (1.25)	82 (1.14)	79.8 (1.11)	57.8 (0.85)	12.0 (0.35)	7.3 (0.27)	4.5 (0.19)	1.0 (0.1)
CD	0.067	NS	0.074	NS	0.086	0.13	0.12	0.109	0.166	0.068

Values shown in parenthesis are arc sine transformed values

maximum vigour throughout the period of study and it was 1513 after one month of storage, which was on par with seeds primed with GA_3 200 ppm. The untreated seeds had minimum vigour (840) and they were on par with all primed seeds except those treated with 10000 ppm thiourea. As against the case of germination per cent, none of the seeds, except those primed with 5000 ppm thiourea, exhibited a continuous superior performance through out the storage period. Seeds primed with GA_3 200 ppm produced seedlings with higher vigour index after 1st, 5th, 9th and 11th months. Though seeds primed with 10000 ppm thiourea were not superior during the initial seven months, they produced seedlings of high vigour index from 9 to 17th month of storage. The untreated seeds and the seeds soaked in water for 12 hours were always poor resulting in lowest vigour index.

Priming cashew seeds generally resulted in extension of storage life. Considering the germination of seeds and vigour index of seedlings, primed seeds were always superior to untreated seeds and seeds soaked in water for 12 hours. 5000 ppm thiourea can be recommended for improving germination per cent of seeds and vigour of seedlings. In one study [6], it was observed that germination percentage of cashew

Table 2. Vigour index as influenced by various priming treatments under ambient conditions of storage

Treatments	Months after storage									
	1	3	5	7	9	11	13	15	17	19
GA_3 200	1321 (35.8)	1158 (33.6)	1116 (33.1)	910 (29.9)	745 (27.2)	641 (25.3)	147 (11.6)	129 (10.7)	53 (6.6)	15 (3.1)
GA_3 400 ppm	1037 (31.9)	990 (31.2)	967 (30.9)	894 (29.8)	861 (29.3)	760 (27.5)	453 (21.3)	348 (18.1)	213 (13.7)	145 (11.4)
Thio Urea 5000 ppm	1513 (38.4)	1433 (37.4)	1248 (35.1)	1140 (33.5)	890 (29.7)	756 (27.4)	602 (24.5)	496 (22)	326 (17.7)	182 (12.9)
Thio Urea 10000 ppm	1233 (34.6)	873 (29.5)	847 (29)	806 (28.3)	787 (28)	699 (26.4)	428 (20.2)	303 (17)	245 (15)	68 (8.2)
KH_2PO_4 2500 ppm	951 (30.7)	883 (29.6)	794 (28.1)	779 (27.8)	740 (27.1)	689 (26.2)	364 (18.5)	359 (18.6)	263 (15.3)	48 (6.8)
KH_3PO_4 5000 ppm	905 (30)	844 (28.9)	805 (28.3)	800 (28.2)	751 (27.3)	629 (24.9)	259 (16.1)	218 (14.7)	76 (8.1)	48 (5.3)
Kinetin 20 ppm	998 (31.1)	942 (30.4)	880 (29.5)	840 (28.9)	652 (25.4)	531 (23)	482 (21.7)	213 (14.4)	100 (9.5)	21 (3.5)
Kinetin 40 ppm	984 (31.1)	853 (29.1)	812 (28.4)	760 (27.5)	743 (27.2)	619 (24.8)	350 (18.5)	175 (12.9)	81 (8.8)	13 (2.9)
Water	986 (31.3)	910 (30.0)	860 (29.2)	790 (28)	778 (27.8)	517 (22.7)	312 (17.5)	109 (10.3)	62 (7.6)	12 (2.8)
10% NaCl	958 (30.8)	839 (28.9)	740 (27.2)	720 (26.7)	665 (25.7)	566 (23.8)	311 (17.3)	117 (10.5)	94 (9.6)	17 (3.3)
NaH_2PO_4 500 ppm	891 (29.8)	854 (29.1)	757 (27.5)	749 (27.3)	734 (27.1)	612 (24.7)	204 (14)	192 (13.8)	155 (12.2)	34 (5.2)
NaH_2PO_4 1000 ppm	888 (29.6)	872 (29.4)	784 (27.9)	734 (26.9)	730 (26.9)	484 (21.1)	278 (16.3)	147 (11.9)	82 (9.0)	23 (4.4)
12 hr water soaking	865 (29.4)	745 (27.0)	691 (26.3)	659 (25.6)	544 (23.1)	406 (20.1)	118 (10.6)	68 (8.2)	16 (3.1)	0 (0.7)
Control (no treatment)	840 (28.9)	735 (27.3)	721 (26.8)	655 (25.5)	603 (24.5)	237 (14.3)	78 (8.7)	54 (7.1)	14 (3.0)	0 (0.7)
CD	3.35	2.55	2.17	3.01	2.64	4.22	5.08	4.69	3.61	2.15

Values shown in parenthesis are square root transformed values

seeds was improved by KH_2PO_4 5000 ppm treatment in darkness and storage at 10°C. In the present study, KH_2PO_4 5000 ppm was not found to be effective, as the treatment and storage conditions were different.

When the selected treatments and untreated seeds were compared (Figs. 1 & 2), it was noticed that priming seeds with 5000 ppm thiourea maintains 60 per cent germination and vigour index value of 326 after 17 months of storage and the corresponding values were 26 and 186, respectively after 19 months of storage. Though the primed and untreated seeds exhibited almost similar germination during the initial month of storage, the untreated seeds showed only 12 per cent germination after 13 months of storage (Fig. 1). Considering the vigour index, seeds primed with 5000 ppm thiourea were always superior to untreated seeds. Thiourea stimulates germination via initial cellular expansion apart from its action in breaking dormancy of seeds [7]. The study conclusively proved that storage life of cashew seeds could be extended to six months by priming the seeds after one month of storage with 5000 ppm thiourea for 24 hours at ambient temperature.

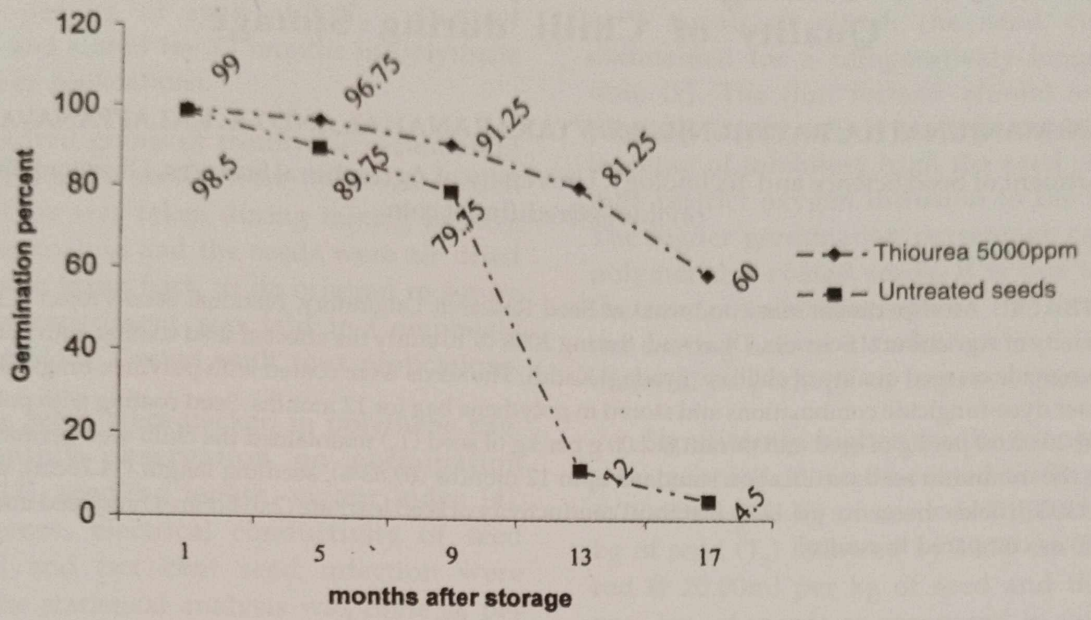

Fig. 1. Germination percentage at different periods of storage

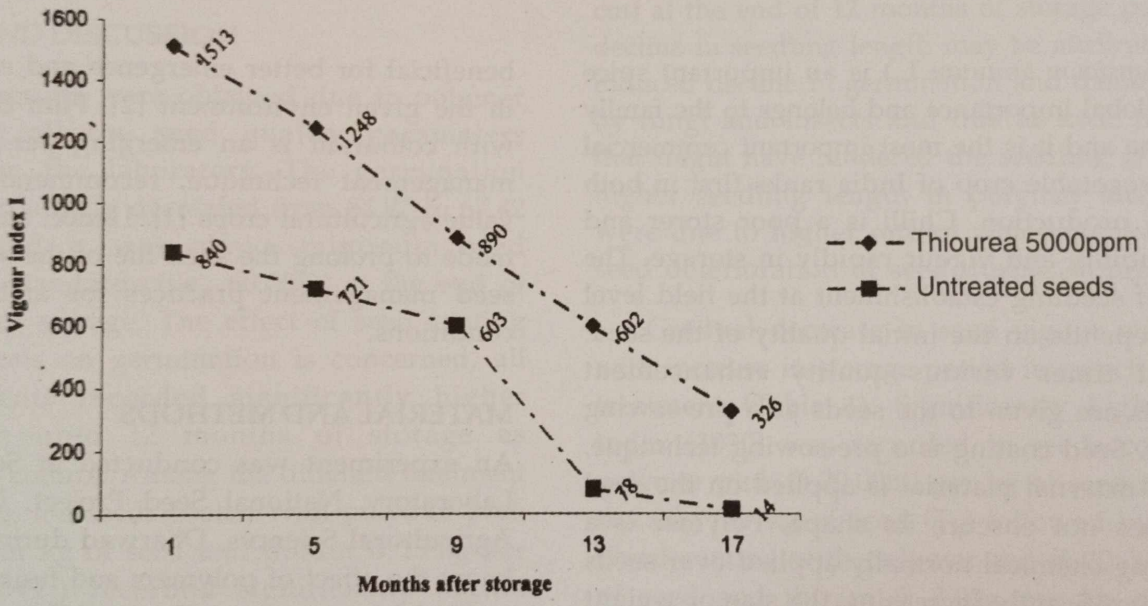

Fig. 2. Vigour index I at different periods of storage

EFERENCES

ANONYMOUS (1962). Final report of the Cashew Research Station, Kottarakkara (1952-1962). Kerala Agricultural University.

ARAVINDAKSHAN, M. & K. GOPI KUMAR (1979). Seed viability in cashew. Cashew Bulletin, **XVI**(1): 6-7.

INTERNATIONAL SEED TESTING ASSOCIATION (1999). International Rules for seed testing. *Seed Sci. & Technol.*, **27**: 25-30.

ABDUL BAKI, A.A. & J.D. Anderson (1973). Vigour determination in soyabean by multiple Criteria. *Crop Sci.*, **13**: 630-633.

5. COCHRAN, W.G. & G.M. COX (1965). *Experimental designs*. Asia Publishing Bombay.

6. HORE, J.K. & S.K. SEN (1999). Extension of storage life of cashew nut (*Anacardium occidentale* L.) seeds. *Advances Hort. & Forestry*, **6**: 45-48.

7. BEWLEY, J.D. & M. BLACK (1983). *Physiology and biochemistry of seeds in relation to germination*. Springer-Verlag. Berlin, Germany.