Environment and Ecology 40 (2) : 373—380, April—June 2022
ISSN 0970-0420

Evaluation of the Released Cashewnut Varieties under the Semi Arid Zone of West Bengal

Mini Poduval

Received 4 October 2021, Accepted 6 March 2022, Published on 27 April 2022

ABSTRACT

Most of the existing cashew orchards of West Bengal are seedling plantations of non-descriptive origin. Therefore, the productivity as well as the size of the nuts is very low. Therefore, research priorities for the state are needed to be projected towards development of region specific varieties through selection from the existing wealth of germplasms as well as evaluating high yielding varieties from other states under the agro climatic situation of the semi arid region. Thus the present experiment was conducted for selecting high yielding varieties suitable for the semi arid region of West Bengal. The trial was carried out at the Regional Research Station, Bidhan Chandra Krishi Viswavidyalaya, Jhargram,West Bengal under All India Coordinated Research Project on Cashew during 2010 to 2019. Twenty four released cashew varieties were evaluated for growth and reproductive characters. It was noticed that VRI- 1, Bhubaneswar – 1 and Madakkathara – II will be suitable for high density planting. Three varieties like Vengurla – 7, Priyanka and UN – 50 produced bold nuts. At the age of 10 years highest yield was recorded in Vengurla- 7 (10.69 kg/tree) followed by Bhaskara (8.75 kg/tree). Considering the main four yield characters i.e., nut weight, shelling %, yield/tree and cumulative yield/tree for recommending varieties for the red and laterite zone of West Bengal, Vengurla – 7, Bhaskara, Ullal- 3, , BPP- 8 and Madakkathara - II were found suitable for this region.

Keywords Nut weight, Shelling percentage, Varieties, Yield.

INTRODUCTION

In India cashew (*Anacardium occidentale* L.) is grown in an area of 10.62 lakh hectares with a total production of 8.17 lakh MT of raw nuts were recorded during 2017–18. India is the largest producer of raw cashewnut contributing 20% of total global production, but the productivity of cashew in India is very low 753 kg/ha (dccd.gov.in 2017 – 18). One of the major causes for decline in productivity was raising of plantation using unselected seedlings instead of vegetatively propagated material. According to Rejani and Yadukumar (2010) in India, usually cashew is grown as a rainfed crop, cultivated in neglected land which otherwise unsuitable for any other crop. West Bengal contributes only 1.59% in production. In West Bengal the cashew growing areas are restricted to the coastal and semi arid regions of the state. The semi arid zone comprises of more or less 6 districts, viz., Bankura, Purulia, Paschim Medinipur, Parts of Birbhum and Burdwan. Most of the existing cashew orchards of these areas are seedling plantations of non-descriptive origin.

Mini Poduval
Associate Professor, AICRP on Cashew, Regional Research Station, Bidhan Chandra Krishi Viswavidyalaya, Jhargram, West Bengal 721507, India
Email : poduval.mini@bckv.edu.in

Table 1. Details of cashew varieties collected from different centers of AICRP on cashew.

Sl. No.	Name of cashew variety	Source
1	BPP- 4, BPP – 6, BPP- 8	CRS, Bapatla, Andhra Pradesh
2	Bhubaneswar –1	CRS, OUAT, Bhubaneswar, Odisha
3	Chintamani – 1, Ullal- 3, Ullal- 4	HRS, UHS, Hogalagere, Karnataka
4	Jhargram – 1	RRS, BCKV, Jhargram, ? West Bengal
5	Madakkathara – I, Madakkathara – II, Kanaka, Dhana, K -22 -1, Priyanka, Amrutha	CRS, KAU, Madakkathara, Kerala
6	Vengurla – 1, Vengurla- 4, Vengurla- 6, Vengurla- 7, UN- 50	RARS, Vengurla, BSKKV, Maharastra
7	VRI - 3	RRS, TNAU, Vridhachalam, Tamil Nadu
8	Bhaskara, NRCC – 2	ICAR – DCR, Puttur, Karnataka
9	Goa - 1	ICAR – Research Complex, Goa

Therefore, the productivity as well as the size of the nuts is very low. For this reason, the farmers are not getting good price for their product. Even the processing units are rejecting the small nuts due to their small size. Therefore, research priorities for the state are needed to be projected towards development of region specific varieties through selection from the existing wealth of germplasms as well as also evaluating high yielding varieties and hybrids from other states under the agro climatic situation of the semi arid region. Thus the present experiment was carried out for selecting high yielding varieties suitable for the semi arid region of West Bengal from the different released varieties

Table 2. Height (m) of cashew genotypes during 2012 – 2019.

Varieties	2012	2013	2014	2015	2016	2017	2018	2019
Bhaskara	1.81	2.88	3.31	3.66	4.34	4.93	5.00	5.30
Madakkathara II	1.56	2.51	2.70	3.16	3.81	4.10	4.51	4.53
Bhubneswar -1	1.32	2.66	2.63	2.78	3.61	4.01	4.38	4.08
K – 22 -1	1.50	2.35	2.80	3.04	4.20	4.70	5.06	5.38
Chintamani - 1	1.26	2.30	2.66	3.36	4.31	5.04	5.34	6.33
Ullal 4	1.63	2.38	3.33	3.44	4.03	4.95	5.09	5.73
Vengurla - 7	1.35	2.74	2.99	3.46	4.78	5.09	5.88	6.08
VRI - 3	1.46	2.73	2.50	2.91	3.30	3.69	4.21	4.25
BPP - 6	1.75	2.35	2.78	3.16	4.49	4.96	5.66	5.60
Amrutha	1.41	2.88	2.61	2.85	3.53	4.06	4.28	4.95
Vengurla - 4	1.39	2.51	2.88	3.19	3.86	4.51	5.15	5.21
Goa - 1	1.31	2.49	2.61	3.45	4.58	5.09	5.60	5.95
Madakkathara I	1.29	1.90	2.45	3.08	3.99	4.49	5.05	5.15
Priyanka	1.83	2.86	2.50	3.44	4.31	4.25	4.85	5.25
BPP - 8	1.58	2.86	2.64	3.16	3.98	4.00	5.06	5.08
Kanaka	1.25	2.41	2.70	3.30	4.29	4.46	4.88	5.60
Vengurla - 1	1.41	2.50	2.86	3.16	4.04	4.13	4.79	5.75
Vengurla - 6	1.49	2.49	2.53	3.11	3.89	3.91	4.58	4.68
Ullal - 3	1.35	2.41	2.63	3.59	4.95	5.28	5.26	5.95
Dhana	1.21	2.45	3.00	3.11	4.24	4.70	5.00	5.43
BPP - 4	1.39	2.46	2.80	3.00	4.35	4.66	5.01	5.29
UN - 50	1.30	2.74	3.08	3.35	4.48	4.54	4.81	5.38
Jhargram - 1	1.43	2.49	2.94	3.10	3.53	3.74	4.09	4.61
NRCC - 2	1.17	2.39	2.96	2.93	4.09	4.46	4.90	4.90
SEm ±	0.10	0.12	0.12	0.10	0.15	0.19	0.23	0.21
CD at 5%	0.28	0.35	0.33	0.30	0.44	0.54	0.64	0.60

Table 3. Trunk girth (cm) of cashew genotypes during 2012 – 2019.

Varieties	2012	2013	2014	2015	2016	2017	2018	2019
Bhaskara	12.25	21.75	33.00	41.75	50.50	55.00	61.25	67.75
Madakkathara II	12.75	22.00	29.75	37.00	44.75	50.50	58.50	67.50
Bhubneswar -1	12.75	21.25	26.50	28.00	38.50	44.00	49.50	53.75
K – 22 -1	11.75	21.50	33.50	40.00	54.00	62.25	69.50	78.75
Chintamani - 1	11.75	21.00	27.75	35.00	44.25	52.25	61.50	74.00
Ullal 4	13.00	20.25	35.25	37.75	50.00	53.50	60.50	70.75
Vengurla - 7	12.75	23.75	34.25	44.25	54.25	61.50	69.50	74.50
VRI - 3	12.00	23.50	28.25	35.50	40.00	45.00	51.25	57.50
BPP - 6	13.75	22.50	34.75	39.75	50.75	57.50	66.00	75.75
Amrutha	13.00	24.25	31.25	36.25	43.25	48.00	50.50	56.00
Vengurla - 4	12.00	21.25	31.00	38.50	46.75	51.00	56.00	56.75
Goa – 1	13.25	22.00	32.00	38.75	49.50	58.75	66.75	81.00
Madakkathara I	10.00	18.00	26.25	34.25	42.75	50.25	56.50	70.75
Priyanka	13.75	24.00	30.00	43.00	49.50	54.50	59.50	69.50
BPP - 8	14.00	19.50	33.25	39.75	47.25	46.25	59.00	64.75
Kanaka	11.25	23.25	26.75	38.50	47.00	51.50	60.50	69.25
Vengurla - 1	11.75	22.00	33.25	37.00	48.75	52.25	59.00	67.50
Vengurla - 6	12.25	24.00	32.00	39.00	46.00	50.25	57.75	59.00
Ullal - 3	11.75	21.25	35.00	37.75	51.25	56.50	62.25	73.00
Dhana	11.75	23.25	31.50	45.25	56.75	64.00	72.75	82.00
BPP - 4	10.75	22.35	31.50	38.25	46.00	55.75	58.25	72.75
UN - 50	10.50	21.25	32.50	42.25	51.25	43.38	61.75	74.25
Jhargram - 1	11.25	19.50	30.75	37.50	40.75	33.13	49.50	58.50
NRCC - 2	11.00	24.50	31.00	40.25	49.25	57.25	66.50	72.00
SEm ±	0.59	NS	1.36	1.78	1.85	4.52	2.88	3.24
CD at 5%	1.66	NS	3.85	5.04	5.24	12.76	8.12	9.15

from different parts of India.

MATERIALS AND METHODS

The trial of cashewnut varieties was carried out at the Regional Research Station, Bidhan Chandra Krishi Viswavidyalaya, Jhargram, West Bengal under All India Coordinated Research Project on Cashew (latitude 22° 45'67"N longitude 87°01'22" E and altitude 78.8 msl) during 2010 to 2019. The soil of the

Table 4. Canopy spread (m) of cashew genotypes during 2012 – 2019.

Varieties	2012	2013	2014	2015	2016	2017	2018	2019
Bhaskara	1.31	2.85	3.77	5.22	4.84	6.31	6.96	6.77
Madakkathara II	1.41	2.70	2.54	3.48	4.51	5.43	6.06	5.44
Bhubneswar -1	1.14	2.62	2.96	3.16	4.82	5.72	5.93	5.00
K – 22 -1	1.38	2.87	3.08	4.00	5.23	5.61	6.55	6.68
Chintamani - 1	0.94	3.03	2.82	3.38	5.50	6.34	7.02	7.08
Ullal 4	1.62	2.88	3.31	4.37	5.33	6.30	6.63	7.04
Vengurla - 7	1.31	3.38	3.16	4.73	6.24	6.26	6.80	7.58
VRI - 3	1.41	3.26	2.86	3.84	4.59	4.83	5.79	5.94
BPP - 6	1.55	2.66	3.35	4.28	5.81	6.76	7.09	7.68
Amrutha	1.23	3.05	2.78	3.43	4.09	4.63	5.35	5.76
Vengurla - 4	1.19	2.53	3.14	4.18	4.39	5.72	6.54	6.07
Goa – 1	1.14	2.83	2.93	3.91	5.64	6.27	6.27	7.39
Madakkathara I	0.91	2.20	2.27	3.07	4.60	4.93	5.24	6.79
Priyanka	1.60	3.10	2.85	4.61	5.63	5.23	6.79	7.06
BPP - 8	1.48	3.08	2.61	4.18	5.18	5.00	6.53	6.68
Kanaka	1.25	3.20	2.58	4.29	5.11	5.09	6.28	6.81
Vengurla - 1	1.15	2.76	3.05	3.52	4.69	5.08	6.17	6.81

Table 4. Continued.

Varieties	2012	2013	2014	2015	2016	2017	2018	2019
Vengurla - 6	1.25	2.82	2.72	4.02	6.14	6.21	6.01	5.89
Ullal - 3	1.20	2.98	3.04	3.86	6.11	6.63	6.49	7.29
Dhana	1.10	3.10	3.22	3.97	5.14	6.69	6.37	7.17
BPP - 4	1.03	2.65	3.11	3.48	5.58	5.80	6.13	6.77
UN - 50	1.15	2.74	2.86	3.88	5.86	5.98	5.99	7.12
Jhargram - 1	1.18	2.88	2.91	3.68	4.71	4.75	6.14	5.84
NRCC - 2	1.10	2.63	3.17	3.34	5.05	5.35	5.84	6.24
SEm +	0.09	0.16	0.13	0.22	0.26	0.39	0.32	0.38
CD at 5%	0.26	0.46	0.37	0.63	0.74	1.11	0.89	1.07

experimental plot was red lateritic in texture with pH of 5.0. Grafted plants of twenty four released cashew varieties developed by different Cashew Research Stations of the country were planted with a spacing of 6 m x 6 m in 2010 by adopting Randomized Block Design (RBD), replicated thrice having four plants per treatment and followed recommended package of practices. The details of source of cashew varieties are presented in (Table 1). The growth parameters such as tree height, tree trunk girth, canopy spread, canopy area were recorded every year, similarly, yield parameters such as flowering laterals per square meter, nuts per square meter, average nut weight, nuts panicle^{-1}, apple weight, yield/tree and shelling percentage were recorded and calculated by adopting standard procedures as follows. Canopy spread was calculated by taking average of the diameter of both north- south and east – west direction. Canopy area was calculated using the formula πrl (Where $\pi = 3.14$, r = radius of canopy, $l = \sqrt{(r^2 + h^2)}$, h (Canopy height) = Plant height – trunk heigh) The shelling % was calculated using the formula Shelling %= (KWt/NtWt) ×100, where KWt= kernel weight and NWt= Nut weight. Similarly, nut yield tree-1 was calculated by adding the total individual nut yield harvested each time. Statistical analysis of all the recorded data were done by adopting the standard procedure suggested by Panse and Sukhatme (1989).

RESULTS AND DISCUSSION

Tables 2-7 represent the analyzed data on different parameters recorded during 2012 to 2019. Growth data such as plant height, trunk girth, canopy spread, canopy area, vegetative laterals per square meter of canopy were recorded from second year of planting while yield attributes like number of inflorescence per square meter of canopy, number of nuts per square meter of canopy, nut weight, apple weight, yield per tree, shelling percentage were recorded from third year onwards. Throughout the period of study significant variations were observed among the varieties with respect to height of plant. Initially during the second year of study (2012) the varieties like Madakkathara – II, BPP- 8, Ullal- 4, BPP - 6, Bhaskara and Priyanka were taller than the rest of the varieties. Under the red and laterite zone of West Bengal, it was observed that the varieties like Vengurla – 7, Goa – 1, BPP- 6, Chintamani – I and Ullal- 3 were become the taller plants among the 24 varieties studied with a height range between 5.75 m to 6.33 m at the age of 9 years. On the other hand, the plants with short height were Bhubaneswar – 1, VRI- 3, Madakkathara- II, Vengurla - 6 and Jhargram -1 with a height range between 4.08 m to 4.68 m at the age of 9 years.

In case of trunk girth, significant differences were noticed among the varieties. With the increase in age the difference in trunk girth among the varieties went on increasing. The range of girth among the varieties was 10 – 14 cm in the second year, 18 – 26 cm in the third year, 26.25 – 35.25 cm in the fourth year, 28 – 45.25 cm in the fifth year, 38.5 – 56.75 cm in the sixth year, 44 – 64 cm in the seventh year 49.5 – 75.25 cm in the eighth year and 53.75 – 82 cm at the end of ninth year of study. It was observed that after ten years of planting the cashew varieties like Bhubaneswar – 1, Amrutha, Vengurla- 4, VRI- 3, Jhargram- 1 and Vengurla- 6 had minimum trunk girth in the range of 53.75 to

Table 5. Canopy area (m^2) of cashew genotypes during 2012 – 2019.

Varieties	2012	2013	2014	2015	2016	2017	2018	2019
Bhaskara	2.55	14.42	21.75	32.48	29.54	46.79	57.04	53.96
Madakkathara II	2.96	11.81	9.35	16.78	24.43	35.76	44.13	32.31
Bhubneswar -1	2.04	11.04	10.17	12.06	25.04	40.38	42.65	27.01
K – 22 -1	2.78	12.79	13.17	18.56	32.37	41.33	49.24	52.96
Chintamani - 1	1.22	12.45	11.29	15.33	35.53	45.96	57.38	58.70
Ullal 4	3.75	13.26	17.50	23.84	32.88	50.63	49.29	57.84
Vengurla - 7	2.52	17.10	13.24	24.89	43.69	47.79	55.89	63.38
VRI - 3	2.54	14.55	11.13	19.71	26.32	29.49	40.99	38.57
BPP - 6	3.55	11.95	13.29	20.18	38.96	50.53	60.07	63.37
Amrutha	2.32	13.89	11.32	13.49	20.18	27.18	32.66	39.02
Vengurla - 4	1.91	10.58	12.98	19.92	22.48	36.80	48.21	43.29
Goa – 1	1.92	11.05	11.04	19.49	39.32	47.05	46.82	59.29
Madakkathara I	1.29	6.98	7.20	13.02	27.75	31.73	36.33	50.23
Priyanka	3.52	7.81	9.10	24.75	39.58	35.79	56.13	55.15
BPP - 8	3.04	11.22	10.26	19.22	31.35	31.44	49.48	48.51
Kanaka	2.19	12.42	9.01	22.12	35.11	32.75	43.32	49.86
Vengurla - 1	2.19	12.34	11.92	14.18	26.78	28.75	40.41	56.88
Vengurla - 6	2.19	11.72	10.16	19.49	45.86	45.62	39.97	41.50
Ullal - 3	1.99	13.44	12.17	19.06	45.70	52.30	48.11	62.10
Dhana	1.57	11.23	13.37	17.67	31.27	49.08	43.21	54.56
BPP - 4	1.85	12.36	13.33	15.06	38.85	39.76	43.59	50.84
UN - 50	1.70	11.47	13.01	17.79	38.68	38.67	41.14	57.79
Jhargram - 1	2.22	14.32	12.16	15.54	28.42	24.86	37.34	38.78
NRCC - 2	1.79	14.24	13.84	13.07	31.67	34.61	39.99	43.35
SEm +	0.33	1.35	1.02	2.11	3.24	4.78	4.29	5.15
CD at 5%	0.93	3.81	2.88	5.96	9.16	13.49	12.13	14.55

59 cm those varieties were on par with respect to trunk girth. While Dhana, Goa- 1, K- 22-1, BPP- 6, Vengurla- 7, UN- 50, Chintamani- 1, Ullal- 3, BPP – 4 and NRCC- 2 were having a trunk girth range between 72 – 82 cm and those varieties were also on par with respect to trunk girth.

The range of canopy spread was between 5 – 7.68 m at the age of 10 years. The spacing was given 6 m x 6 m and the varieties attended a canopy spread less than 6 m were Bhubaneswar – 1, Madakkathara-II, Amrutha, Jhargram -1, Vengurla - 6 and VRI-3. More than 600% increase in canopy spread was recorded in Chintamani – 1(653.19%) and Madakkathara -1 (646.15 %). Some of the varieties like Ullal- 3, UN – 50, Goa- 1, Dhana and BPP – 4 had more than 500% increase in canopy spread from the initial stage. The varieties with compact and less canopy area were Bhubaneswar – 1, Madakkathara-II, VRI- 3, Jhargram -1, Amrutha, Vengurla- 6, Vengurla – 4 and NRCC- 2 while big area was covered by Ullal- 3, BPP – 6 and Vengurla- 7.

There were significant variation was noticed among the varieties with respect to canopy area. Initially at the second year the canopy of the varieties like K-22-1, Madakkathara – II, BPP -8, Priyanka, BPP- 6 and Ullal- 4 increased maximum but gradually canopy of other varieties like Chintamani - 1, Goa – 1, Ulla l- 3, BPP- 6 and Vengurla-7 expanded to cover maximum area.Maximu expansion was in Chintamani – 1 (4711.48%) followed by Madakkathara - I (3793.80%) and Dhana (3375.16%). Minimum expansion was recorded in VRI- 3 (1418.5%), Bhubaneswar – 1(1224.02%) and Madakkathara – II (991.55%). Therefore, while going for establishing an orchard with particular varieties the canopy coverage in 10 years time can be easily calculated and accordingly spacing can be decided. It is noticed that VRI- 1, Bhubaneswar – 1 and Madakkathara – II will be suitable for high density planting. Pooled data revealed that maximum number of flowers/sq m of canopy was produced by Jhargram – 1 (15.08) which

Table 6. Pooled mean of yield attributing parameters of cashew during 2013 – 2019. * Subject to DMRT.

Varieties	Flowering /m^2	Nuts /m^2	Nuts/panicle	Nut weight (g)	Apple weight (g)	Shelling %
Bhaskara	8.90 ^{d}	21.21^{b}	6.63^{b}	6.64 ^{bcdefg}	60.94^{a}	32.27
Madakkathara II	12.28 ^{abc}	21.01^{b}	6.55^{b}	6.03 ^{cdefgh}	48.15^{a}	32.01
Bhubneswar -1	13.59 ^{abc}	47.84^{a}	13.47^{a}	4.91 ^{h}	37.77^{b}	32.85
K – 22 -1	12.58 ^{abc}	20.19^{b}	7.42^{b}	5.91 ^{cdefgh}	48.03^{a}	32.10
Chintamani - 1	11.03 ^{abc}	20.83^{b}	9.37^{b}	5.63 ^{defgh}	38.69^{b}	30.12
Ullal 4	11.06 ^{abc}	22.03^{b}	5.93^{b}	5.74 ^{defgh}	61.72^{a}	31.82
Vengurla - 7	10.98 ^{abc}	20.53^{b}	5.88^{b}	8.04 ^{a}	62.28^{a}	31.88
VRI - 3	13.98 ^{abc}	21.15^{b}	5.63^{b}	5.87 ^{cdefgh}	45.81^{a}	32.87
BPP - 6	8.70^{d}	15.50^{c}	6.46^{b}	5.03 ^{h}	49.64^{a}	30.09
Amrutha	12.29 ^{abc}	25.15^{b}	8.87^{b}	5.97 ^{cdefgh}	48.22^{a}	31.51
Vengurla - 4	9.15^{d}	31.00^{b}	8.37^{b}	6.05 ^{cdefgh}	50.44^{a}	29.99
Goa – 1	9.08^{d}	20.25^{b}	8.03^{b}	6.27 ^{cdefgh}	55.26^{a}	29.48
Madakkathara I	10.58^{bc}	16.05^{b}	4.91^{b}	5.27 ^{h}	39.76^{b}	30.99
Priyanka	11.30^{abc}	11.48^{c}	3.59^{c}	7.44 ^{ab}	66.24^{a}	27.38
BPP - 8	12.46^{abc}	21.32^{b}	6.08^{b}	6.89 ^{bcde}	65.93^{a}	29.90
Kanaka	12.00^{abc}	21.67^{b}	5.11^{b}	5.37 ^{gh}	55.72^{a}	32.16
Vengurla - 1	9.58^{d}	28.27^{b}	9.55^{b}	5.52 ^{efgh}	54.55^{a}	30.66
Vengurla - 6	11.68^{abc}	21.64^{b}	5.55^{b}	5.88 ^{cdefgh}	57.70^{a}	30.11
Ullal - 3	8.77^{d}	20.00^{b}	7.37^{b}	6.91 ^{bcd}	59.71^{a}	30.31
Dhana	8.68^{d}	15.58^{c}	6.50^{b}	6.75 ^{bcdef}	56.63^{a}	28.97
BPP - 4	10.57^{bc}	23.05^{b}	7.78^{b}	4.95 ^{h}	43.86^{b}	28.70
UN - 50	10.69^{bc}	18.71^{b}	6.79^{b}	7.14 ^{bc}	55.64^{a}	30.27
Jhargram - 1	15.08^{a}	24.81^{b}	7.13^{b}	5.32 ^{gh}	51.77^{a}	32.77
NRCC - 2	14.74^{ab}	23.68^{b}	6.28^{b}	6.11 ^{cdefgh}	51.98^{a}	35.01
SEm ±	0.86	2.74	0.85	0.24	3.74	NS
CD at 5%	2.41	8.28	2.58	0.74	11.31	

was on par with NRCC- 2, VRI- 3, Bhubaneswar -1, K- 22 – 1, BPP- 8, Amrutha, Madakkathara - II, Kanaka, Vengurla 6, Priyanka, Ullal- 4, Chintamani-1 and Vengurla-7. Vikram *et al*. (2013) reported Significantly higher number of panicles per square meter of canopy in Vengurla-7(18.41), which was on par with VRI-3 (15.67). Number of nuts/ sq m was maximum in Bhubaneswar -1 (47.84). In most of the other varieties were on par with respect to nuts/sq m except Priyanka, BPP – 6 and Dhana where it was minimum, ranging from 11.48 – 15.50. Among the cluster bearing varieties Bhubaneswar -1 had highest number of nuts /panicle (13.47). According to Chandrasekhara *et al.* (2018), under Odisha condition also number of nuts panicle-1 recorded maximum in variety, Bhubaneswar-1 (9.0). Other cluster bearing types were Vengurla- 1 (9.55), Chintamani – 1 (9.37), Amrutha (8.87), Vengurla – 4 (8.37) and Goa – 1(8.03). Lowest number of nuts /panicle was recorded in Priyanka (3.59). The varieties could be grouped into three different groups based on the nut weight i.e. bold nut having weight between (7- 9) g, medium nut weight between (5 - 7) g and small nut <5 g. Among the 24 varieties pooled data depicted that three varieties like Vengurla – 7, Priyanka and UN – 50 produced bold nuts. Most of the other varieties had produced medium sized nuts. Among the twenty four varieties, Bhubaneswar – 1 and BPP – 4, produced small sized nuts having 4 - 5 g nut weight. Tripathy *et al.* (2015) reported slightly higher value of the nut weight in coastal Odisha condition. It establish the fact that in cashew, the nut weight is highly influenced by genetically and environmentally (Manoj and George 1993).

Significant variations were observed with respect to apple weight of the varieties. Except four, BPP – 4, Madakkathara- 1, Bhubaneswar – 1 and Chintamani- 1, most of the other varieties were on par with respect to apple weight. The range was between 45.81 – 66.24 g. Pooled data on shelling % showed that except Vengurla- 4, BPP – 8, Goa-1, Dhana and BPP- 4 all other varieties had more than 30% shelling recovery and the highest was in

Table 7. Yield/tree (kg) of cashew genotypes during 2013 – 2019. **In 2017 Crop damaged due to hail storm.

Varieties	2013	2014	2015	2016	2017 **	2018	2019	Pooled	DMRT	Cumulative yield for 6 harvests (kg/tree)
Bhaskara	1.11	1.91	3.77	9.67		9.62	8.75	5.81	a	34.85
Madakathara II	0.30	1.75	2.37	3.21		6.51	5.09	3.21	abcd	18.36
Bhubneswar 1	1.68	1.52	4.76	7.02		13.54	4.83	5.56	abc	24.72
K – 22 -1	1.02	1.45	2.58	6.38		7.87	4.08	3.90	abcd	19.30
Chintamani 1	0.68	1.18	2.02	4.24		9.63	3.99	3.62	abcd	16.68
Ullal 4	1.50	1.41	4.38	5.53		7.20	4.66	4.11	abcd	23.04
Vengurla 7	0.57	1.80	7.53	3.91		9.00	10.69	5.58	ab	36.93
VRI - 3	1.28	0.91	3.56	4.46		4.32	3.30	2.97	bcd	18.47
BPP-6	0.47	1.38	2.16	3.80		4.93	3.68	2.74	bcd	15.88
Amrutha	1.90	1.81	1.94	3.64		5.84	3.35	3.08	bcd	18.08
Vengurla 4	1.28	1.77	5.10	4.20		10.91	5.05	4.72	abcd	23.14
Goa 1	0.83	1.55	2.14	4.53		8.90	5.22	3.86	abcd	18.90
Madakkathara I	0.46	0.54	1.27	4.01		2.92	3.99	2.20	cd	14.22
Priyanka	0.38	0.55	3.25	4.04		5.89	4.68	3.13	abcd	17.68
BPP-8	1.76	0.65	3.91	7.05		8.26	5.02	4.44	abcd	23.66
Kanaka	1.16	0.95	2.74	4.40		4.11	6.05	3.24	abcd	22.06
Vengurla1	1.30	0.95	1.72	5.27		5.92	5.48	3.44	abcd	19.67
Vengurla 6	1.13	0.51	2.64	4.80		6.81	4.81	3.45	abcd	17.87
Ullal 3	1.17	0.34	4.17	6.95		9.17	7.68	4.91	abcd	27.78
Dhana	1.03	0.84	2.19	3.90		7.04	5.27	3.38	abcd	19.54
BPP 4	0.64	0.92	1.57	5.71		7.67	3.09	3.27	abcd	15.54
UN-50	0.78	1.87	1.86	4.19		6.68	6.81	3.70	abcd	23.15
Jhargram1	1.50	1.00	1.95	4.71		7.80	3.86	3.47	abcd	16.82
NRCC-2	1.11	1.97	1.50	5.37		10.08	3.74	3.96	abcd	17.84
SEm ±	0.15	0.25	0.49	0.80		1.53	0.59	0.50		
CD at 5%	0.43	0.71	1.37	2.26		4.33	1.67	1.50		
CV%	29.44	21.01	32.80	31.81		20.69	23.06	34.30		

NRCC- 2 (35.01). At the age of 10 years highest yield was recorded in Vengurla- 7 (10.69 kg/tree) followed by Bhaskara (8.75 kg/tree). But varieties like Chintamani 1, Madakkathara I, Jhargram1, NRCC-2, BPP- 6 and Amrutha yielded less than 4 kg/tree. Pooled data depicted that Vengurla – 7, Bhaskara and Bhubaneswar – 1 yielded an average of 5- 6 kg/tree. The productivity of Bhubaneswar-1 the variety from OUAT Bhubaneswar was almost same in Odisah as well as West Bengal condition (Tripathy *et al.* 2015). Cumulative data revealed that highest yielding varieties were Vengurla – 7, Bhaskara, Ullal- 3, Bhubaneswar – 1, BPP – 8, UN-50, Vengurla- 4, Ullal- 4 and Kanaka produced more than 20 kg/tree for six harvests.

CONCLUSION

Therefore, considering the main four yield characters i.e. nut weight, shelling %, yield/tree and cumulative yield/tree for recommending varieties for the red and laterite zone of West Bengal, Vengurla – 7, Bhaskara, Ullal- 3, , BPP- 8 and Madakkathara - II were found suitable for this region.

ACKNOWLEDGEMENT

My heartfelt gratitude to Bidhan Chandra Krishi Viswavidyalaya, West Bengal for the research facilities provided and to the Director, Directorate of Cashew Research (ICAR), Puttur, Karnataka, India for providing the financial and other facilities to ca carry out the study under AICRP on Cashew.

REFERENCES

Chandrasekhar M, Sethi K, Tripathy P, Mukherjee SK, Panda PK, Roy A (2018) Performance of released cashew (*Anacardium occidentale* L.) varieties under

hot and humid climatic zone of Odisha. Ind J Agricult Res 5 (2) : 152—156. https://dccd.gov.in/Content.aspx?mid=1075 and tid=1

Manoj PS, George TE (1993) Heterosis in cashew (*Anacardium occidentale* L.). *The cashew* 7 (3) : 7—9.

Panse VG, Sukhatme PV (1989) Statistical methods for agricultural workers. ICAR, New Delhi.

Rejani R, Yadukumar N (2010) Soil and water conservation techniques in cashew grown along steep hill slopes. *Sci Hort* 126 (3) : 371—378.

Tripathy P, Sethi Kabita, Mukherjee SK (2015) Evaluation of Released Cashew Varieties under Odisha Condition. *Int J Bio-Resour Stress Manage* 6 (5) : 566—571.

Vikram HC, Hegde NK, Jagadeesh RC (2013) Performance of cashew varieties under northern transition zone of Karnataka. *J Planta Crops* 41 (3) : 441—443.