



## Seedling selection in open pollinated genotypes of cashew (*Anacardium occidentale*)

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### ABSTRACT

In a highly heterozygous crop like cashew (*Anacardium occidentale* L.), selection of high yielding trees from a seedling population of existing varieties is one of the ways of development of variety. Hence an experiment was undertaken to study the extent of variability in seedlings of six popular genotypes, viz. NRCC Sel 2, Vengurle 4, Vridhachalam 3, Bhaskara, VTH 174 and VTH 30/4 and to identify promising trees. Eighty open pollinated seeds each from trees belonging to six genotypes were collected; seedlings were raised and planted during 2007 at Directorate of Cashew Research, Experimental Station, Shantigodu. Growth parameters like trunk girth, tree height, tree spread and nut yield per tree were recorded. The progeny performance in different varieties revealed that the mean nut yield per tree was highest with 2.46 kg in Vridhachalam 3. With regard to individual tree performance tree number 480 belonging to VTH 30/4 recorded highest yield of 6.9 kg nuts/tree. The frequency distribution patterns showed that data of trunk girth was moderately negatively skewed implying increasing alleles are in slight excess and dominant for this trait. Whereas tree height and tree spread distributions were moderately positively skewed indicating decreasing alleles are in slight excess and dominant for these traits. The nut yield showed highly positively skewed distribution revealing decreasing alleles are in excess and dominant. The kurtosis was very high for nut yield indicating that yield variability is due to a few extreme differences from the mean. It was observed that trunk girth and tree spread were positively correlated with nut yield. The study could identify one promising seedling (T No.480), a seedling progeny of VTH-30/4 in terms of nut yield.

**Key words:** Cashew, Nut yield, Seedling selection.

Cultivated cashew (*Anacardium occidentale* L.) belonging to family Anacardiaceae, is highly heterozygous in nature due to cross pollination. By the virtue of this, seedlings raised from seeds of open pollinated varieties as well as hand pollinated hybrids do not breed true and are heterogeneous. Nevertheless, it is possible to select promising seedlings from such a pool of heterogeneous population and multiply them through vegetative propagation so as to clone the desired traits.

Present scenario of cashew production in India is low with 7.28 lakh tonnes of raw nuts as against the demand of 1.3-1.4 million tonnes (DCR Vision 2030) and the national average productivity also stands low at 772 kg/ha with cultivated cashew area of 9.82 lakh ha (DCCD 2013). As a consequence of lower domestic raw nut production, country imports raw cashew nuts from other countries to meet the demand of cashew processing industries. This calls for increasing the production of cashew by

development of varieties with high yields. In a heterozygous crop like cashew, selection of high yielding trees from a seedling population of existing varieties is deemed as the most effective and quickest way for development of variety.

Previous studies (Salle *et al.* 1989, Pugalendhi *et al.* 1990, Shete *et al.* 1993, Cruz and Fletcher 1997, Valencia *et al.* 2008) have pointed out a wide range of variation in cashew trees of seedling origin. These studies were carried out either on naturally existing population or non-descript types. Hence, for the first time in the country an attempt was made to exploit variability in seedlings originated from open pollinated seeds derived from popular cultivars of cashew with an objective to identify promising trees in the population.

### MATERIALS AND METHODS

The investigation was carried out at ICAR-Directorate of Cashew Research, Experimental Station, Shantigodu, Karnataka, India (12° 45' N latitude, 75° 4' E longitude and 90 m above MSL). The study area lies along the West Coast region of India and the climate is seasonally wet, dry tropics (hot humid) with distinct dry seasons (from January to May) during which the fruit development takes place. The average annual rainfall is 3000 to 3500 mm and is distributed

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Table 1 Variability for growth parameters (16 seedlings /variety) and yield (entire population) in seedling progenies of six varieties

Trait	Parameter	NRCC Sel 2	Vengurle 4	VRI 3	Bhaskara	VTH 174	VTH 30/4
Girth (cm)	Range	24-63	40-87	34-72	44-80	26-75	30-72
	Mean	44.94	58.81	53.50	60.19	56.94	51.31
	SEm ±	3.44	2.91	2.57	2.84	3.97	3.48
	CV %	30.49	19.78	19.23	18.89	27.89	27.17
Height (m)	Range	3.25-6.45	4.00-7.45	3.50-7.10	3.75-8.90	5.10-7.25	4.10-7.25
	Mean	4.80	5.21	4.76	5.80	6.05	5.43
	SEm ±	0.21	0.30	0.21	0.39	0.15	0.24
	CV %	17.71	23.03	17.44	26.72	10.25	18.05
Tree spread (m)	Range	3.50-7.62	3.25-9.72	3.22-7.80	3.87-8.95	4.62-8.9	3.62-9.25
	Mean	5.04	5.89	5.33	5.81	6.67	6.23
	SEm ±	0.26	0.41	0.25	0.33	0.26	0.37
	CV %	20.83	27.84	18.57	23.06	15.44	23.43
Yield (kg/tree)	Range	0.3-2.98	0.2-2.98	0.7-4.41	0.2-3.38	0.5-3.05	0.3-6.9
	Mean	1.76	1.56	2.40	1.75	1.86	1.81
	SEm ±	0.06	0.06	0.08	0.06	0.06	0.10
	CV %	28.26	33.0	27.58	31.19	26.30	45.47

from late May to November. The soil of experimental site is lateritic and gravelly.

Eighty open pollinated seeds each from trees (more than 10 years age) belonging to six popular cultivars, viz. NRCC Sel 2, Vengurle 4, Vridhachalam 3, Bhaskara, VTH 174 and VTH 30/4 were collected during 2007. All the open pollinated seeds were sown in polybags containing a mixture of sand, soil and farm yard manure in the ratio of 1:1:1. The seedlings were raised in the nursery and seedlings (5 months old) were planted in the field during 2007 at a spacing of 6m×6m. Standard cultural practices were followed for raising the seedling plantation. Growth parameters such as trunk girth, tree height, tree spread and nut yield /tree were recorded from third year onwards during fruiting season with a sample of 16 seedlings in each variety. The fifth year (3<sup>rd</sup> harvest) data recorded was analyzed for descriptive statistics, frequency distribution and correlation analysis using IBM SPSS software version 20. Here the sampled data of each variety and pooled data (96 seedlings) of six varieties was analyzed for descriptive statistics and frequency distribution for growth parameters. Further, nut yield alone was recorded in well established 366 seedlings (entire population) of all six varieties and its data was subjected to descriptive statistics and frequency distribution. The correlation analysis was done using pooled data of six samples (96 seedlings) of six varieties for growth parameters and yield.

## RESULTS AND DISCUSSION

### *Variation in seedlings of varieties*

The trunk girth ranged from 24-63 cm, 40-87 cm, 34-72 cm, 44-80 cm, 26-75 cm and 27-82 cm in seedlings of NRCC Sel 2, Vengurle 4, Vridhachalam 3, Bhaskara, VTH 174 and VTH 30/4 respectively (Table 1). The range for trunk girth was wider in VTH 174 with a CV of 27.89% and narrow in Bhaskara with a CV of 18.89%. The lowest average girth

was recorded in NRCC Sel 2 and the highest was recorded in Bhaskara. The ranges for tree height were 3.25-6.45 m, 4.00-7.45 m, 3.50-7.10 m, 3.75-8.90 m, 5.10-7.25 m and 4.10-7.25 m in seedlings of NRCC Sel 2, Vengurle 4, Vridhachalam 3, Bhaskara, VTH 174 and VTH 30/4. The wide range for this trait was observed in Bhaskara with a CV of 26.72% and narrow range was observed in VTH 174 with a CV of 10.25%. The mean tree height was maximum in VTH 174 and minimum in Vridhachalam 3. The tree spread ranged from 3.50-7.62 m, 3.25-9.72 m, 3.22-7.80 m, 3.87-8.95 m, 4.62-8.90 m and 3.62-9.25 m in seedlings of NRCC Sel 2, Vengurle 4, Vridhachalam 3, Bhaskara, VTH 174 and VTH 30/4 respectively. The wider range for this character was recorded in Vengurle 4 with a CV of 27.84% and narrow range was observed in NRCC Sel 2 with a CV of 20.83%. The mean tree spread was lowest in NRCC Sel 2 and highest in VTH 174. The yield per tree ranged from 0.30-2.98 kg, 0.20-2.98 kg, 0.70-4.41 kg, 0.20-3.38 kg, 0.50-3.05 kg and 0.30-6.90 kg in seedlings of NRCC Sel 2, Vengurle 4, Vridhachalam 3, Bhaskara, VTH 174 and VTH 30/4 respectively. The nut yield range was wider in VTH 30/4 with a CV of 45.47% and narrow in VTH 174 with a CV of 26.30%. The highest mean nut yield per tree (2.40 kg) was observed in Vridhachalam 3. The highest nut yield per tree was recorded in tree number 480 and it belonged to VTH 30/4.

### *Variation in pooled seedling population of six varieties*

The trunk girth, tree height, tree spread and yield per tree ranged from 24-87 cm, 3.25-8.90 m, 3.23-9.73 m and 0.2-6.9 kg respectively in the pooled population (Table 2). The means of trunk girth, tree height, tree spread and yield per tree were 54.78 cm, 5.34 m, 5.83 m and 1.89 kg respectively. The frequency distribution pattern showed that data of trunk girth was moderately negatively skewed indicating more number of seedlings was towards higher side of girth

Table 2 Descriptive statistics for growth parameters (96 seedling progenies) and yield (entire population) of six varieties

Character/Statistic	Girth (cm)	Height (m)	Tree spread (m)	Yield (kg/plant)
Range	24-87	3.25-8.90	3.23-9.73	0.2-6.9
Mean	54.78	5.34	5.83	1.89
SD	13.56	1.13	1.35	0.67
SEm±	1.38	0.12	0.14	0.03
CV%	24.75	21.16	23.16	31.97
Skewness	-0.94	0.72	0.51	1.43
Kurtosis	2.51	0.40	0.19	8.33

(Fig 1). Genetically this implies increasing alleles are in slight excess and dominant for this trait. Whereas tree height and tree spread data was moderately positively skewed indicating more number of seedlings having these traits towards lower side. This implies decreasing alleles are in slight excess and dominant for these traits. The yield data was highly positively skewed revealing majority of seedlings possessing low yield. Genetically decreasing

alleles are in excess and dominant for yield. All growth parameters and yield data exhibited leptokurtic behaviour for the kurtosis values. Particularly, the kurtosis value was very high for yield data describing more of the yield variability is due to a few extreme differences from the mean, rather than a lot of modest differences from the mean.

Correlation analysis

The correlation between trunk girth and nut yield per tree was highly significant and this is in line with the works of Piria and Manivannan (2001), Rao et al. (2002), Abraham et al. (2007). Correlations between tree spread and nut yield per tree was significant and similar observations were found by Abraham et al. (2007), Rao et al. (2002) (Table 3). Correlation analysis among the growth parameters revealed highly significant positive association between trunk girth and tree height, trunk girth and tree spread and tree height and was found also in the studies of Tavares et al. (2011) and Samal et al. (2001). Abraham et al. (2007) reported that tree spread had positive direct effect on nut yield and trunk girth had negative direct effect on nut yield, but it increases

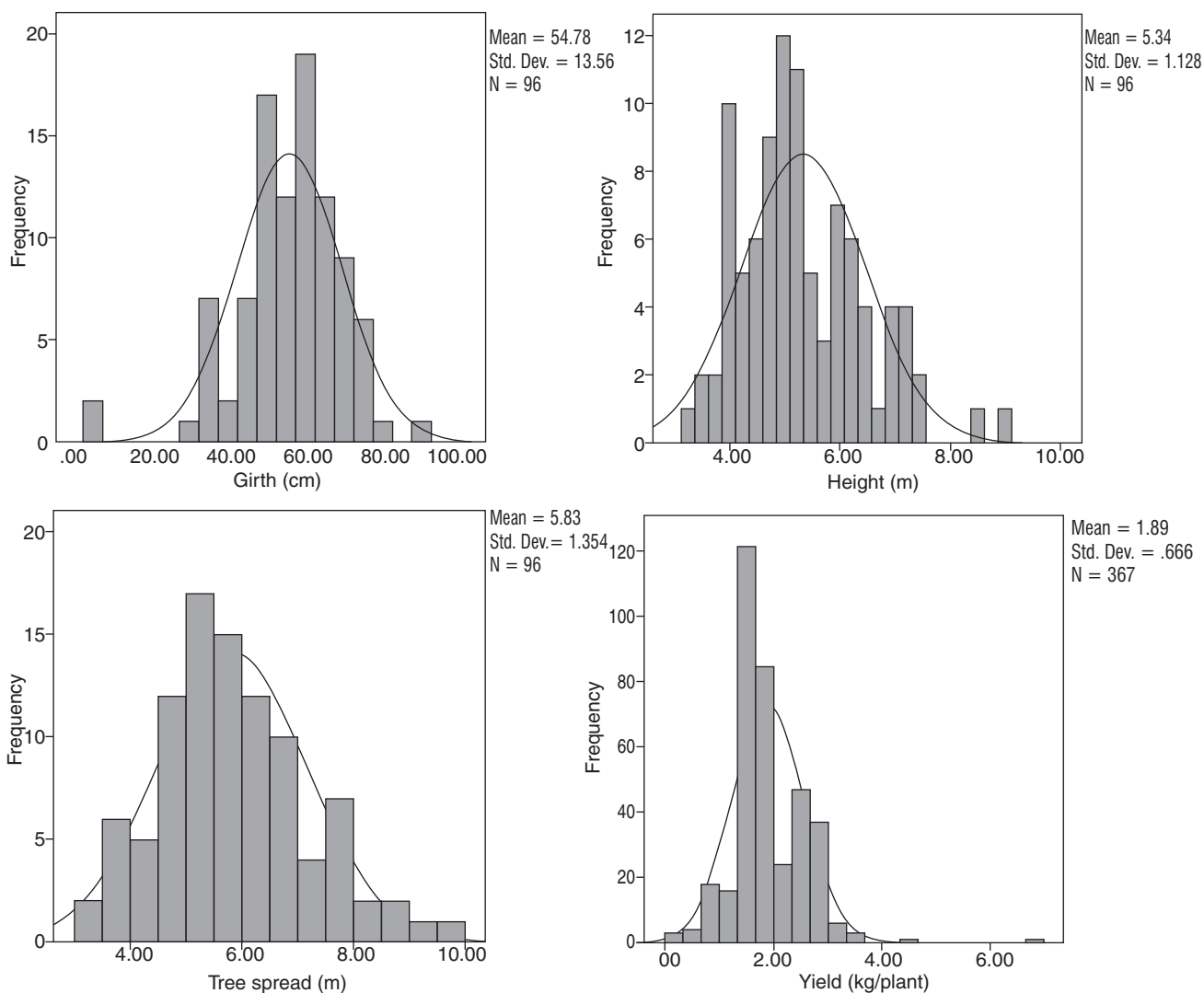


Fig 1 Frequency distribution for girth, height, tree spread (96 progenies) and yield (366 progenies) of six varieties

Table 3 Correlation between growth parameters and yield

	Trunk girth	Tree height	Tree spread	Yield per tree
Trunk girth	1	0.455**	0.653**	0.295**
Tree height		1	0.641**	0.178 <sup>ns</sup>
Tree spread			1	0.230*
Yield per tree				1

\*\*Significant at 1%, \*Significant at 5%, ns: Non-significant

nut yield through its influence on tree spread. This kind of relation among the growth characters suggests that selection for higher trunk girth or tree spread will lead to increased yield as there exists significant positive association between trunk girth and tree spread and both have significant positive correlation with yield.

The progenies of Vridhachalam 3 showed better mean performance for yield followed by VTH 30/4. Hence it can be inferred that breeding value of this variety is high. The frequency distribution pattern revealed that yield data was highly positively skewed indicating more number of progenies yielding towards lower side and describing decreasing alleles are in excess and dominant for this trait. Correlation analysis in the present study revealed that selection for higher trunk girth or tree spread will help in increasing the yield. The important outcome of the study is that tree number 480 a seedling progeny of VTH-30/4 was found promising as it recorded the highest nut yield per tree (6.9 kg). Hence, Tree No. 480 holds promise for cloning and further evaluation to exploit its yield potential.

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