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Effect of application of organic manures on growth, yield and quality of Cashew

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Abstract

A trial on effect of organic and inorganic manures on growth, yield and quality of cashew was conducted during the year 2018-19 under AICRP-Cashew programme at RFRS, Vengurla. Cashew grafts (V-4) planted at 7m x 7m during 2008 under organic management trial were used for present study. 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 quality parameters recorded at appropriate stages. Recorded data was statically analyzed. Among the different treatments tried, application of 100% N as Vermicompost + BCF (T4) recorded the highest number of lateral (32.53/m²), number of panicle (22.63/m²).

The maximum fruit set (43.80/m²) observed in the treatment T5 (Recycling of organic residues with addition of 20% cow dung slurry) and followed by T7 (43.50/m²), T4 (42.00/m²) and T2 (41.00/m²). While, the highest number of nuts per panicle (8.43) and nut weight (10.10g) recorded in treatment T7 (25% N as FYM + Recycling of organic residues + *In situ* green manuring /green leaf manuring + BCF - 200g/tree) followed by second best higher nut weight in T4 (9.53g). Whereas, the maximum apple weight (84.43 g) recorded in treatment T4. The highest annual nut yield of cashew 8.90 kg/tree & 1.82 t/ha recorded with application of RDF + 10 kg FYM-control (T8) and closely followed in treatments T4 (8.68 kg/tree & 1.77 t/ha). So far as quality attributes of cashew apple concerned, the highest TSS of cashew apple recorded in treatment T4 (15.670B). The lowest acidity of cashew apple recorded in treatment T7 (0.24%) followed by treatments T4 & T1 (0.26%). The highest cashew apple volume (88.60 ml) recorded with RDF + 10 kg FYM - control (T8) and at par with treatments T6 (81.10 ml) and T2 (75.90 ml). In overall, application of 100% N as Vermicompost + BCF (T4) appeared as best treatment and enhanced growth, yield and quality of cashew cv. Vengurla-4, even though the highest yield recorded in RDF + 10 kg FYM-control (T8).

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

Introduction

Cashew is one of the important major earning 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]. Maharashtra contributing 18% in cashew area and 31.49% of total cashew nut production of the country. Maharashtra ranks first in area, production and productivity of cashew. 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) ^[12] 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 comparative effect of organic manures on growth, yield and quality of cashew during the year 2018-19 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 under organic management trial were used for present investigation.

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 - RDF + 10 kg FYM. All the treatments were applied in circular trench around the tree in the month of June. 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].

Results and discussion

The results and discussions are summarized under following heads

1. Effect of organic and inorganic 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 2018-19 presented in Table 1. Data revealed that the various treatments significantly affect the flushing, flowering and fruiting attributes of cashew except flowering duration (days) during the year 2018-19. The highest number of laterals (32.53/m²) was recorded in the treatment T4 (100% N as Vermicompost + BCF) and at par with treatment T8 – Control (32.27/m²). The flowering duration was ranged the minimum from 91.20 days in treatment T6 to the maximum 95.17 days in T5. Significantly the maximum flowering panicles (22.63/m²) was recorded in the treatment T4 (100% N as Vermicompost + BCF) and at par with treatments T8 (21.60/m²) and T7 (20.20/m²). The maximum fruit set (43.80/m²) noted in the treatment T5 (Recycling of organic residues with addition of 20% cow dung slurry) and at par with treatments T7 (43.50/m²), T4 (42.00/m²) and T2 (41.00/m²). The highest number of nuts per panicle (8.43) recorded in treatment T7 (25% N as FYM + Recycling of organic residues + *In situ* green manuring /green leaf manuring + BCF - 200g/tree) and at par with the treatments T5 (8.30), T2 (8.07), T1 & T3 (7.93) and T6 (7.63).

In the present investigation the effect of application of organic manures on flowering duration of cashew cv. Vengurla-4 was not significant ($P < 0.05$) and was attributed to probably a slow rate of mineralization.

2. Effect of organic and inorganic manures on yield and yield parameters of cashew

Application of various manures through both organic and inorganic sources significantly affected the yield and yield parameters of cashew cv. Vengurla-4 except shelling percentage during the year 2018-19 (Table 2).

Application of 25% N as FYM + Recycling of organic residues + *In situ* green manuring /green leaf manuring + BCF - 200g/tree (T7) recorded significantly the highest nut weight of 10.10 g and on par with the treatment T4 (9.53g). Whereas, significantly the maximum apple weight (84.43 g) was recorded with application of T4 treatment (100% N as Vermicompost + BCF) and on par with treatment T1 - 100% N as FYM (81.10 g).

The annual nut yield of cashew cv. Vengurla-4 under organic management was recorded significantly the highest 8.90 kg/tree & 1.82 t/ha with application of RDF + 10 kg FYM-control (T8) and at par with treatments T4 (8.68 kg/tree & 1.77 t/ha), T1 (8.39 kg/tree & 1.71 t/ha), T2 (7.37 kg/tree & 1.50 t/ha) and T6 (6.75 kg/tree & 1.38 t/ha). While, the lowest yield of 4.79 kg/tree & 0.98 t/ha was obtained by recycling of organic residue with the addition of 20% cow dung slurry (T5). The shelling percentage was ranged minimum from 28.17% in treatment T2 to maximum 29.50% in treatment T7. 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), 100% N as FYM (T1), 100% N as FYM + Biofertilizers consortium (BCF) 200g/tree (T2) and *In situ* green manuring/green leaf manuring to meet 100% - Retain litter + planting cowpea (T6).

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) [10]. Rajendra *et al.* (2020) [9] 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) [4] 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) [11] reported that plants receiving vermicompost + poultry manure + Azotobacter gave highest average fruit weight and other yield attributing characters in strawberry.

Increased in yield by application of 100% N through FYM due to fact that application of FYM supply optimum level of N,P,K and addition of biofertilizers consortium that also help in nutrients availability for uptake of plant. The integrated effect of both might have increased the cashew yield. Whereas, increased yield in T6 treatment due to application of green manure that decomposed in the soil and converted in to humus further planting of cowpea fix the atmospheric nitrogen that readily available to plant in uptake form that might have enhanced the cashew yield.

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) [3].

3. Effect of organic and inorganic manures on quality attributes of cashew

The data on quality attributes of cashew presented in Table 3 revealed that various organic manures treatments significantly alter the quality parameter of cashew apple *viz.*, TSS (0B),

acidity (%) and apple volume (g.). The highest TSS of cashew apple cv. Vengurla-4 (15.670B) recorded with application of 100% N as Vermicompost + BCF (200g/tree) (T4) and at par with treatment T2 & T7 - (15.330 B) and T3 (14.670 B). Both these treatments were registered highest TSS and significantly superior over rest of the treatments including control.

The lowest acidity of cashew apple of cv. Vengurla-4 (0.24%) recorded in treatment T7 (25% N as FYM + Recycling of organic residues + *In situ* green manuring / green leaf manuring + BCF - 200g/tree) and at par with treatments T4 & T1 (0.26%) and T3 & T6 (0.31%).

The highest cashew apple volume (ml.) of cv. Vengurla-4 (88.60 ml) recorded with RDF + 10 kg FYM - control (T8) and at par with treatments T6 (81.10 ml) and T2 (75.90 ml).

Application of manures through both organic and inorganic sources significantly affected the quality parameters of

cashew cv. Vengurla-4. The cashew apple TSS (0B) was recorded significantly maximum 15.670B with application of vermicompost + BCF (T4) and followed in treatments T2 & T7 - (15.330 B) and T3 (14.670 B). While the lowest acidity (0.24%) recorded in T7. Whereas, the highest cashew apple volume (88.60 ml) recorded with RDF + 10 kg FYM - control (T8) and followed by T6 (81.10 ml) and T2 (75.90 ml). The present results might be due to treatment effects. The present findings are in line with Mahendra and Singh (2009) [5] they obtained the maximum TSS, minimum acidity with application of FYM + 100 per cent NPK + Azotobacter + PSB during both the years. Highest fruit weight and total soluble solid was reported with FYM + vermicompost + Azotobacter and PSB by Patel *et al.* (2005) [8]. However, on controversy Binepal *et al.* (2013) [2] reported that the high TSS (12.19%) in guava with application of recommended dose of fertilizers.

Table 1: Flowering and fruiting parameters of cashew organic farming trial during the year 2018-19

Treatments	No. of laterals/m ²	No. of flowering panicle/m ²	Flowering duration (days)	Fruit set/ m ²	No. of nuts/ panicle
T1 - 100% N as FYM	29.90	19.20	94.43	38.63	7.93
T2 - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	29.03	18.27	93.70	41.00	8.07
T3 - 50% N as FYM + BCF (200g/tree) + Rock phosphate	28.30	18.13	93.37	38.33	7.93
T4 - 100% N as Vermicompost + BCF (200g/tree)	32.53	22.63	92.77	42.00	7.50
T5 - Recycling of organic residues with addition of 20% cow dung slurry	26.83	18.43	95.17	43.80	8.30
T6 - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	28.47	19.33	91.20	37.63	7.63
T7 - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	29.00	20.20	94.60	43.50	8.43
T8 - RDF + 10 kg FYM (control)	32.27	21.60	94.03	35.37	6.90
SEm ±	0.70	0.87	0.53	1.16	0.29
CD at 5%	2.13	2.64	N.S.	3.51	0.89

Table 2: Yield and yield parameters of cashew organic farming trial during the year 2018-19

Treatments	Yield (kg/tree)	Yield (t/ha)	Nut wt. (g)	Apple wt. (g)	Shelling (%)
T1 - 100% N as FYM	8.39	1.71	8.46	81.10	28.67
T2 - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	7.37	1.50	8.77	76.67	28.17
T3 - 50% N as FYM + BCF (200g/tree) + Rock phosphate	5.40	1.10	8.67	71.10	29.00
T4 - 100% N as Vermicompost + BCF (200g/tree)	8.68	1.77	9.53	84.43	28.67
T5 - Recycling of organic residues with addition of 20% cow dung slurry	4.79	0.98	8.77	70.53	28.50
T6 - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	6.75	1.38	8.70	75.63	29.17
T7 - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	4.88	0.99	10.10	68.43	29.50
T8 - RDF + 10 kg FYM (control)	8.90	1.82	8.83	78.90	28.33
SEm ±	0.71	0.15	0.29	1.27	0.46
CD at 5%	2.17	0.44	0.87	3.85	N.S

Table 3: Quality parameters of foliar cashew organic farming trial during the year 2018-19

Treatments	Apple TSS (0Brix)	Apple Acidity (%)	Apple Volume (ml.)
T1 - 100% N as FYM	14.00	0.26	59.00
T2 - 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	15.33	0.32	75.90
T3 - 50% N as FYM + BCF (200g/tree) + Rock phosphate	14.67	0.31	69.97
T4 - 100% N as Vermicompost + BCF (200g/tree)	15.67	0.26	64.43
T5 - Recycling of organic residues with addition of 20% cow dung slurry	13.33	0.37	72.47
T6 - <i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	13.33	0.31	81.10
T7 - 25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring / green leaf manuring + BCF (200g/tree)	15.33	0.24	65.60
T8 - RDF + 10 kg FYM (control)	14.00	0.37	88.60
SEm ±	0.50	0.024	5.24
CD at 5%	1.51	0.073	15.90

Conclusion

Among the different organic and inorganic manure tried in cashew, application of 100% N as Vermicompost + BCF (T4) recorded the highest number of lateral (32.53/m²), number of panicle (22.63/m²). The maximum fruit set (43.80/m²) observed in the treatment

T5 (Recycling of organic residues with addition of 20% cow dung slurry) and followed by T₇ (43.50/m²), T₄ (42.00/m²) and T₂ (41.00/m²). While, the highest number of nuts per panicle (8.43) and nut weight (10.10g) recorded in treatment T₇ (25% N as FYM + Recycling of organic residues + *In situ* green manuring /green leaf manuring + BCF - 200g/tree) followed by second best higher nut weight in T₄ (9.53g). Whereas, the maximum apple weight (84.43 g) recorded in treatment T₄ (100% N as Vermicompost + BCF) and followed by treatment T₁ 100% N as FYM (81.10 g). The highest annual nut yield of cashew 8.90 kg/tree & 1.82 t/ha recorded with application of RDF + 10 kg FYM-control (T₈) and closely followed in treatments T₄ (8.68 kg/tree & 1.77 t/ha). So far as quality attributes of apple concerned, the highest TSS of cashew apple recorded in treatment T₄ followed in T₂ & T₇ - (15.330 B) and T₃ (14.670 B). The lowest acidity of cashew apple recorded in treatment T₇ (0.24%) followed by treatments T₄ & T₁ (0.26%). The highest cashew apple volume (88.60 ml) recorded with RDF + 10 kg FYM - control (T₈) and at par with treatments T₆ (81.10 ml) and T₂ (75.90 ml). In overall growth, yield and quality of cashew cv. Vengurla-4 enhanced with application of 100% N as Vermicompost + BCF (T₄) even though the highest yield recorded in RDF + 10 kg FYM-control (T₈). On the basis of results of present finding, it can be concluded that application of 100% N as Vermicompost + BCF appeared as best treatment for organic management of cashew. However, the premium price for organically produce cashew is must and necessary for sustainable cashew cultivation.

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