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Short communication

Effect of *panchagavya* and GA_3 on germination and seedling growth in cashew (*Anacardium occidentale* L.)

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ABSTRACT

An experiment consisting of three sowing periods (March-May, June-August and September-November) and seven pre-sowing treatments was undertaken to study the effect of these factors on seed germination and initial seedling growth in cashew. Seeds sowing during June - August gave significantly better germination and initial seedling growth. However, maximum germination percentage, maximal seedling growth and minimum days to germination were observed with GA_3 200ppm during all three sowing periods compared to that in other treatments. As for *panchagavya*, @ 10% and 20%, was found to be beneficial in treated seeds. All the growth parameters studied were also superior with GA_3 application, excepting root growth. Best root growth was recorded with *panchagavya* at 20%.

Key words: Cashew, *Anacardium occidentale* L., GA_3, germination, growth, *panchagavya*

Cashew (*Anacardium occidentale* L.) is native to South America (Mitchell and Mori, 1987) and was introduced into India during the 16th Century by the Portuguese (Johnson, 1973). It is now an important commercial-plantation crop in India, grown mainly along the East coast (Tamil Nadu, Andhra Pradesh, Orissa and West Bengal), West coast (Kerala, Karnataka, Maharashtra and Goa) and the North-Eastern Region (Meghalaya, Manipur, Assam, Tripura and Nagaland). It is widely grown in Asia, Africa and South America. Its kernel is highly nutritive (Jain *et al*, 1954; Morton, 1961; Joseph, 1975) containing about 21% protein, 22% carbohydrates and 41% fats. Production of quality planting material is of utmost important for which the seedlings need to be healthy, free from diseases and pests, and the seed should contain sufficient amount of auxin for good germination, rendering them ideal for softwood grafting. Owing to its significant contribution to the national economy, there is a huge demand for quality planting material both for area expansion and replacement of old and unproductive orchards. Huballi (2009) reported a requirement of about 1.25 crore grafts to cover nearly 50,000 hectares, on annual basis. Therefore, to meet an increasing demand, there is a need to produce quality planting material at a rapid rate. Cashew seed is recalcitrant by nature, and year round production of healthy planting material is difficult, as, viability of the seed deteriorates rapidly upon storage (Aravindakshan and Gopi Kumar, 1979; Mandal, 2000). To facilitate its germination, the seed must be provided favourable environmental conditions such as adequate moisture supply, appropriate gaseous balance and optimum light. It is necessary to enhance germination while maintaining uniformity of seedlings. With this in view, the present study was undertaken to standardize period of sowing and pre-sowing treatment for optimum germination and good growth in cashew seedlings.

The experiment was conducted over two consecutive years (2009 and 2010), at Horticultural Research Station (HRS), Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. The experimental site is located at 23ºN latitude and 80ºE longitude, at an elevation of 9.75 meters above mean sea level, with the sub-tropical climate of the region providing average annual rainfall of 154.7cm from the South-West monsoon.

Freshly-harvested seeds of cashew were used for June-August sowing, whereas, stored seeds were used during March–May (9 months) and September–November (4 months) for sowing. Seeds were selected based on sinker and floater method, i.e., seeds that sank in water alone were considered for sowing. A hundred seeds were sown per treatment in polythene bags (size 26cm x 17cm) filled with FYM, sand and soil in 1:1:1 ratio for germination. Seeds

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that produced 5mm or longer radicals were taken as germinated. Growth parameters such as seedling height, collar diameter, number of leaves, shoot and root dry weight, were recorded at 60 days after germination. The experiment was laid out in Factorial Randomized Block Design, with seven treatments and three replications. Seeds were sown during the first week each of March, June and September for the three sowing periods (March-May, June-August and September-November). Details of treatments are: 5% *Panchagavya* (T_1), 10% *Panchagavya* (T_2), 20% *Panchagavya* (T_3), GA_3 50ppm (T_4), GA_3 100ppm (T_5), GA_3 200ppm (T6), and no treatment, i.e., Control (T_7). Seeds were soaked in these solutions for three hours. *Panchagavya* was prepared by mixing cow dung (2.5kg), cow urine (1.5 litre), *ghee* i.e. clarified butter (500g), cow milk (1 litre), curd (1 litre) and jaggery (500g). Cow dung, cow urine and *ghee* were mixed in a plastic bucket and stirred continuously for a week to remove methane gas. Then, cow milk, curd and jaggery were added and the mixture stirred and kept aside for a week. The extracts were weighed and diluted in water to prepare 5%, 10% and 20% *panchagavya* solution. Data were statistically analyzed as per Gomez and Gomez (1984).

From seeds sown during three different periods during a year, it was found that June - August was best, yielding the highest germination in a very short time, whereas, March - May was not suitable, as, it resulted in the lowest germination rate (Table 1). Seed germination and growth of cashew seedlings were significantly influenced by pre-sowing treatment (Table 1). Pre-sowing treatment with GA_3 at 200ppm gave 100% germination within 8.5 days, followed by GA_3 at 100ppm (99% germination in 9 days). Lowest germination (90% in 13.5 days) was recorded in Control during June - August sowing. Sowing period September - November also gave germination rates similar to the pre-sowing treatment of June - August. Results on sowing period confirm that cashew sown during two seasons (March-May and September-November) in West Bengal produces better germination, without substantial deterioration to the crop. This may also be due to the prevalent favourable climatic conditions and high viability retained in a fresh seed during this period. Pre-sowing treatment also gave uniform and quick germination. Similar effect with GA_3 treatment has been reported (Furuta, 1961). It is likely that this treatment removes the waxy layer of the pericarp, thereby facilitating better germination (Harris *et al*, 1994). Three *panchagavya* treatments were also tried and similar effects were recorded on germination in June – August sowing, whereas, lowest values were recorded in March – May sowing. During September – November sowing, germination percentage ranged from 62% to 83%. Maximum germination percentage was recorded with GA_3 200ppm (Fig. 1). Beneficial effect of treatment of seeds with *panchagavya* on germination has also been reported by Pathak and Ram (2004).

Fig. 1. Cashew seedlings treated with GA_3 200ppm during June – August sowing

Table 1. Effect of pre-sowing treatment on germination and number of days to germination in cashew seed

Treatment	March - May		June - August		September - November	
	Germination (%)	Days taken to germination	Germination (%)	Days taken to germination	Germination (%)	Days taken to germination
Panchagavya 5%	38.0 (38.06)	17.50	95.0 (77.08)	13.00	66.0 (54.33)	14.50
Panchagavya 10%	51.0 (45.57)	16.00	97.0 (80.02)	10.00	74.0 (59.34)	11.50
Panchagavya 20%	54.0 (47.29)	15.00	96.0 (78.46)	12.50	70.0 (56.79)	13.50
GA_3 50ppm	47.0 (43.28)	16.50	92.0 (73.57)	11.50	67.0 (54.94)	14.00
GA_3 100ppm	52.0 (46.15)	15.00	99.0 (84.26)	9.00	76.0 (60.67)	11.00
GA_3 200ppm	61.0 (51.35)	13.50	100.0 (90.00)	8.50	83.0 (65.65)	9.00
Control	31.0 (33.83)	18.00	90.0 (71.56)	13.50	62.0 (51.94)	14.50

Figures in parentheses are logarithmic transformed values

Table 2. Effect of pre-sowing treatment on initial seedling growth in cashew

Treatment	March - May			June - August			September - November		
	Plant height (cm)	Seedling diameter (cm)	No. of leaves	Plant height (cm)	Seedling diameter (cm)	No. of leaves	Plant height (cm)	Seedling diameter (cm)	No. of leaves
Panchagavya 5%	18.10	0.74	9.48	22.92	0.88	11.03	22.71	0.85	11.17
Panchagavya 10%	19.01	0.77	9.64	24.31	0.96	12.20	22.80	0.90	11.38
Panchagavya 20%	21.07	0.88	10.56	24.73	1.05	12.55	23.82	0.91	11.94
GA_3 50ppm	18.38	0.76	9.40	23.06	0.92	11.67	22.65	0.86	11.35
GA_3 100ppm	20.99	0.86	10.59	25.18	1.05	12.67	24.36	1.02	12.23
GA_3 200ppm	23.15	1.00	11.64	27.25	1.15	13.91	26.05	1.03	13.12
Control	17.93	0.70	8.83	22.62	0.82	10.83	21.82	0.82	10.98
S.Em. (±)	0.37	0.03	0.25	0.43	0.04	0.17	0.45	0.03	0.30
C.D. *(P=0.05)*	1.14	0.09	0.75	1.30	0.12	0.52	1.35	0.11	0.90

Table 3. Effect of pre-sowing treatment on seedling growth of cashew

Treatment	March - May			June - August			September - November		
	Leaf area (cm^2)	Root length (cm)	Shoot: root length	Leaf area (cm^2)	Root length (cm)	Shoot: root length	Leaf area (cm^2)	Root length (cm)	Shoot: root length
Panchagavya 5%	27.27	14.61	1.22	27.75	17.80	1.28	29.31	17.62	1.28
Panchagavya 10%	31.01	13.88	1.30	31.84	19.22	1.27	26.96	17.56	1.32
Panchagavya 20%	25.56	15.65	1.34	34.69	18.68	1.32	31.76	18.66	1.27
GA_3 50ppm	26.19	14.35	1.27	26.58	17.80	1.32	24.36	16.58	1.36
GA_3 100ppm	26.01	14.82	1.40	35.06	17.81	1.42	35.41	17.23	1.41
GA_3 200ppm	31.24	15.55	1.48	37.75	18.59	1.46	32.62	17.47	1.48
Control	23.52	14.79	1.28	28.28	18.57	1.21	28.86	16.40	1.32
S.Em. (±)	0.77	0.36	0.03	1.38	0.25	0.03	1.26	0.43	0.01
C.D. *(P=0.05)*	2.34	1.10	0.10	4.21	0.76	0.09	3.82	1.31	0.05

Effect of pre-sowing treatment on initial seedling-growth in cashew is presented in Table 2. Initial seedling-growth showed similar trends in germination, and sowing during June - August recorded better growth, followed by September – November. The least growth was recorded in March - May sowing. Seeds pre-soaked in GA_3 200ppm recorded maximum plant height, collar diameter and number of leaves, while, the least plant height, collar diameter and number of leaves were recorded in Control in all three periods of sowing. This may be due to early and uniform germination supported by GA_3, hastening initiation of shoot growth, thus leading to better seedling height. Further, application of GA_3 may have also helped increase cell division, leading to better initial shoot-growth. Similar results were reported by Walase *et al* (2007) and Shanmugavelu (1963; 1970). All the three treatments with *panchagavya* gave better seedling growth during June - August sowing, with the highest seedling height, collar diameter and number of leaves, followed by September - November sowing. The lowest values were recorded in March – May sowing. Yelleshkumar *et al* (2008) reported that seeds treated with 3% *panchagavya* were superior in sprout height, seedling diameter, number of sprouts and number of leaves in mango. Leaf area, root length and root:shoot ratio were highest when sowing was done during June – August; all the parameters studied were lowest in March - May sowing (Table 3). Pre-sowing treatment also influenced leaf area, root growth and root:shoot ratio. Maximum leaf area (37.75cm^2) and root:shoot ratio (1.46) was recorded in GA_3 treatment in sowing during June - August, while, maximum root growth was recorded in 10% *panchagavya*. Lowest values were associated with GA_3 50ppm and 5% *panchagavya*. Root growth was unaffected, as, pre-treated seeds in all the sowings gave similar root growth. It is very interesting to note that application of *panchagavya* produced better root growth irrespective of sowing time. According to Solaiappan (2002), *panchagavya* has beneficial microorganisms like *Azospirillum*, *Azotobacter*, *phosphobacteria* and *Lactobacillus*, which may be the reason for good root growth. The present findings are in conformity with Yabuta and Hayashi (1939) and Sumiki (1952). Fresh and dry root and shoot weights are presented in Table 4. Similar trends were observed in June - August sowing, which showed maximum fresh and dry root and shoot weights, while, lowest values were recorded in March – May sowing. Seeds treated with GA_3 200ppm produced higher shoot growth and weight in the three different sowing

Table 4. Effect of pre-sowing treatment on fresh and dry shoot and root weight of cashew seedling

Treatment	March - May				June - August				September - November			
	Shoot fresh wt. (g)	Shoot dry wt. (g)	Root fresh wt. (g)	Root dry wt. (g)	Shoot fresh wt. (g)	Shoot dry wt. (g)	Root fresh wt. (g)	Root dry wt. (g)	Shoot fresh wt. (g)	Shoot dry wt. (g)	Root fresh wt. (g)	Root dry wt. (g)
Panchagavya 5%	3.70	0.77	1.06	0.15	6.76	1.47	1.72	0.44	5.61	1.05	1.67	0.45
Panchagavya 10%	4.38	0.91	1.24	0.21	6.95	1.57	1.97	0.65	6.06	1.13	1.75	0.43
Panchagavya 20%	5.16	1.04	1.45	0.33	7.41	1.72	1.88	0.59	6.09	1.18	1.78	0.60
GA_3 50ppm	4.02	0.77	1.13	0.13	6.45	1.48	1.66	0.42	5.11	0.96	1.39	0.24
GA_3 100ppm	5.20	1.07	1.24	0.21	7.73	1.97	1.70	0.41	6.46	1.50	1.53	0.30
GA_3 200ppm	5.72	1.20	1.30	0.23	8.11	2.01	1.86	0.58	7.29	1.81	1.58	0.26
Control	3.83	0.74	1.26	0.21	6.19	1.52	1.81	0.57	4.91	0.92	1.40	0.25
S.Em. (±)	0.30	0.10	0.05	0.02	0.49	0.10	0.02	0.01	0.51	0.22	0.07	0.07
C.D. *(P=0.05)*	1.01	0.34	0.16	0.08	1.46	0.29	0.07	0.07	1.56	0.61	0.20	0.22

periods. This could be related to broader leaves, thereby enhanced photosynthetic activity and accumulation of nutrients in the leaf tissues. This, in turn, may have helped improve shoot growth and dry biomass.

It may be concluded from the present study that sowing cashew during June -August or September - November was better for germination rate and initial seedling growth. Treatment with GA3 200ppm was the most effective for germination and better initial seedling growth in cashew during the three different sowing periods. However, GA_3 may not be a suitable option to a farmer due to its high price and problem with availability. Therefore, pre-sowing treatment with the farmer-friendly *panchagavya* (20%) can be adopted due to its easy availability and economic viability.

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