

Growth and Yield Performance of Cashew (*Anacardium occidentale* L.) Varieties

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Abstract Evaluation of cashew varieties was carried out Mangalore. Highest plant height was observed in Kanaka (6.25 m). Spreading, upright and compact, upright and open branching habit was observed among the varieties. Compact and sparse type of canopy shape was observed. Significantly highest leaf area index was observed in Vengurla-7 (104.33) and lowest was observed in Vengurla-1 (59.57). Yield of nuts was ranging between 7.88 kg/tree in amrutha to 21.88 kg/tree in priyanka.

Keywords Cashew nut, Varieties, Growth, Yield.

Introduction

Cashew is a member of the family Anacardiaceae with natural order sapindales, is an evergreen tree. It is a native of tropical central and south America, but is now distributed all over the tropics and part of warm subtropics. However colder subtropical areas are not suitable for cashew due to cold and frost, although the tree may grow and even bear a few flowers. It originated in Brazil and dispersed throughout the tropical low land of Mexico and West Indies. It was introduced into Africa and India by Portuguese travellers in the 15th and 16th centuries. 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.

Considering the demand of the cashew growing community and the processing industries, there is a need to boost the nut yield (productivity) per unit area. 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 Agriculture and Horticultural Research Station, Ullal during 2009-2010 and 2010-2011. It is located at 15m 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 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 three replications. Eight healthy, matured shoots were tagged in each tree at the time of emergence of new flush in four directions. When the new shoots emerged, observation on growth parameters were recorded on these tagged shoots at monthly intervals.

The observations on the growth characters such as height of the tree, stem girth, plant habit, canopy spread, leaf length, leaf breadth, leaf area index, laterals, number of vegetative shoots and days taken to 50% vegetative shoots/ new flush were recorded when the plants had completed the current season growth. The height of plant was measured from the ground level to the top of tree using graduated stick and expressed in meter. The plants of different varieties were observed and based on growth habit, the plants were grouped into 1. Upright and compact-score 1, 2. Upright and open-score 2, 3. Spreading-score, 3. The circumference (Stem girth) was measured at the height of 30 cm above the ground level and expressed in meters.

The canopy shape was determined depending on the sparseness and closeness (compact) of shoots and following scores were given.

1. Compact-1.0, 2. Sparse-2.0, 3. Between compact & sparse-1.5.

The canopy spread of trees was measured in East-West and North-South direction and mean spread is expressed in square meter (m²). The sixth leaf (index leaf) on the lateral was selected randomly

on four directions. The leaf length was measured from the base of the lamina to the tip of the leaf. The maximum width at central portion of leaf was measured and the mean of 10 leaves were expressed in cm. Leaf area was worked out by adopting standard method which is based on linear measurements of leaf. The formula used to work out leaf area was $A = 0.21 + 0.69 P$ when P is the product of length and breadth of leaf and 0.21 is the factor. The number of shoots within one meter square wooden frame at four directions was counted and the mean of four directions were expressed in number. The vegetative shoots within one meter square wooden frame were connected and expressed in number. The number of days for 50% vegetative shoots production in plants is recorded and expressed in number. Fisher's method of analysis of variance was applied for analysis and interpretation of data for the year 2009-10 and 2010-11. The level of significance of $p=0.05$ in F tests was applied. Critical difference (CD) were worked out wherever F test was significant. The pooled data from both the years is presented here.

Results and Discussion

Significantly highest plant height was observed in Kanaka (6.25 m), which was on par with Priyanka (6.14 m), Vengurla -1 (6.06 m), Dhana (5.99 m), UN-50 (5.96 m), Ullal-4 (5.94 m), Madakkathara-2 (5.84 m), Madakkathara-1 (5.80 m) and Bhaskara (5.79 m). The lowest plant height was observed in Ullal-1 (4.96 m). Similarly, in a study conducted by Rajanna et al. [1] showed a maximum tree height in ME-4/4 (6.4m) followed by vengurla-5 (6.1 m) and lowest height was observed in 1/63 cromphet (3.4 m). Reddy et al. [2] and Hanumanthappa et al. [3] showed that variation for plant height. The spreading type of branching habit was observed in Ullal-1, Vengurla-1, Dhana, Madakkathara-2, Priyanka and Amrutha. While Ullal-2, Kanaka, Dharashree and Vengurla-7 exhibited the upright and compact branching habit. Ullal-3, Ullal-4, Bhaskara, UN-50 and Madakkathara-1 had upright and open branching habit. It was noted that the spreading and profusely branching habit resulted in more interception of solar energy by the well spread canopy and hence, there was a better accumulation of photosynthesis resulting in good flowering and increased productivity. (Table 1).

Table 1. Growth performance of cashew varieties. NS = Non significant, * = Significant, ** = Highly significant.

Sl. No.	Variety	Plant height (m)	Branching habit	Stem girth (m)	Canopy spread		Canopy shape
					East-West (m)	North-South (m)	
1	Ullal-1	4.96	3	0.85	9.96	8.00	2.00
2	Ullal-2	5.48	1	0.73	8.01	7.94	1.50
3	Ullal-3	5.73	2	0.77	9.29	9.80	2.00
4	Ullal-4	5.94	2	0.82	9.14	8.93	1.00
5	Vengurla-1	6.06	3	0.89	9.99	8.75	1.50
6	Bhaskara (11/6 Goa)	5.79	2	0.82	8.34	7.78	1.00
7	Kanaka	6.25	1	0.82	8.34	7.44	2.00
8	Dhana	5.99	3	0.76	7.19	6.96	1.00
9	Dharashree	5.23	1	0.70	7.66	7.18	1.50
10	Madakkathara-2 (NDR - 2-1)	5.84	3	0.86	6.86	8.48	1.50
11	UN - 50	5.96	2	0.89	8.64	8.53	2.00
12	Madakkathara-1 (BLA-39-4)	5.80	2	0.68	7.88	6.49	1.00
13	Vengurla-7	5.71	1	0.88	9.78	9.19	1.00
14	Priyanka	6.14	3	0.77	9.23	8.89	1.50
15	Amrutha	5.05	3	0.78	7.65	8.09	2.00
<i>F</i> -test		**	NS	*	*	*	NS
SEm		0.172	1 = Upright & Compact	0.045	0.677	0.629	1.00 = Compact
CD at 5%		0.492	2 = Upright & Open	0.128	1.933	1.797	2.00 = Sparse
CV		6.019	3 = Spreading	11.267	15.886	15.429	1.50 = Between compact & sparse

Among 15 varieties, maximum stem girth was observed in UN-50 and Vengurla-1 (0.89 m) and lowest was observed in Madakkathara-1 (0.68 m). Similarly, Rajanna et al. (1) showed the trunk girth varying from 65 cm to 158 cm. Lakshmana et al. [2], Reddy et al. [3], Hanumanthappa et al. [4] and Vikram et al. [5] also reported a variation for stem girth. Canopy spread (East-West) was ranging between 6.86 m in Madakkathara -2 to 9.99 m in Vengurla-1. Canopy spread from North-South was ranging between 6.49 m 9.80 m. The results were in conformity with the results obtained by Meera and Jayaprakash [6], where a maximum canopy spread from east to west and north to south was (7.50 m) in cross of MDK1X PLD 57. The minimum (3.50 m and 3.25m respectively) was found in PLD57.

The compact type of canopy shape was observed in Ullal-4, Bhaskara, Dhana, Madakkathara-1 and Vengurla-7. Ullal-1, Ullal-3, Kanaka UN-50 and Amrutha exhibited sparse type of canopy shape. Ullal - 2, Vengurla-1, Dhana, Madakkathara-2 and Priyanka had canopy shape in between compact and sparse type. Observed the difference in the growing habits

of cashew trees. Some trees grew tall and had a conical canopy others remained low and developed an umbrella shaped canopy. Leaf length was maximum in Vengurla-7 (17.33 cm) and lowest was observed in Vengurla-1 (12.44 cm). Significantly highest leaf breadth was recorded in Bhaskara (9.21 cm) and lowest was observed in Vengurla-1 (6.80 cm). Significantly highest leaf area index was observed in Vengurla-7 (104.33) on par with Ullal-3 (98.26), Bhaskara (97.95), UN-50(92.84) and Kanaka (92.40). Lowest was observed in Vengurla-1 (59.57). It was reported that the maximum leaf size of 167.78 cm² in 9/43 WYNAD – Kerala and a minimum of 88.4 cm² in 3/108 Gubbi-Karnataka accessions. The variation in leaf area index could be attributed to the variation in dimensions of the leaves.

Significantly highest number of laterals was recorded in Vengurla-7 and Bhaskara (5.00), followed by Ullal-2 and UN-50 (4.63). Whereas, the lowest number of laterals was noticed in Ullal-3 (3.38). It was opined that the maximum number of lateral shoots per unit area gives compactness to the canopy of the tree. The trees with compact canopy are high

Table 2. Growth and yield performance of cashew varieties. * = Significant, ** = Highly significant.

Sl. No.	Variety	Leaf length (cm)	Leaf breadth (cm)	Leaf area index	Number of laterals	Vegetative shoots	Yield/tree (kg)
1	Ullal-1	13.54	7.66	72.07	4.50	9.25	15.50
2	Ullal-2	14.21	7.59	75.11	4.63	9.00	12.88
3	Ullal-3	15.63	8.93	98.26	3.38	9.63	14.28
4	Ullal-4	13.50	7.95	75.23	4.38	7.75	13.39
5	Vengurla-1	12.44	6.80	59.57	4.00	7.25	14.91
6	Bhaskara (11/6 Goa)	15.23	9.21	97.95	5.00	8.63	11.63
7	Kanaka	15.88	8.30	92.40	4.38	8.50	11.13
8	Dhana	14.41	8.03	80.15	4.38	9.00	14.50
9	Dharashree	15.55	8.25	89.85	4.50	8.50	9.00
10	Madakkathara-2 (NDR-2-1)	15.46	8.21	88.00	4.38	8.75	21.38
11	UN-50	15.81	8.39	92.84	4.63	8.63	10.50
12	Madakkathara-1 (BLA-39-4)	15.80	7.88	86.57	4.00	7.50	19.13
13	Vengurla – 7	17.33	8.69	104.33	5.00	7.88	12.63
14	Priyanka	14.90	8.39	87.10	4.50	9.75	21.88
15	Amrutha	15.73	7.03	76.63	4.38	9.00	7.88
<i>F</i> -test		**	**	**	**	*	**
SEm		0.411	0.350	4.669	0.146	0.486	0.357
CD at 5%		1.174	1.000	13.324	0.416	1.386	1.020
CV		5.474	8.666	10.976	6.623	11.296	5.092

yielders. Observed the production of two laterals in the bearing shoots in June-July following the harvest of fruits and these shoots produced flowers in December besides, producing a few laterals, some of which produced flowers in the same season. Significantly highest vegetative shoots was observed in Priyanka (9.75) on par with Ullal-3 (9.63), Ullal-1 (9.25), Ullal-2 (9.00), Dhana (9.00), Madakkathara-2 (8.75), UN-50 (8.63 m), Bhaskara (8.63), Dharashree and Kanaka (8.50). The lowest number of vegetative shoots were observed in Vengurla-1 (7.25). 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). It was reported 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. Lakshmana et al. [2] Meera and Jayaprakash [6], Poduval [7], Rajanna et al. [1], Reddy et al. [3], Solanki et al. [8] and Venkataramana et al. [9] showed a variation in nut yield/tree. Hanumanthappa et al [4] opined that the variation in nut weight, kernel weight, yield per plant and number of nuts/kg weight could be due to environmental factors and varietal characters. (Table 2)

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