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Long term effect of application of organic manures on growth, yield and soil nutrient status of cashew

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Abstract

A long term trial on organic management of cashew was conducted during 2011-12 to 2018-19 (8 years) under AICRP-Cashew programme at RFRS, Vengurla. Cashew grafts (V-4) planted at 7m x 7m during 2008. Trial was laid out in RBD with three replications and eight treatments comprises of different source of manures were applied in the month of June. Standard package of practices uniformly followed during investigation. Growth, yield attributes and soil nutrients status recorded at appropriate stages. Year-wise as well as pooled data (8years) was statically analyzed. Application of RDF + 10kg FYM (T₈) gave the highest yield (6.02 kg/tree & 1.22 t/ha) followed by T₄-100% N as Vermicompost + BCF (5.23 kg/tree & 1.06 t/ha). Further, the highest available soil N and P₂O₅ content (312.20 kg/ha & 37.61 kg/ha, respectively) recorded after harvest in T₈ treatment. The higher available soil K₂O content noted in T₄ treatment (910.50 kg/ha).

Keywords: Cashew, organic manures, pooled data, soil nutrients and yield

Introduction

Cashew is one of the important major plantation crop of Konkan region of Maharashtra. The area under cashew in Maharashtra is 1.91 lakh ha with production of 2.69 lakh tones and productivity is 1367 kg/ha (Anon., 2017) ^[1]. This contributing 18% in area and 31.49% of total production of the country Maharashtra ranks first in both area, production and productivity. The high cashew productivity in Maharashtra due to the fact of major areas of the cashew has been established with high yielding varieties. In order to get better yield, it is essential to maintain adequate N:P:K ratio in the soil. Application of 10-15 kg of farmyard manure per plant is recommended to ensure adequate organic matter in the soil. The fertilizers recommended for a 4 year and onward age of cashew tree are 1000 g N (2.1 kg urea), 250g P₂O₅ (1.56 kg SSP) and 250 g K₂O (400 g MOP). Integration of organic and inorganic nutrient inputs could therefore be considered as a better option in increasing fertilizer use efficiency and providing a more balanced supply of nutrients. Vanlauwe *et al.* (2002) ^[13] reported that combination of organic and inorganic nutrient sources result into synergy and improved conservation and synchronization of nutrient release. With view to study the effect of different organic manures either alone or in integrations on yield and quality of cashew, a trial was initiated.

Materials and Methods

An experiment was conducted to study the effect of organic manures on yield and quality of cashew during 2011-12 to 2018-19 (8 years) at Regional Fruit Research Station, Vengurla under AICRP-Cashew programme. For conducting of experiment, uniform one year old cashew grafts of cv. Vengurla-4 planted at 7m x 7m during 2008. The experiment was laid out in Randomized Block Design with three replications and 8 treatments (T₁-100% N as FYM, T₂-100% N as FYM + Biofertilizers consortium (BCF) (200g/tree), T₃- 50% N as FYM + BCF (200g/tree) + Rock phosphate, T₄-100% N as Vermicompost + BCF (200g/tree), T₅- Recycling of organic residue with the addition of 20% cow dung slurry (20% weight of organic residue as cow dung slurry), T₆- green leaf manuring to meet 100% (Retain litter + planting cowpea) T₇- 25% N as FYM + Recycling of organic residues + green leaf manuring + BCF (200g/tree)

and T₈- Control - recommended dose of fertilizer + 10 kg FYM). The initial soil nutrient status of the experimental plot and treatment-wise soil nutrient status after harvest of crop was estimated. Uniform package of practices were simultaneously followed. Similarly the data recorded at appropriate stages during investigation period were statistically analyzed as per procedure given by Panse and Sukhatme (1995) [7]. The chemical properties were estimated as per the procedure given by Jackson (1973) [3], Subbiah and Asija (1956) [11] and Tondon (1993) [12].

Results and Discussion

The results and discussions are summarized under following heads

Effect of organic manures on flushing, flowering and fruiting attributes of cashew

Data pertaining to number of laterals/m², number of flowering panicles/m², flowering duration (days), fruit set/m² and number of nuts per panicle during the year 2011-12 to 2018-19 (8 years) was presented in Table 1 to Table 5, respectively.

It is revealed from the data presented in Table 1 that there was no significant difference among the various treatments with respect to mean pooled study of number of laterals/m² during investigation period due to treatment effect. However, it showed significant difference during the years 2015-16 and 2018-19, respectively. During the year 2015-16, significantly the highest production of laterals (30.33/m²) was observed under the treatment T₇ (25% N as FYM + Recycling of organic residues + *In situ* green manuring / green leaf manuring + BCF -200g/tree) and it was at par with treatments T₄ (29.67/m²), T₆ (28.43/m²) and T₂ (27.70/m²). While during the year 2018-19, treatment T₄ (100% N as Vermicompost + BCF - 200g/tree) recorded the maximum number of laterals (32.53/m²) and at par with treatment T₈ (RDF+ 10 kg FYM - control) i.e. 32.27/m². Both these treatments were found significantly superior over rest of the treatments.

Data presented in Table 2 revealed that there was significant no difference among the different treatments with regards to number of panicles/m² during investigation period and also the pooled studies except the years 2013-14, 2015-16 and 2018-19. During the year 2013-14, the maximum production of panicles/m² was recorded in treatment T₆ (17.42/m²) and at par with treatments T₃ (16.92/m²) and T₅ (15.92/m²). The highest number of panicles (25.60/m²) was observed in treatment T₅ and superior over rest of the treatments during the year 2015-16. While, during the year 2018-19 the maximum number panicles (22.63/m²) were noted in treatments T₄ (100% N as Vermicompost + BCF - 200g/tree) and at par with treatments T₈ (21.60/m²) and T₇ (20.20/m²).

Data on flowering duration (Table 3) revealed that application of different organic treatment significantly influenced the flowering duration (days) during the years 2012-13, 2014-15 and 2015-16 but showed non-significant results during rest of the years and pooled study. During the year 2012-13, the maximum flowering duration was observed in treatment T₄ (121.53 days) and at par with treatments T₃ (120.47 days), T₅ (119.33 days) and T₆ (119.30 days), While during the year 2014-15, the treatment T₂ (110.33 days) recorded maximum flowering duration and at par with treatments T₁ (109.66 days), T₈ (108.66 days) T₄ (108 days) T₅ (107.33 days), and T₃ (105.66 days). Whereas, the maximum flowering duration (97.67 days) was recorded in treatment T₃ and it was found significantly superior over rest of the treatments during the year 2015-16.

There was significant no difference among the different treatments with regards to fruit set/m² during investigation period and also the pooled studies except for two years 2015-16 and 2018-19 (Table 4). During the year 2015-16, the maximum fruit set/m² was recorded in treatment T₅ (56.60/m²) and at par with treatments T₂ (55.47/m²), T₁ (48.27/m²) and T₆ (47.93/m²). The highest fruit set/m² was observed in treatment T₅ (43.80/m²) and at par with treatments T₇ (43.50/m²), T₄ (42.00/m²) and T₂ (41.00/m²) during the year 2018-19.

Data on number of nuts per panicle (Table 5) revealed that application of different organic treatment significantly influenced the number of nuts per panicle during the years 2015-16 to 2018-19 but showed non-significant results during rest of the years and pooled study. During the year 2015-16, the maximum number of nuts per panicle was observed in treatment T₂ (12.67) and at par with treatment T₅ (10.50), While during the year 2016-17 and 2017-18, the treatment T₄ recorded maximum number of nuts per panicle (8.29 & 4.57, respectively) and superior over rest of the treatments. Whereas, the maximum number of nuts per panicle (8.43) was recorded in treatment T₇ and at par with treatment T₅ (8.30), T₂ (8.06), T₁ & T₃ (7.93) and T₆ (7.63) during the year 2018-19.

In the present investigation the effect of application of organic manures on flowering duration, production of laterals, number of panicle/m², fruit set/m², number of nuts/panicle of cashew cv. Vengurla-4 was not significant (P<0.05) and was attributed to probably a slow rate of mineralization.

Effect of organic manures on yield and yield parameters of cashew

Application of various manures through both organic and inorganic sources significantly affected the yield and quality attributes of cashew cv. Vengurla-4 (Table 6 to Table 10) during the year 2011-12 to 2018-19 (8 years) and pooled study.

The nut yield of cashew cv. Vengurla-4 at under organic management was recorded significantly the maximum 6.92 kg/tree and 8.44 kg/tree during the year 2015-16 and 2016-17, respectively (Table 6) when trees were supplied with 100% N as Vermicompost + BCF (T₄); however, it was on par with treatments T₈ (6.53 kg/tree), T₆ (6.30 kg/tree), T₂ (6.17kg/tree) and T₁ (4.76 kg/tree) during the year 2015-16 and at par with treatments T₂ (8.33 kg/tree) and T₈ (8.15 kg/tree) during the year 2016-17. While, the maximum yield of 6.70 kg/tree noted in treatment T₄ and superior over rest of the treatment during the year 2017-18. During the year 2018-19, treatment T₈ (RDF + 10 kg FYM) recorded the maximum yield of 8.90 kg/tree and at par with treatments T₄ (8.68 kg/tree), T₁ (8.39 kg/tree), T₂ (7.37 kg/tree) and T₆ (6.75 kg/tree). Pooled data on yield for 8 years (2011-12 to 2018-19) showed the highest mean pooled yield recorded in treatment T₈ (6.02 kg/tree) and at par with the treatments T₄ (5.23 kg/tree).

Similar trend was observed in respect of yield t/ha in present investigation (Table 7). Application of 100% N as Vermicompost + BCF (T₄) recorded the highest yield of 1.41 t/ha 1.72 t/ha and 1.36 t/ha during the 2015-16, 2016-17 and 2017-18, respectively however, it was on par with treatments T₈ (1.33 t/ha), T₆ (1.29 t/ha) and T₂ (1.28 t/ha) during the year 2015-16 and at par with treatments T₂ (1.69 t/ha) and T₈ (1.66 t/ha) during the year 2016-17 and at par with treatment T₈ (1.08 t/ha). During the year 2018-19, treatment T₈ (RDF + 10 kg FYM) recorded the maximum yield of 1.82 t/ha and at par with treatments T₄ (1.77 t/ha), T₁ (1.71t/ha), T₂ (1.50 t/ha) and T₆ (1.38 t/ha). Pooled data on yield t/ha for 8 years (2011-12

to 2018-19) revealed that the highest mean pooled yield recorded in treatment T₈ (1.22 t/ha) and at par with the treatments T₄ (1.06 t/ha) and T₂ (1.01 t/ha).

The data of effect of organic manure on nut weight of cashew recorded during 2011-12 to 2018-19 and pooled study presented in Table 8. Data revealed that the treatment T₅ (Recycling of organic residue with the addition of 20% cow dung slurry) recorded significantly the maximum nut weight (9.27 g) however, it was found on par with all the treatments except T₁ (8.27 g) and T₈ (8.57 g) during the year 2015-16 while during the year 2016-17, the maximum nut weight (10.10 g) was observed in treatment T₆ and at par treatment T₄ (9.83 g) and T₁ (9.50 g). Whereas during the year 2017-18, the higher nut weight noted in treatment T₄ (10.50 g) and at par with treatments T₅ (10.23 g), T₈ (10.03 g), T₆ (10.00 g) and T₇ (9.93 g). During the year 2018-19, the maximum nut weight observed in treatment T₇ (10.10 g) and at par with treatment T₄ (9.53 g). Pooled study for 8 years showed the non significant results.

Data on apple weight recorded during the years 2011-12 to 2018-19 and pooled study presented in Table 9. The data revealed that there was not uniform trend was obtained with respect to apple weight. The maximum apple weight was recorded in T₆ (76.88 g) and it was on par with treatments T₃ (76.83 g), T₂ (73.50 g), T₅ (71.90 g) and T₇ (70.50 g) during the year 2011-12. During the year 2013-14, the maximum apple weight was noted in treatment T₈ (78.00g) and at par with treatments T₇ (73.33g), T₅ (72.47 g) and T₄ (67.77 g). While apple weight was found more in treatment T₁ (116.67g) and at par with treatment T₄ (110.0g) during the year 2015-16. The maximum apple weight of 85.83g, 88.50g and 84.43g was noticed in treatment T₄ during the years 2016-17, 2017-18 and 2018-19, respectively. Pooled study for 8 years showed the non significant results.

Data on shelling per cent during the years 2012-13 to 2018-19 and pooled study (7 years) presented in Table 10. The maximum shelling percentage (31.17%) was noticed with application of 50% N as FYM + BCF + Rock phosphate (T₃) and at par treatment T₄ (100% N as Vermicompost + BCF) i.e. 30.83% during the year 2015-16. While, the highest shelling percentage recorded in treatment T₄ (30.0%) and at par with treatments T₂ and T₈ (29.33%).

In present investigation significantly highest nut yield was obtained by application of recommended dose of fertilizer + 10 kg FYM (T₈ - control) followed by application of 100% N as Vermicompost + BCF (T₄).

Increased yield recorded with application of RDF + 10 kg FYM (T₈). When the fertilizer given through inorganic source in the soil that lead to immediate and readily available of nutrients that further help in more photosynthesis and dry matter production that might be significantly increased the yield in T₈ treatment. Earlier study also indicated that cashew gives very good response to RDF in different states (Rupa and Bhat, 2010) [9]. Rajendra *et al.* (2020) [8] also obtained the second best highest yield in cashew (4.05 kg/tree) with application of RDF + 10 kg FYM.

Application of vermicompost + BCF also produced the higher nut yield because of fact that, integration of vermicompost

and biofertilizer consortium (BCF) enriches the physical and biological properties of soil, fixed the atmospheric nitrogen that increased availability of nutrients to the plants and further their uptake. The present findings are in agreement with Kumar and Kumar (2013) [5] they also observed maximum number of fruits and fruit yield (kg/tree) with application of vermicompost 75 kg/tree in mango. Maheswarappa (2011) [6] obtained significantly higher nut yield in coconut with application of vermicompost. Soni *et al.* (2018) [10] reported that plants receiving vermicompost + poultry manure + Azotobacter gave highest average fruit weight and other yield attributing characters in strawberry.

The depression in values of yield of cashew in other organic treatments might be due to the fact that some of the nutrients applied to the soil were immobilized by soil micro-fauna, soil organic matter and other edaphic factors thereby making them unavailable to the cashew. This observation is consistent with the findings of Ibiremo *et al.* (2012) [2].

Effect of organic manures on NPK status of soil after crop harvest

The data on initial soil properties of experimental plot and after crop harvest presented in Table 11.

The treatment-wise soil nutrient status after harvest of crop was estimated during the year 2018-19 and results are significant for available soil N, P₂O₅ and K₂O content however, showed non-significant results for soil pH, EC and organic carbon. The data presented in Table 11 indicated that experimental site is lateritic clay loam in texture, pH of the soil ranged from minimum 4.72 (T₁) to maximum 5.07 (T₄) while, electrical conductivity ranged from 0.12 dSm⁻¹ (T₈) to 0.15 dSm⁻¹ (T₅ and T₇). The organic carbon ranged from 1.65% (T₄) to 2.52 (T₁). From the data it is revealed that, the highest available soil N content (312.20 kg/ha) was recorded with application of recommended dose of fertilizer + 10 kg FYM (T₈) and it was significantly superior over rest of the treatments. This treatment also showed maximum gain of soil nitrogen content over rest of the treatments as well as initial soil nitrogen content. The available soil P₂O₅ content was found significantly the maximum in treatment T₈ (37.61 kg/ha) and at par with treatments T₇ (36.56 kg/ha), T₃ (34.13 kg/ha) and T₄ (32.93 kg/ha). These treatments also showed maximum gain in soil phosphorus content over initial soil phosphorus content. The available soil K₂O content was recorded significantly the highest (910.50 kg/ha) by application of 100% N as Vermicompost + BCF - 200g/tree (T₄) and superior over rest of the treatments. Further showed the maximum gain of soil potassium content over rest of the treatment as well as over initial soil potassium content.

In present finding the highest soil nitrogen and phosphorus content recorded with application of RDF + 10kg FYM (T₈). Similar findings reported by Kalyani Nagraj and Sharma (2018) [4] they showed that, 80% RDF and Cow dung slurry @10 lit/tree recorded the maximum available nitrogen (1.29%), available phosphorus (0.20%), available potassium (0.78%) in mango leaf.

Table 1: Number of laterals/m² of cashew under organic management during 2011-12 to 2018-19

Sr. No.	Treatments	Number of laterals/m ²							Pooled mean	
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18		2018-19
1	T ₁ - 100% N as FYM	28.17	29.80	25.83	25.50	27.10	27.83	28.03	29.90	27.77
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	30.08	31.07	24.92	27.58	27.70	28.83	28.93	29.03	28.52
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	29.42	30.97	23.67	27.39	27.03	29.50	29.60	29.32	28.36
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	23.50	30.00	26.08	25.75	29.67	29.08	30.43	32.53	28.38
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	27.50	29.23	25.00	26.75	26.00	29.50	29.17	26.83	27.50
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	29.00	29.80	31.33	27.75	28.43	28.42	27.37	28.46	28.82
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	27.25	30.80	26.00	26.66	30.33	25.33	27.53	29.00	27.86
8	T ₈ - RDF + 10 kg FYM (Control)	29.08	31.57	26.58	28.83	26.93	30.33	31.60	32.27	29.65
	SEm±	1.86	0.89	1.40	0.88	0.86	1.62	1.61	0.70	0.56
	CD at 5%	N.S.	N.S.	N.S.	N.S.	2.63	N.S.	N.S.	2.12	N.S.

Table 2: Number of flowering panicles/m² of cashew under organic management during 2011-12 to 2018-19

Sr. No.	Treatments	Number of flowering panicles/m ²							Pooled mean	
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18		2018-19
1	T ₁ - 100% N as FYM	16.33	15.33	15.08	15.58	16.70	16.58	18.87	19.20	16.71
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	17.68	15.03	15.17	16.25	16.50	16.58	20.10	18.27	16.95
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	17.58	15.90	16.92	19.72	16.53	17.92	19.60	18.13	17.79
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	15.50	14.63	15.58	15.41	16.03	18.00	21.07	22.63	17.36
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	15.75	13.57	15.92	15.66	25.60	17.42	19.83	18.43	17.77
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	17.08	15.37	17.42	16.41	15.50	17.17	18.30	19.33	17.07
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	14.75	15.53	15.33	16.58	18.87	17.42	18.60	20.20	17.16
8	T ₈ - RDF + 10 kg FYM (Control)	17.42	16.07	14.58	18.25	15.63	18.92	22.77	21.60	18.15
	SEm±	1.13	0.96	0.52	1.21	0.72	0.75	1.64	0.87	0.60
	CD at 5%	N.S.	N.S.	1.57	N.S.	2.19	N.S.	N.S.	2.64	N.S.

Table 3: Flowering duration (days) of cashew under organic management during 2011-12 to 2018-19

Sr. No.	Treatments	Flowering duration (days)							Pooled mean	
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18		2018-19
1	T ₁ - 100% N as FYM	116.92	109.40	103.50	109.66	95.00	98.67	91.40	94.43	102.37
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	119.75	110.07	105.30	110.33	97.67	98.33	93.70	93.70	103.60
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	114.58	120.47	100.70	105.66	94.00	92.67	91.47	93.37	101.61
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	118.33	121.53	105.40	108.00	95.33	99.00	92.50	92.77	104.11
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	119.92	119.33	103.30	107.33	94.33	95.67	93.27	95.17	103.54
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	121.00	119.30	100.80	102.66	94.33	100.00	92.17	91.20	102.68
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	120.42	106.97	98.40	102.33	95.33	94.33	94.30	94.60	100.83
8	T ₈ - RDF + 10 kg FYM (Control)	123.00	110.80	103.50	108.66	94.33	97.00	95.30	94.03	103.33
	SEm±	3.57	3.08	2.16	1.76	0.68	2.64	1.43	0.53	1.02
	CD at 5%	N.S.	9.33	N.S.	5.34	2.06	N.S.	N.S.	N.S.	N.S.

Table 4: Fruit set /m² of cashew under organic management during 2011-12 to 2018-19

Sr. No.	Treatments	Fruit set /m ²								Pooled mean
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
1	T ₁ - 100% N as FYM	22.58	39.40	20.28	44.91	48.27	21.67	14.60	38.63	31.29
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	30.58	40.30	33.83	46.41	55.47	25.32	14.27	41.00	35.90
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	23.17	37.13	31.92	48.08	42.70	24.83	13.83	38.33	32.50
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	23.17	40.97	31.42	53.33	42.97	23.58	16.07	42.00	34.19
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	22.55	43.47	37.88	41.33	56.60	20.83	14.33	43.80	35.10
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	36.83	38.30	34.33	43.66	47.93	23.08	15.27	37.63	34.63
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	25.83	40.20	40.42	47.91	42.60	25.00	14.93	43.50	35.05
8	T ₈ - RDF + 10 kg FYM (Control)	27.17	38.87	31.08	54.25	38.37	26.83	14.13	35.37	33.26
	SEm±	5.19	1.66	6.67	5.40	3.13	2.07	1.20	1.16	1.47
	CD at 5%	N.S.	N.S.	N.S.	N.S.	9.48	N.S.	N.S.	3.51	N.S.

Table 5: Number of nuts per panicle of cashew under organic management during 2011-12 to 2018-19

Sr. No.	Treatments	Number of nuts per panicle								Pooled mean
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
1	T ₁ - 100% N as FYM	2.95	14.53	5.69	8.49	8.57	3.00	2.60	7.93	6.72
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	4.18	14.20	5.67	9.17	12.67	4.52	3.53	8.06	7.75
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	2.64	14.70	5.15	9.25	7.67	3.75	2.43	7.93	6.69
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	3.27	14.80	5.67	9.93	8.03	8.29	4.57	7.50	7.76
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	2.45	16.03	5.88	7.40	10.50	3.17	2.40	8.30	7.02
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	4.74	14.37	5.77	8.44	8.77	3.86	2.97	7.63	7.09
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	3.47	15.70	4.58	9.33	8.37	4.02	2.50	8.43	7.05
8	T ₈ - RDF + 10 kg FYM (Control)	3.66	13.77	6.00	10.06	6.43	4.46	3.23	6.90	6.81
	SEm±	0.95	0.62	1.15	1.11	0.87	0.53	0.20	0.29	0.38
	CD at 5%	N.S.	N.S.	N.S.	N.S.	2.64	1.59	0.60	0.89	N.S.

Table 6: Yield (kg/ tree) of cashew under organic management during 2011-12 to 2018-19

Sr. No.	Treatments	Yield (kg/ tree)								Pooled mean
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
1	T ₁ - 100% N as FYM	3.24	2.92	2.06	3.10	4.76	4.92	2.69	8.39	4.01
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	4.69	3.86	2.66	2.79	6.17	8.33	3.95	7.37	4.98
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	3.53	2.76	2.10	4.32	3.81	4.21	2.68	5.40	3.60
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	2.89	2.61	1.55	4.06	6.92	8.44	6.70	8.68	5.23
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	2.06	2.06	1.15	3.16	2.65	3.74	2.39	4.79	2.75
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	4.11	2.92	2.25	3.57	6.30	4.25	2.76	6.75	4.11
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	2.82	3.70	1.55	4.73	4.35	3.64	2.44	4.88	3.51
8	T ₈ - RDF + 10 kg FYM (Control)	4.91	5.16	2.32	6.91	6.53	8.15	5.29	8.90	6.02
	SEm±	0.69	0.78	0.45	0.83	0.79	0.59	0.22	0.71	0.36
	CD at 5%	N.S.	N.S.	N.S.	N.S.	2.41	1.79	0.67	2.16	1.03

Table 7: Yield (t/ha) of cashew under organic management during 2011-12 to 2018-19

Sr. No.	Treatments	Yield (t/ha)								Pooled mean
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
1	T ₁ - 100% N as FYM	0.65	0.60	0.42	0.63	0.97	1.01	0.55	1.71	0.82
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	0.94	0.79	0.54	0.57	1.28	1.69	0.81	1.50	1.01
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	0.71	0.56	0.43	0.88	0.78	0.86	0.55	1.10	0.73
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	0.58	0.53	0.32	0.83	1.41	1.72	1.36	1.77	1.06
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	0.41	0.43	0.24	0.64	0.54	0.76	0.48	0.98	0.56
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	0.82	0.60	0.46	0.72	1.29	0.87	0.57	1.38	0.84
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	0.56	0.76	0.32	0.96	0.75	0.74	0.50	0.99	0.70
8	T ₈ - RDF + 10 kg FYM (Control)	0.96	1.05	0.47	1.41	1.33	1.66	1.08	1.82	1.22
	SEM±	0.13	0.16	0.09	0.17	0.14	0.12	0.10	0.14	0.07
	CD at 5%	N.S.	N.S.	N.S.	N.S.	0.43	0.36	0.30	0.44	0.21

Table 8: Nut weight (g) of cashew under organic management during 2011-12 to 2018-19

Sr. No.	Treatments	Nut weight (g)								Pooled mean
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
1	T ₁ - 100% N as FYM	8.00	8.23	7.80	8.83	8.27	9.50	9.30	8.46	8.55
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	8.50	8.57	8.60	9.10	8.83	9.07	9.67	8.77	8.89
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	9.10	8.20	8.50	8.83	9.23	9.43	9.90	8.67	8.98
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	8.63	7.57	8.10	9.13	8.83	9.83	10.50	9.53	9.01
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	8.27	7.70	8.30	9.06	9.27	9.10	10.23	8.77	8.84
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	8.73	8.03	9.00	9.10	8.90	10.10	10.00	8.70	9.07
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	9.13	8.33	8.20	8.86	9.03	9.20	9.93	10.10	9.10
8	T ₈ - RDF + 10 kg FYM (Control)	8.33	8.33	8.70	9.30	8.57	9.13	10.03	8.83	8.90
	SEM±	0.31	0.33	0.33	0.17	0.17	0.22	0.19	0.29	0.12
	CD at 5%	N.S.	N.S.	NS	N.S.	0.53	0.65	0.58	0.87	N.S.

Table 9: Apple weight (g) of cashew under organic management during 2011-12 to 2018-19

Sr. No.	Treatments	Apple weight (g)								Pooled mean
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
1	T ₁ - 100% N as FYM	63.07	63.53	65.10	90.83	116.67	81.67	69.10	81.10	78.88
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	73.50	68.00	61.30	92.50	81.67	79.17	85.00	76.67	77.23
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	76.83	64.26	63.43	90.00	96.67	78.33	75.00	71.10	76.95
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	67.73	68.50	67.77	101.67	110.00	85.83	88.50	84.43	84.30
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	71.90	70.10	72.47	93.33	90.00	71.67	63.33	70.53	75.42
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	76.88	64.97	66.00	86.66	83.33	82.50	66.67	75.63	75.33
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	70.50	63.30	73.33	98.33	90.00	68.33	63.33	68.43	74.45
8	T ₈ - RDF + 10 kg FYM (Control)	65.30	65.00	78.00	101.66	95.00	78.50	88.33	78.90	81.34
	SEM±	2.84	2.49	3.49	7.76	4.16	2.17	6.31	1.27	2.46
	CD at 5%	8.61	N.S.	10.29	N.S.	12.62	6.57	19.14	3.85	N.S.

Table 10: Shelling% of cashew under organic management at Vengurle centre during 2012-13 to 2018-19

Sr. No.	Treatments	Shelling%							Pooled mean
		2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
1	T ₁ - 100% N as FYM	29.50	29.83	29.00	28.83	28.67	27.67	28.67	28.88
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	29.33	28.67	29.00	30.00	28.67	29.33	28.17	29.02
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	28.50	28.50	29.50	31.17	29.00	26.50	29.00	28.88
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	29.00	28.33	29.66	30.83	29.50	30.00	28.67	29.43
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	29.50	29.17	29.16	29.50	29.00	27.17	28.50	28.86
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	29.33	29.00	28.50	29.17	29.17	27.83	29.17	28.88
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	29.33	28.67	29.33	29.33	28.83	27.17	29.50	28.88
8	T ₈ - RDF + 10 kg FYM (Control)	30.00	29.17	29.66	29.83	28.50	29.33	28.33	29.26
	SE _m ±	0.59	0.35	0.57	0.31	0.49	0.30	0.46	0.26
	CD at 5%	N.S.	N.S.	N.S.	0.93	N.S.	0.91	N.S.	N.S.

Table 11: Initial and final soil properties under cashew organic management trial

Sr. No.	Treatment Details	pH	EC dSm ⁻¹	OC (%)	N (kg/ha)	P ₂ O ₅ (kg/ha)	K ₂ O (kg/ha)
1	T ₁ - 100% N as FYM	4.72	0.14	2.52	230.97 (L)	20.70 (M)	780.83 (VH)
2	T ₂ - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	4.82	0.13	2.14	227.83 (L)	26.45 (MH)	754.73 (VH)
3	T ₃ - 50% N as FYM + BCF (200g/tree) + Rock phosphate	4.93	0.14	2.43	227.87 (L)	34.13 (H)	801.40 (VH)
4	T ₄ - 100% N as Vermicompost + BCF (200g/tree)	5.07	0.14	1.65	232.03 (L)	32.93 (H)	910.50 (VH)
5	T ₅ - Recycling of organic residues with addition of 20% cow dung slurry	5.06	0.15	2.00	230.43 (L)	28.56 (H)	747.67 (VH)
6	T ₆ - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	4.73	0.13	2.05	222.60 (L)	25.08 (MH)	764.57 (VH)
7	T ₇ - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	5.00	0.15	1.80	250.83 (L)	36.56 (VH)	787.17 (VH)
8	T ₈ - RDF + 10 kg FYM (Control)	4.84	0.12	2.45	312.20 (M)	37.61 (VH)	768.40 (VH)
	SE _m ±	0.09	0.01	0.30	13.28	2.05	28.17
	CD @ 5%	N.S.	N.S.	N.S.	40.28	6.22	85.49
	Initial soil status	5.40	0.08	1.48	300.2	20.84	268.8

Conclusion

On the basis of eight years pooled study, it can be concluded that the application of RDF + 10kg FYM (T₁-control) gave the highest yield (6.02 kg/tree & 1.22 t/ha) followed by application of T₄ - 100% N as Vermicompost + BCF (5.23 kg/tree & 1.06 t/ha) and T₂ - 100% N as FYM + BCF (4.98 kg/tree & 1.01 t/ha). Further, the highest available soil N content (312.20 kg/ha) was recorded with application of recommended dose of fertilizer + 10 kg FYM (T₈). While, the maximum available soil P₂O₅ content observed in treatment T₈ (37.61 kg/ha) and followed in T₇ (36.56 kg/ha), T₃ (34.13 kg/ha) and T₄ (32.93 kg/ha). Whereas, the highest available soil K₂O content was noted (910.50 kg/ha) with application of 100% N as Vermicompost + BCF - 200g/tree (T₄). The present study indicating the scope of organic cashew cultivation for improvement of yield, quality and soil health. The study also revealed a scope for further elaborate the quality of the organically produce cashew.

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