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Effect of nutrients on yield and yield attributing characters in cashew (*Anacardium occidentale* L.)

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Abstract
An experiment on "Effect of nutrients on yield and yield attributing characters in cashew (*Anacardium occidentale* L.)" was carried out at Cashew Research Station, Ranasinghpur under All India Coordinated Research Project on Cashew, Odisha University of Agriculture and Technology, Bhubaneswar during the year 2017-18 by adopting Randomized Block Design (RBD) with six treatments and four replications (T_1: 100% RDF (500:250:250 g NPK/Plant), T_2: T_1 + FYM @ 10kg/Plant/Year, T_3: T_2 + Foliar spray of major nutrients (3% Urea + 0.5% H_3PO_4 + 1% K_2SO_4), T_4: T_2 + Foliar spray of secondary and micronutrients (0.5% $ZnSO_4$ + 0.1% Solubor + 0.5% $MgSO_4$), T_5: T_3+ Foliar spray of secondary and micronutrients (0.5% $ZnSO_4$ + 0.1% Solubor + 0.5% $MgSO_4$) and T_6: Control). The study revealed that combination of 100% RDF (500:250:250 g NPK/Plant) + FYM @ 10kg/Plant/Year + Foliar spray of major nutrients (3% Urea + 0.5% H_3PO_4 + 1% K_2SO_4) + Foliar spray of secondary and micronutrients (0.5% $ZnSO_4$ + 0.1% Solubor + 0.5% $MgSO_4$) recorded maximum number of panicles m^{-2} (18.40), sex ratio (0.41), apple weight (54.83g), nut weight (7.35g), nut length (3.81cm), nut breadth (2.69cm) and nut yield $plant^{-1}$(2.70kg).

Keywords: Cashewnut, nutrient management, yield parameters and nut yield

Introduction
The goldmine of wasteland, cashew (*Anacardium occidentale* L.) is an export oriented crop of our country. Although, India ranks first in production, processing and export of kernel in the World, but productivity of existing cashew plantation is very poor, hardly 707 kg ha^{-1} (DCCD, 2018-19) [3] as compared to the other countries. Low productivity of cashew in the country is the cause of importing such a huge quantity of raw cashew nut every year. The wide gap between the present level of productivity and potential productivity of cashew nut in the country is due to non-adoption of improved management practices, the existence of old and senile plantations etc. Usually cashew is grown under poor fertile, low productive, marginal and problematic soils where plant availability of optimum quantity of nutrients is an inherent edaphic constraint. Nutrient management is the basic cognitive process of managing the timing, source, amount and method of nutrient application with the aim of maximizing crop productivity while reducing nutrient losses that could bring up environmental problems. But nutrient management in cashew is not a regular practice in India, even though adequate fertilizer application might be the viable means for increasing the productivity of cashew. Therefore, the low production and productivity problems of cashew can be overcome by appropriate nutrient management practices.

Materials and Methods
The study was carried out at Cashew Research Station, AICRP on Cashew under Odisha University of Agriculture and Technology, Bhubaneswar by adopting Randomized Block Design (RBD) with six treatments (T_1: 100% RDF (500:250:250 g NPK/Plant), T_2: T_1 + FYM @ 10kg/Plant/Year, T_3: T_2 + Foliar spray of major nutrients (3% Urea + 0.5% H_3PO_4 + 1% K_2SO_4), T_4: T_2 + Foliar spray of secondary and micronutrients (0.5% $ZnSO_4$ + 0.1% Solubor + 0.5% $MgSO_4$), T_5: T_3+ Foliar spray of secondary and micronutrients and T_6: Control) and four replications. The plantation was established in the year 2014 taking "Balabhadra" as the test variety. RDF was applied as soil application while secondary and micro nutrients were applied as foliar spray at flushing, flowering and nut development stage. Data on vegetative, yield attributes and nut yield were recorded following the procedure described in Experimental Manual on Cashew (NRCC, 2005) [9]. Data on various yield attributes and nut yield were analyzed statistically following Panse and Sukhatme (1985) [10].

Results and Discussion

Data recorded on various yield attributes revealed significant differences during the study (Table 1). Duration of flowering ranged from minimum 84.19 days (Control) to maximum 87.96 days (T_4). Enhancement in duration of flowering in T_4 may be due to the effect of magnesium, zinc and boron. Number of panicles meter^{-2} is an important character for production of high yield. Maximum number of panicles was observed in treatment T_5(18.40) and minimum was recorded in T_6(15.99). Boron was very essential for flower production and zinc affects the flowering and fruit set through its role in auxin synthesis which may be the possible reason. Similar findings have been observed by Lakshmipathi *et al*. (2014) [7] and Rajamanickam *et al*. (2015) [11] in cashew. Sex ratio of cashew was significantly influenced by application of nutrients and highest sex ratio was observed in T_5(0.41). Increase in sex ratio may be due to the combined effect of macro and micronutrients. Foliar application of zinc sulphate (0.5%) + borax (0.1%) was beneficial for increasing the sex ratio as reported by Lakshmipathi *et al*. (2014) [7] in cashew. Application of magnesium with macronutrients (N, P, K) and micronutrients (zinc and boron) had a significant effect on apple weight. It was found that the highest apple weight (54.83 g) was recorded in T_5 though it was statistically *at par* with T_4 (53.83 g). This may be due to the rapid synthesis of protein and translocation of carbohydrates which leads to increase fruit weight and size of fruit. These finding are supported by Lakshmipathi *et al*. (2014) [7] in cashew. Similar findings also reported by Banik and Sen (1997) [1], Nehete *et al.* (2011) and Gurjar *et al*. (2015) [6] in mango.

Nut weight was recorded maximum in T_5(7.35 g) while the lowest nut weight was recorded in T_6(6.39 g). Application of micronutrient zinc has significant effect on photosynthesis and translocation of food materials to nuts while boron helps in seed and fruit development. These findings corroborates with the results of Ghosh and Bose (1986) [4] and Rajamanickam *et al*. (2015) [11] in cashew. Nut length and breadth were significantly influenced by nutrient application. Nut length (3.81 cm) and breadth (2.69 cm) was recorded maximum in T_5, while minimum nut length (3.51 cm) and nut breadth (2.44 cm) was observed in T_6 (control). This may be due to the effect of micronutrients which helps in cell development and cell elongation that influences nut size. Similar finding were reported by Lakshmipathi *et al*. (2014) [7] in cashew. Shelling was recorded maximum in T_4 (32.17) which were *statistically at par* with all other treatments except T_1 and T_6. This may be due to the optimum filling of kernel because of synthesis of fats and protein. These findings are similar to Ghosh (1990) [5] in cashew. Application of macro and micro nutrient had significant effect on nut yield of cashew. Among the six different treatment combinations, T_5 recorded maximum nut yield tree^{-1} (2.70 kg) during the evaluation. This may be due to larger nuts, more number of nuts and improved sex ratio. These findings are supported by Bhoyar and Ramdevputra (2016) [2], Yadav *et al.* (2011) [12] in guava and Mandal *et al.* (2002) [8] in banana.

It was found from this experiment that combined application of 100% RDF (500:250:250 g NPK/Plant) + FYM @ 10kg/Plant/Year+ Foliar spray of major nutrients (3% Urea + 0.5% H_3PO4 + 1% K2SO4) + Foliar spray of secondary and micronutrients (0.5% ZnSO4 + 0.1% Solubor + 0.5% MgSO4) recorded maximum number of panicles/m^2 (18.40), sex ratio (0.41), apple weight (54.83 g), nut weight (g), nut length (cm), nut breadth (cm) and nut yield/plant in an nutrient deficient marginal red lateritic soils of Bhubaneswar.

Table 1: Effect of nutrients on yield and yield attributing characters in cashew (*Anacardium occidentale* L.)

Treatments	Duration of flowering (days)	Number of panicles m^{-2}	Sex ratio	Apple weight (g)	Nut weight (g)	Nut length (cm)	Nut breadth (cm)	Shelling percentage	Nut yield plant^{-1} (kg)
T_1- 100% RDF(500:250:250 g PK/plant)	86.83	16.80	0.33	51.25	6.79	3.56	2.57	29.52	2.46
T_2- T_1 + FYM @ 10 kg/plant/year	86.24	17.04	0.37	50.45	6.87	3.72	2.55	31.18	2.59
T_3- T_2 + Foliar spray of major nutrients 3% urea + 0.5% H_3PO_4 + 1% K_2SO_4.	85.05	17.87	0.36	51.71	7.04	3.68	2.59	30.48	2.66
T_4- T_2+ Foliar spray of secondary nutrients and micronutrients (0.5% $ZnSO_4$ + 0.1% Solubor + 0.5% gSO_4).	87.96	17.39	0.38	53.83	7.24	3.77	2.64	32.17	2.64
T_5- T_3 + Foliar spray of secondary nutrients and micronutrients (0.5% $ZnSO_4$ + 0.1% Solubor + 0.5% gSO_4).	86.20	18.40	0.41	54.83	7.35	3.81	2.69	31.24	2.70
T_6- Control	84.19	15.99	0.29	48.43	6.39	3.51	2.44	28.11	2.39
Mean	86.19	017.26	0.36	51.74	6.95	3.67	2.58	30.45	2.57
SE(m)±	0.24	0.51	0.02	0.78	0.04	0.06	0.05	1.18	0.16
CD at 5%	0.73	1.53	0.07	2.36	0.14	0.17	0.16	2.51	0.47
CV%	0.56	5.87	12.80	3.02	1.29	3.07	4.07	5.46	12.14

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