

Evaluation of Cashew Varieties for Flowering and Yield Characters

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Abstract Fifteen cashew varieties were evaluated for flowering and yield characters. Number of hermaphrodite flowers per panicle ranged between 10.75 in Dhana to 14.50 in Ullal-2. Ullal-4 was having short duration of flowering season (37.88) and Ullal-1 had longer duration of flowering (37.88). Panicles per m² were maximum in Ullal-1 (16.63). Nuts per panicle ranged between 5.25 in Dharashree to 7.88 in Amrutha. Nut yield was highest in Priyanka (21.88 kg/tree) and lowest was found in Amrutha (7.88 kg/tree).

Keywords Cashew varieties, Evaluation, Flowering, Yield.

Introduction

Cashew (*Anacardium occidentale* L.) a tropical plant of commercial importance, belongs to family Anacardiaceae. It is believed to be the native of Brazil, from where it was introduced to the Malabar Coast

of India by early Portuguese during 16th century. The crop is mainly grown on the waste lands in high rainfall areas for its nuts and to check soil erosion. Hence it is considered as 'Gold Mine' of the wasteland as it requires low inputs for production. It is one of the most important plantation crops earning huge foreign exchange through its kernel and Cashew Nut Shell Liquid (CNSL).

Cashew kernels are highly nutritious containing protein (21.0%), fat (47.0%), carbohydrates (22.0%), minerals and vitamins. Cashew proteins contain all the essential amino acids and are comparable with milk protein casein. Besides, kernels are quite rich in unsaturated fatty acids, thus are not bad cholesterol and are considered as safe food. Owing to high nutrition and low volume, it has become a preferred snack food. In India more than 3650 processing units are engaged in processing of cashew. The units employ nearly about 10 lakh workers, mostly of underprivileged sections of rural women. It shows there is a tremendous potential for area expansion and increased productivity. Cashew is a hardy crop, drought resistant and comes up well in poor and marginal soils. It is a highly cross pollinated crop with high degree of heterogeneity. Selection of suitable cultivar / variety for a particular area is of vital importance in improving the production. To meet the demand of better planting materials for large scale plantations, it is necessary to evaluate the growth and yield potential of various cashew cultivars.

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Materials and Methods

The experiment was carried out at Agricultural and Horticultural Research Station, Ullal during 2009–2010 and 2010–2011. It is located at 15 m above mean sea level with a latitude of 13°N and longitude of 75°E. The Agricultural and Horticultural Research Station, Ullal being located in a cashew growing belt, has mainly typical laterite soils of west coast with patches of red sandy loam. The terrain is mostly undulating with a gradient of 4 to 15%. The soil is acidic in nature with pH ranging from of 5.4 to 5.8. The soils are with low to medium fertility and crop response to manuring and irrigation is highly encouraging in this type of soils. The experiment was laid out in complete randomized block design with 15 varieties and three replications. Observations on the flowering and fruiting behavior of the trees were recorded at weakly intervals after initiation of inflorescence. Out of the eight tagged shoots, three shoots were used for recording the sex ratio and five shoots were maintained for recording of fruit set. The season of flowering was recognized by the fortnight when the 50% of flowering was over and recorded as follows :

Before Dec-1.0, Jan -1–Jan-15-2.0, Jan-16–Jan-31-3.0, Feb-1-Feb-15-4.0, Feb-16-Feb-28-5.0, Mar-1-Mar-15-6.0, Mar-16-Mar-31-7.0, After Apr-1-8.0.

Male flowers were identified in each panicle and their average number was recorded after the opening of all the flowers. The perfect flowers were counted individually in each panicle and removed immediately after counting, and their average number was recorded. The observations were made in five tagged shoots. Ratio of perfect to male flowers was worked out and presented as sex ratio. The period between panicle initiation and 50% flowering of a tree was recorded and expressed in number of days. The period between panicle initiation and 100% flowering of a tree was recorded and expressed in number of days.

The fully grown panicle was grouped into 1. Conical - Score-1, 2. Deltoid - Score-2, 3. Pyramidal-Score-3.

The length of panicle was recorded by taking the measurements from the point of lowest rachis to the

tip of the panicle and expressed in centimeter. The distance between the two horizontal ends of panicle is the panicle width and expressed in centimeter. The flowering shoots within one square meter frame were counted and expressed in number. The number of florets in a inflorescence were counted and expressed as a number. The number of panicles present in one meter square area of canopy were counted and expressed in numbers. The total number of nuts retained in the panicle till maturity was counted and expressed in number. The fallen nuts were collected from each tree and dried under sunlight, and the total nut weight was expressed as kilogram / tree.

Results and Discussion

Highest flowering shoots were observed in Kanaka (5.75) and lowest in Ullal-2 (4.00). Similarly, Rajanna et al. [1] showed that number of flowering laterals per meter square area to be varying from 17.0 in M-6/1 to (34.0) in Vengurla-5. Honnabyraiah et al. [2] and Vijay Kumar et al. [3] also showed that variation for flowering shoots. Ullal-2, Kanaka, Dhana and Ullal-4 were early flowering which flowered during November-December. The varieties Ullal-3, Ullal-1, Vengurla-1, Madakkathara-2, UN-50, Bhaskara, Dhana, Madakkathara-1 and Priyanka were mid season flowering types that have flowered after January. Vengurla-7 and Amrutha were late season flowering types. The results were in conformity with Vikram et al. [4].

Male flowers / panicle was significantly highest in Ullal-1 (66.63) and lowest was recorded in Ullal-3 (29.88). Highest hermaphrodite (bisexual flowers)/ panicle was observed in Ullal-2 (14.50) followed by Vengurla-7 (13.88), Madakkathara-2 (NDR-2-1) (13.75), Bhaskara and Vengurla-1 (13.13), Ullal-1 (13.00), Madakkathara-1 (12.88). The lowest hermaphrodite (Bisexual flowers) / panicle were observed in Dhana (10.75). Significantly highest sex ratio was observed in case of Ullal-3 (41.63) on par with Ullal-1 (40.52), Ullal-2 (39.75), Bhaskara (39.44), Madakkathara-2 (37.68) and Vengurla-7 (36.79). Lowest sex ratio was observed in Ullal-4 (17.83) than other cashew varieties. Variation for flowers and sex ratio was reported earlier several workers (Meera and Jayaprakash [5], Sharma et al. [6], Singh et al. [7]. Since, the male flowers dominate the inflorescence, there will be a great

Table 1. Flowering characters of cashew varieties. NS=Non significant, **=Highly significant, Flowering season : 1.00 = Before Jan, 3.00=Jan 2nd fortnight, 5.00=Feb 2nd fortnight, 7.00 = Mar 2nd fortnight, 2.00=Jan 1st fortnight, 4.00=Feb 1st fortnight, 6.00=Mar 1st fortnight.

Sl. No.	Variety	Flow- ering shoots/ m ²	Season of flow- ering	Male flowers/ panicle	Herma- phro- dite flowers/ panicle	Sex ratio	Days to 50% flow- ering	Days to 100% flow- ering
1	Ullal-1	5.00	3.00	38.38	13.00	40.52	39.25	54.75
2	Ullal-2	4.00	1.00	36.50	14.50	39.75	36.63	45.25
3	Ullal-3	4.75	2.00	29.88	12.38	41.63	34.00	44.88
4	Ullal-4	5.13	1.50	66.63	11.75	17.83	25.50	37.88
5	Vengurla-1	4.88	2.50	37.13	13.13	35.48	27.13	42.63
6	Bhaskara (11/6 Goa)	5.38	3.00	34.25	13.13	39.44	32.38	44.88
7	Kanaka	5.75	1.00	34.63	11.38	32.85	29.63	44.38
8	Dhana	4.13	1.00	31.00	10.75	35.37	35.13	47.50
9	Dharashree	4.50	3.50	34.75	10.88	31.24	27.13	44.88
10	Madakkathara-2 (NDR-2-1)	4.38	2.50	36.63	13.75	37.68	35.63	47.63
11	UN-50	4.13	2.00	36.88	12.63	34.25	33.75	43.38
12	Madakkathara-1 (BLA-39-4)	4.63	3.00	36.50	12.88	35.48	29.63	41.75
13	Vengurla-7	4.38	4.00	38.00	13.88	36.79	31.63	43.75
14	Priyanka	4.75	3.50	37.75	12.00	31.78	33.00	43.75
15	Amrutha	4.38	5.00	35.00	12.00	34.77	34.13	44.13
	F-test	NS	—	**	**	**	**	**
	SEm	0.466		1.868	0.603	2.085	0.640	0.838
	CD at 5%	NS		5.332	1.720	5.950	1.827	2.391
	CV	19.948		9.941	9.617	11.918	3.964	3.743

variation for number of flowers and the fruit set in a panicle. Number of hermaphrodite flowers in a panicle contributes to the maximum fruit set.

The results of days to flowering revealed that Ullal-1 took highest number of days (39.25 and 54.75 respectively) to 50% and 100% flowering, indicating the longer duration of flowering. Whereas, Ullal-4 (25.50 and 37.88) took minimum number of days indicating the shorter duration of flowering. The results were in conformity with Hanumanthappa et al. [8], who recorded maximum number of days taken to 100% flower emergence (49.36) in Ullal-1. The Vengurla-4 recorded minimum number of days (43.30) for 100% flower emergence. The cashew varieties Ullal-1, Kanaka, Dharashree, Madakkathara-2, UN-50 and Vengurla-7 had conical shape of the panicle. Ullal-1, Ullal-3, Dhana, Amrutha were having spherical shape and the Ullal-2, Vengurla-1, Bhaskara, Madakkathara-1 and Priyanka, had deltoid shape of the panicle. The variation in the panicle shape was observed earlier

where it is reported about 45% of the panicles with conical shape, 40% with irregular and 15% of pyramidal shape.

The panicle length among genotypes varied from 17.09 cm in Ullal-2 to 24.06 cm in Dhana. Whereas, the width of the panicle varied from 18.93 cm in Ullal-4 to 23.90 cm in Vengurla-7. The variations in the panicle and flower parameters can be attributed to varietal character and also depend on the environmental factors Srinivas [9]. Significantly higher number of florets / inflorescence (Panicle) was observed in Ullal-1, (11.12). Which was on par with Ullal-4 (10.62), Dhana (10.50), Amrutha (10.5), Ullal-2 (10.25), Vengurla-1 (10.25), UN-50 (10.00), Priyanka (9.87), Kanaka (9.5) and Vengurla-7 (9.50). The lowest number of Florets / inflorescence (Panicle) was observed in Dharashree (7.25). Similarly, Sethi et al. [10] showed that the number of laterals to be varying from 13.59 in F-16 to 24.64 in A-71. Vijay Kumar et al. [3] showed that maximum number of laterals in Vengurla-2 (30.61)

Table 2. Flowering and yield characters of cashew varieties. NS=Non significant, **=Highly significant.

Sl. No.	Variety	Panicle shape	Panicle length (cm)	Panicle width (cm)	Florets per panicle	Panicles/m ²	Nuts/inflorescence	Yield (kg/tree)
1	Ullal-1	2.00	19.63	23.38	11.13	16.63	7.25	15.50
2	Ullal-2	3.00	17.09	21.75	10.25	14.00	7.88	12.88
3	Ullal-3	2.00	19.18	21.45	8.25	13.63	6.75	14.28
4	Ullal-4	1.00	19.16	18.93	10.63	12.63	6.50	13.39
5	Vengurla-1	3.00	20.01	19.90	10.25	13.75	5.75	14.91
6	Bhaskara (11/6 Goa)	3.00	19.46	22.55	8.88	14.00	6.00	11.63
7	Kanaka	1.00	20.69	20.46	9.50	12.50	6.25	11.13
8	Dhana	2.00	24.06	22.29	10.50	11.38	7.63	14.50
9	Dharashree	1.00	23.19	21.39	7.25	11.75	5.25	9.00
10	Madakkathara-2 (NDR-2-1)	1.00	19.81	21.18	9.38	11.50	5.75	21.38
11	UN-50	1.00	19.10	19.43	10.00	12.38	6.88	10.50
12	Madakkathara-1 (BLA-39-4)	3.00	21.88	23.89	9.00	11.38	5.63	19.13
13	Vengurla-7	1.00	22.25	23.90	9.50	11.13	6.75	12.63
14	Priyanka	3.00	23.13	22.74	9.88	10.88	5.50	21.88
15	Amrutha	2.00	21.80	23.56	10.50	11.63	6.13	7.88
<i>F</i> -test		NS	**	**	**	**	**	**
SEm		1.00 = Conical	0.841	0.683	0.613	0.483	0.492	0.357
CD at 5%		2.00 = Spherical	2.399	1.949	1.748	1.379	1.405	1.020
CV		3.00 = Deltoid	8.125	6.269	12.683	7.666	15.403	5.092

and the minimum was found in Vengurla-5 (16.63).

Significantly highest number of panicles (inflorescence) per m² were observed in Ullal-1 (16.62). Whereas, the lowest number of panicle per m² was observed in Priyanka (10.875). Rajanna et al. [1] and Srinivas et al. [9] showed that significant differences in number of flowering laterals per m². Maximum number of nuts / panicle was observed in Ullal-2 (7.88), which was on par with Dhana (7.63), Ullal-1 (7.25), UN-50 (6.88), Ullal-3 (6.75), Vengurla-7 (6.75) and Ullal-4 (6.50). The minimum number of nuts per panicle was observed in Dharashree (5.25). In cashew, all the hermoprodite flowers that get pollinated will not reach maturity and fruit drop occurs. The fruit drop is attributed to physiological reasons, insects attack also plays important role in immature fruit drop. Solanki et al. [11] opined that the fruit drop may be affected by weather and climate resulting in difference in performance of different cultivars at different climatic conditions. The nuts/panicle were found to be high in those varieties which had the maximum of hermaph-

rodite flowers in their inflorescence. Vikram et al. [4]. Poduval [12] and Hanumanthappa et al. [8] also showed that variation for nuts / panicle.

Highest yield of nuts/tree was observed in Priyanka (21.88 kg/tree) followed by madakkathara-2 (21.38). Whereas, lowest nut yield / tree was observed in amrutha (7.88). Zachariah et al. [13] showed that a maximum nut yield of 18.60 kg per tree in Dharasree, followed by 18.35 kg per tree in Amrutha. The lowest yield per tree (10.70 kg) was found in Dhana. Meera and Jayaprakash [5], Poduval [12], Rajanna et al. [1], Reddy et al. [14], Solanki et al. [11] and Venkataramana et al. [15] reported variation in nut yield/tree. The genetical and environmental factors influence the yield of nuts per tree.

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