Performance of released cashew (*Anacardium occidentale* L.) varieties under hot and humid climatic zone of Odisha

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**ABSTRACT**

The wide gap between the present level of productivity and potential productivity (2 ton ha\(^{-1}\)) of cashew nut in the country as well as in the state of Odisha is due to use of traditional varieties of low yield potential and non-adoption of scientific orchard management practices. To address the issue of low productivity of cashew in the state, a multi locational trial was laid out during the year 2008 using clonal planting materials of twenty five released cashew varieties collected from different co-operating centres of AICRP on Cashew, India. The collected grafted plants were planted at a spacing of 7.5 m x 7.5 m following Randomized Block Design (RBD) having six plants per treatment and replicated twice. Recommended package of practices were adopted uniformly to raise a good crop. Data recorded on various vegetative growth parameters, yield attributing traits and nut yield of different cashew varieties revealed that Vengurla-7 recorded maximum for the vegetative parameters like tree height (5.45m), trunk girth (84.05cm) and canopy spread in North-South direction (8.75m) while canopy spread in East-West direction was recorded maximum in variety, BPP-8 (8.75m). Maximum number of flowering laterals m\(^{-2}\) was recorded in variety, Chintamani-1(28.87) while variety, BPP-8 recorded maximum nuts m\(^{-2}\) (46.0). Number of nuts panicle\(^{-1}\) recorded maximum in variety, Bhubaneswar-1 (9.0). Nut weight(9.6 g) as well as kernel weight(3.02 g) was recorded maximum in variety, Vengurla-7. Variety, Kanaka recorded highest shelling(32.76%) among the tested varieties. Nut yield per plant was significantly maximum in variety, BPP-8 (16.75 kg plant\(^{-1}\)) while that of lowest in variety Jharagram-1 (1.60kg plant\(^{-1}\)) at 7\(^{th}\) harvest. TSS was recorded maximum in variety, Bhubaneswar-1 while acidity was maximum in variety Vengurla-4 (0.22%). Yield is the ultimate target for any evaluation programme. Evaluation of twenty five released varieties revealed that variety BPP-8 was the highest nut yielder under hot and humid climatic zone of Odisha.

**Key words**: Cashew, Nut yield, Performance, Varieties.

**INTRODUCTION**

Cashew is an important commercial plantation crop of India and widely cultivated in states like Kerala, Tamil Nadu, Maharashtra, Goa, Karnataka, Andhra Pradesh, Orissa, West Bengal and North Eastern states. Presently in India, the area under cashew is about 10.34 lakh hectare with the total raw nut production of 6.70 lakh metric tons and productivity of 605 kg ha\(^{-1}\) (Malhotra *et al.*, 2016). In Odisha cashew is grown in an area of 1.80 lakh ha. with annual nut production of 0.85 lakh ton., is the third largest producer of cashewnut in the country. Productivity of cashew nut in the state is only 474 kg ha\(^{-1}\) for which Odisha cashew processing industry facing a shortfall of 35,000 metric tons raw cashew nut per year. The wide gap between the present level of productivity and potential productivity (2 ton ha\(^{-1}\)) of cashew nut in the country as well as in the state are due to use of traditional varieties of low yield potential, non-adoption of improved management practices and existence of old and senile plantations etc. In the present study an attempt has been made to identify the superior cashew variety(s) suitable for commercial cultivation under the hot and humid agro-climatic conditions of Odisha.

**MATERIALS AND METHODS**

A multi locational trial was laid out during the year 2008 using clonal planting materials of twenty five released cashew varieties collected from different co-operating centres of AICRP on Cashew, India. The collected grafted plants were planted at a spacing of 7.5 m x 7.5 m following Randomized Block Design (RBD) having six plants per treatment replicated twice. Recommended package of practices were adopted uniformly to raise a good crop. The details of source collection of cashew varieties used in the experiment are presented in Table 1. The present study was undertaken for the fruiting season 2016-17(10 year old plants) with an objective to study the nut yield performance of cashew varieties under hot and humid climatic zone of Odisha, India.

Data were recorded on various vegetative growth parameters, yield attributing traits and nut yield of different

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Vegetative Growth Parameters: Statistical analysis of various vegetative growth parameters indicated significant variations among the varieties (Table 2). Among the twenty five tested varieties, Vengurla-7 recorded maximum for the vegetative parameters like tree height (5.45m), trunk girth (84.05cm) and canopy spread in North-South direction (8.75m) while canopy spread in East-West direction was recorded maximum in variety, BPP-8(8.75m). Cashew varieties such as K22-1(4.20m) and VRI-3(4.25m) recorded minimum plant height among the evaluated cashew varieties, indicating their suitability for high density planting. Cashew variety, Madakkathara-2 recorded the minimum trunk girth as well as canopy spread in both in East-West and North-South direction. The number of total laterals m⁻² ranged from minimum 16.37 in Bhubaneswar-1 to maximum 29.50 in Chintamani-1. Hanumanthappa et al., (2014) and Tripathy et al., (2015) reported similar variation in vegetative growth parameters among cashew types.

Yield and Yield Attributes: The results on number of flowering laterals m⁻², nuts panicle⁻¹, number of nuts m⁻², nut weight(g), kernel weight(g) and shelling % revealed significant variations among the varieties (Table 3).
Table 3: Mean of yield attributes of twenty five cashew varieties

| Varieties       | Number of flowering laterals m² | Nuts panicle² | Number of nuts m² | Nut weight (g) | Kernel weight (g) | Shelling % |
|-----------------|---------------------------------|---------------|-------------------|---------------|-------------------|------------|
| BPP-4           | 19.37                           | 5.5           | 41.75             | 7.20          | 0.40              | 0.24       |
| BPP-6           | 23.50                           | 7.5           | 36.50             | 6.45          | 1.85              | 0.28       |
| BPP-8           | 25.50                           | 6.0           | 46.00             | 9.30          | 2.66              | 0.28       |
| Bhubaneswar-1   | 14.00                           | 9.0           | 25.62             | 6.45          | 1.97              | 0.30       |
| Chintamani-1    | 28.87                           | 4.5           | 15.25             | 7.10          | 2.13              | 0.30       |
| Jharagam-1      | 20.87                           | 1.0           | 3.50              | 6.80          | 2.05              | 0.30       |
| Madakathara-1   | 23.12                           | 7.5           | 34.87             | 7.30          | 2.37              | 0.32       |
| Madakathara-2   | 24.87                           | 3.0           | 13.50             | 6.90          | 2.08              | 0.30       |
| K-22-1          | 28.00                           | 4.5           | 15.75             | 6.40          | 1.99              | 0.31       |
| Dhana           | 27.87                           | 3.0           | 14.50             | 7.40          | 2.09              | 0.28       |
| Kanaka          | 18.75                           | 3.0           | 21.37             | 5.70          | 1.87              | 0.32       |
| Priyanka        | 18.37                           | 1.5           | 9.12              | 9.45          | 2.78              | 0.29       |
| Amrutha         | 25.87                           | 3.5           | 13.75             | 6.95          | 2.10              | 0.30       |
| Vengurla-1      | 21.87                           | 3.5           | 17.75             | 6.95          | 2.12              | 0.30       |
| Vengurla-4      | 19.12                           | 5.5           | 26.50             | 7.35          | 2.20              | 0.29       |
| Vengurla-6      | 24.87                           | 7.5           | 21.62             | 8.95          | 2.62              | 0.29       |
| Vengurla-7      | 20.12                           | 3.5           | 17.75             | 9.60          | 3.02              | 0.31       |
| VRI-3           | 21.62                           | 5.5           | 37.87             | 7.05          | 2.34              | 0.28       |
| NRCC Sel-2      | 17.50                           | 4.0           | 26.50             | 8.55          | 2.51              | 0.29       |
| Ullal-1         | 24.25                           | 2.5           | 25.50             | 7.10          | 2.13              | 0.30       |
| Ullal-3         | 20.50                           | 4.0           | 23.12             | 8.15          | 2.20              | 0.26       |
| Ullal-4         | 15.25                           | 5.0           | 24.75             | 8.15          | 2.54              | 0.31       |
| UN-50           | 17.87                           | 2.0           | 25.37             | 8.20          | 2.38              | 0.29       |
| Goa-1           | 20.25                           | 5.5           | 34.87             | 7.55          | 2.45              | 0.32       |
| Bhaskara        | 16.50                           | 6.0           | 34.37             | 7.15          | 2.16              | 0.30       |

SEm(±)  1.61  1.43  0.17  0.05  0.34  0.99
CD (5 %) 4.72  4.19  0.49  0.15  0.99

Maximum number of flowering laterals m² was recorded in variety, Chintamani-1(28.87) followed by BPP-8 (25.50), Madakathara-2 (24.87), K-22-1 (28.00), Dhana (27.87), Amrutha (25.87), Vengurla-6 (24.87) and Ullal-1(24.25). Minimum number of flowering laterals m² was recorded in variety, Bhubaneswar-1 (14.00). Number of nuts panicle¹ recorded maximum in variety, Bhubaneswar-1 (9.0) followed by BPP-6, Madakathara-1 and Vengurla-6(7.5 each). Variety, Jharagam-1 recorded the minimum number of nuts panicle¹(1.0). Average number of nuts m² ranged from minimum 3.50 in Jharagam-1 to maximum 46.0 in BPP-8.

According to Poduval (2015) number of nuts m² contributed towards the total nut yield plant¹ in variety, H-255 under West Bengal condition.

The nut yield varied from minimum 5.7 g in Kanaka to maximum 9.6 g in Vengurla-7. More than 8.0 g nut weight was recorded in BPP-8, Vengurla-6, Priyanka, NRCC Sel-2, Ullal-3, Ullal-4 and UN-50. Tripathy et al. (2015) and Gajbhiye et al., (2015) reported variations in nut weight of different cashew types. It is also revealed that the kernel weight in most of the varieties were more than 2.00 g and maximum kernel weight was recorded in variety Vengurla-7 (3.02g). The kernel weight was recorded minimum in cashew variety, BPP-6(1.85g). Among the tested varieties highest shelling was recorded in variety Kanaka (32.76%) followed by Goa-1(32.39%) and Madakathara-1(32.40%). Minimum recovery of kernel was recorded in variety, Ullal-3.

Table 4: Mean annual nut yield (kg plant⁻¹) and cumulative nut yield (kg plant⁻¹) of twenty five cashew varieties

| Varieties       | Annual nut yield (kg plant⁻¹) | Cumulative nut yield (kg plant⁻¹) |
|-----------------|-------------------------------|-----------------------------------|
| BPP-4           | 13.77                         | 31.21                             |
| BPP-6           | 6.45                          | 28.18                             |
| BPP-8           | 16.75                         | 56.27                             |
| Bhubaneswar-1   | 9.45                          | 30.67                             |
| Chintamani-1    | 6.70                          | 21.19                             |
| Jharagam-1      | 1.60                          | 9.95                              |
| Madakathara-1   | 13.97                         | 35.95                             |
| Madakathara-2   | 2.57                          | 14.05                             |
| K-22-1          | 7.42                          | 20.74                             |
| Dhana           | 9.55                          | 31.91                             |
| Kanaka          | 6.27                          | 24.88                             |
| Priyanka        | 2.37                          | 12.82                             |
| Amrutha         | 4.45                          | 16.27                             |
| Vengurla-1      | 5.32                          | 18.33                             |
| Vengurla-4      | 12.15                         | 33.04                             |
| Vengurla-6      | 13.27                         | 31.24                             |
| Vengurla-7      | 12.8                          | 46.96                             |
| VRI-3           | 9.22                          | 25.57                             |
| NRCC Sel-2      | 11.30                         | 31.38                             |
| Ullal-1         | 6.30                          | 17.82                             |
| Ullal-3         | 5.10                          | 21.19                             |
| Ullal-4         | 6.50                          | 20.68                             |
| UN-50           | 6.95                          | 16.78                             |
| Goa-1           | 9.15                          | 24.73                             |
| Bhaskara        | 13.10                         | 38.38                             |

SEm(±)  0.46  -  
CD (5 %) 1.36  -  

The nut yield varied from minimum 5.7 g in Kanaka to maximum 9.6 g in Vengurla-7. More than 8.0 g nut weight was recorded in BPP-8, Vengurla-6, Priyanka, NRCC Sel-2, Ullal-3, Ullal-4 and UN-50. Tripathy et al. (2015) and Gajbhiye et al., (2015) reported variations in nut weight of different cashew types. It is also revealed that the kernel weight in most of the varieties were more than 2.00 g and maximum kernel weight was recorded in variety Vengurla-7 (3.02g). The kernel weight was recorded minimum in cashew variety, BPP-6(1.85g). Among the tested varieties highest shelling was recorded in variety Kanaka (32.76%) followed by Goa-1(32.39%) and Madakathara-1(32.40%). Minimum recovery of kernel was recorded in variety, Ullal-3.
Table 5: Mean of apple parameters of twenty five cashew varieties

| Varieties   | Apple colour       | Apple weight (g) | TSS° Brix | Acidity (%) |
|-------------|--------------------|------------------|-----------|-------------|
| BPP-4       | Yellow             | 35.60            | 10.08     | 0.15        |
| BPP-6       | Yellow             | 42.27            | 10.63     | 0.14        |
| BPP-8       | Yellow             | 60.00            | 9.96      | 0.19        |
| Bhubesanwar-1| Red               | 39.95            | 12.75     | 0.20        |
| Chintamani-1| Reddish Yellow    | 39.30            | 11.80     | 0.15        |
| Jhargram-1  | Yellow             | 54.80            | 12.10     | 0.14        |
| Madakkathara-1| Yellow          | 47.00            | 11.75     | 0.20        |
| Madakkathara-2| Red              | 34.10            | 10.40     | 0.19        |
| K-22-1      | Red                | 51.75            | 10.05     | 0.11        |
| Dhana       | Yellow             | 52.50            | 10.59     | 0.16        |
| Kanaka      | Yellow             | 65.50            | 11.38     | 0.21        |
| Priyanka    | Reddish Orange    | 98.42            | 9.18      | 0.16        |
| Amrutha     | Yellow             | 37.80            | 11.90     | 0.21        |
| Vengurla-1  | Reddish yellow    | 38.20            | 10.64     | 0.19        |
| Vengurla-4  | Red                | 57.60            | 10.84     | 0.22        |
| Vengurla-6  | Yellow             | 69.70            | 9.51      | 0.17        |
| Vengurla-7  | Yellow             | 56.50            | 11.01     | 0.19        |
| VRJ-3       | Red                | 34.30            | 10.75     | 0.18        |
| NRCC Sel-2  | Red                | 74.35            | 10.09     | 0.17        |
| Ullal-1     | Yellow             | 44.15            | 11.54     | 0.16        |
| Ullal-3     | Red                | 48.15            | 10.81     | 0.19        |
| Ullal-4     | Yellow             | 54.40            | 12.31     | 0.19        |
| UN-50       | Reddish yellow    | 52.55            | 10.46     | 0.19        |
| Goa-1       | Yellow             | 69.30            | 10.95     | 0.13        |
| Bhaskara    | Orange             | 65.20            | 10.53     | 0.16        |

SEm(±) - 2.47, CD (5 %) - 7.21

(28.14%). Similar variations in shelling % of cashew varieties has been reported by Gajbhiye et al., (2015) and Poduval (2015).

The tested varieties also revealed significant variations for mean annual nut yield (kg plant⁻¹) as well as cumulative nut yield plant⁻¹ during the period of investigation (Table 4). Significantly highest nut yield was recorded in variety, BPP-8 (16.75 kg plant⁻¹) while that of lowest in variety Jhargram-1 at the 7th harvest. Cashew varieties which recorded > 10 kg annual nut yield plant⁻¹ at 7th harvest(10 year old plants) were NRCC Sel-2(11.30), Vengurla-4(12.15), Vengurla-7(12.80), Bhaskara (13.10), Vengurla-6 (13.27), BPP-4 (13.77) and Madakkathara-1(13.97). Hence, these varieties have the potential of producing higher nut yield than rest of the tested varieties. Cumulative nut yield plant⁻¹ for 7 harvests was also recorded maximum for the above mentioned varieties during the study (Table 4). Tripathy et al., (2015) reported similar variations in nut yield of different cashew types under Odisha condition.

**Physico-Chemical Parameters:** Wide variations were observed for various physico-chemical parameters of cashew apple such as colour, weight, TSS⁰(brix) and acidity(%) (Table 5). Yellow colour was found to be a dominating colour among the tested varieties. Weight of cashew apple ranged from minimum 34.10g in Madakkathara-1 to maximum 98.42 g in Priyanka. Among the twenty five varieties evaluated, the TSS ranged from minimum of 9.18° brix in Priyanka to maximum 12.75° brix in Bhubaneswar-1. Significantly maximum acidity(%) was recorded in variety, Vengurla-4(0.22%) while the minimum was recorded in variety, K 22-1(0.11%). TSS and Acidity are two important biochemical parameters of cashew apple which determine the quality of preserve product in cashew. Anand et al., (2015) Hore et al., (2015) and Tripathy et al.,( 2015) reported variation in cashew apple weight, TSS and acidity content of different cashew types.

**CONCLUSION**
Evaluation of twenty five released cashew varieties revealed that variety, Vengurla-7 was the most vigorous plant having maximum plant height, trunk girth and canopy spread. variety, chintamani -1 produced maximum vegetative as well as reproductice shoot. Nut weight as well as kernel weight were highest in variety, Vengurla-7. Variety, BPP-8 produced maximum nut m⁻² and was the maximum nut yielder (16.75 kg plant⁻¹) at 7th harvest under the hot and humid climatic zone of Odisha. So, cashew variety, BPP-8 may recommended for commercial cultivation in the state of Odish to achieve the targeted yield of 2 ton. ha⁻¹.
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