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Influence of organic nutrient modules on yield attributes of different cropping systems

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Abstract
The experiment was conducted during *kharif* season of 2023-24 at research farm of Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to find out effect of various organic nutrient modules on various intercropping systems. The experiment was laid out in Strip Plot Design (SrPD) with five main plots and three sub plots consisting of five cropping systems, three nutrient modules with three replications. Key findings suggest that cotton intercropped with Green manuring Sunhemp and pigeonpea soybean exhibited the best yield attributes under the 50% compost + 25% vermicompost + 25% neem cake treatment. This module enhanced crop performance due to improved soil fertility and nutrient availability.

Keywords: Organic, cotton, pigeonpea, yield attributes, compost, vermicompost

1. Introduction
A production system that maintains the wellbeing of the land, ecology, and human population is organic agriculture. Rather than utilizing inputs that have negative effects, it depends on biological processes, biodiversity, and cycles that are tailored to the local environment. Tradition, creativity, and science are all combined in organic agriculture to improve everyone's quality of life, fair relationships, and the environment as a whole. Organic farming, in contrast to chemical farming, is focused on "feeding the soil" as opposed to "feeding the plant". It is a way to return to the natural world what has been taken from it. In the long run, the largest yield can be achieved in a sustainable and environmentally beneficial way because organic farming strives to maintain soil health. India has great of potential to generate all sorts of organic products due to diverse agro climatic conditions. The long-standing practice of organic farming is advantageous and has potential for organic growers in a number of regions in the nation. India is first in terms of the overall number of producers and second in the world for organic agricultural land, according to the statistics that are currently available (Source: FiBL & IFOAM Year Book, 2024) [12]. The entire area registered under the NPOP for the organic certification process as of March 31, 2024, is 7.3 mha (2023–24). This comprises the cultivable area of 44,75,836.91 hectares. The largest area certified as organic has been covered by Madhya Pradesh out of all the states, followed by Maharashtra, Rajasthan, and Gujarat. India produced around 3.6 mt (million tonnes) of certified organic products which includes all varieties of food products.

2. Materials and Methods
A field experiment was conducted during *kharif* season of 2023- 24 Agronomy Research Farm, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to find out effect of various organic nutrient modules on various intercropping systems. The experiment was laid out in Strip Plot Design (SrPD) with five main plot factors and three sub plot factors consisting of 5 cropping systems and 3 nutrient modules replicated thrice. The crops and varieties adopted are PKV- Ashlesha (Pigeonpea), AKA-7 (Cotton), PDKV Amba (Soybean), Blackgold (Blackgram), PDKV Yashashree (Foxtail millet), K-12 (Sunhemp). Treatment details of cropping system were T_1 - Cotton + Blackgram (2:1), T_2 - Pigeonpea + Foxtail millet (1:3), T_3 - Cotton + (GM)Sunhemp (2:1) here *in-situ* green manuring of sunhemp was done 40 DAS, T_4 - Pigeonpea + Soybean (1:3), T_5 - Sole Cotton and three

sub plot factors i.e. nutrient modules N1 – 75% Compost + 25% Vermicompost, N2 – 50% Compost + 25% Vermicompost + 25% Neem cake and N3 – Control where no manure was applied. Dose of phosphorous was compensated by PROM in N1 and N2.

3. Results and Discussion

3.1 Yield attributes

3.1.1 Cotton

Data related to number of bolls pocked plant^{-1}, boll weight, seed cotton yield plant^{-1} and seed index is presented in Table 1. The mean number of picked bolls per plant were 14.05, average boll weight was 2.12 (g), average cotton yield plant^{-1} (g) was 12.79, mean average seed index (g) was 5.52.

3.1.2 Cropping system

The yield attributes of cotton i.e. bolls pocked plant^{-1}, boll weight, seed cotton yield plant^{-1} and seed index were found highest in cotton + (GM) sunhemp (2:1). Reduced number of plant population and *in-situ* green manuring of sunhemp had smothering effect on weeds and conserving soil moisture while optimizing resource use produced more boll number plant^{-1} and boll weight that reflected in higher seed cotton weight plant^{-1}. Least cotton yield plant^{-1} was found in sole cotton. Similar results were recorded by Pote (2020) [7] and Shingrup (2022) [10].

3.1.3 Organic Modules

Yield attributes were significantly influenced by the organic integrated nutrient management and treatment with 50% Compost + 25% Vermicompost (top dressing) + 25% Neem cake. The increased yield attributes of cotton might be due to the effect of compost and vermicompost which considered to be a good source of plant nutrients and also the mineralization of organic nitrogen in compost and vermicompost which was slow process, might have provided the required nitrogen during the crop growth, with combined application of neem cake. Similar results were recorded by Ramesh *et al*. (2006) [8] Deepa Joshi *et al*. (2016) [2].

3.1.4 Pigeonpea, Blackgram, Soybean and Foxtail Millet

The data pertaining to number of pods plant^{-1}, seed weight plant^{-1}, test weight of pigeonpea, blackgram and soybean while panicle length, number of tillers plant^{-1}, grain weight and test weight of foxtail millet is presented in Table 2. The mean number of pods plant^{-1} of pigeonpea, blackgram, and soybean 125.4, 17.41 and 30.58 respectively. While the panicle length and number of tillers of foxtail millet were 7.21 and 10.62.

3.1.5 Cropping system

The yield attributes in pigeonpea, intercropping systems were highly influenced. Highest number yield attributing characters were found in pigeonpea + soybean (1:3) system over pigeonpea + foxtail millet (1:3). Similar results were recorded by Chaudhari *et al*. (2006) [1], Kasbe *et al*. (2010) [6], Tiwari *et al*. (2012) [11] and Dhandayuthapani *et al*. (2015) [3].

3.1.6 Organic Modules

The highest yield attributing characters were recorded in all crops under treatment 50% Compost + 25% Vermicompost (top dressing) + 25% Neem cake over other integrated nutrient treatments. The results were similar with the findings of Ramesh *et al*. (2006) [8], Sharma *et al*. (2010) [9] and Gupta *et al*. (2018) [4].

Tables 1: Yield attributes of cotton as influenced by different cropping system and nutrient modules.

Treatments	No. of Bolls Plant^{-1}	Boll Weight (g)	Seed Cot Yield plant^{-1}	Seed Index (g)
A) Main Factor Cropping system				
T_1- Cot + BG (2:1)	14.02	2.12	12.83	5.45
T_2- PP + FM (1:3)				
T_3- Cot + GM (2:1)	14.54	2.16	14.69	5.59
T_4- PP + Soy (1:3)				
T_5- Sole Cot	13.62	2.10	10.85	5.53
B) Sub Factor Nutrient Modules				
N1- Com + VC	13.97	2.10	13.95	5.57
N2-Com + NC + VC	16.32	2.27	15.53	5.86
N3-control (No Manure)	11.88	2.01	8.90	5.13
GM	14.05	2.12	12.79	5.52

Note: Cot – Cotton, PP – Pigeonpea, BG – Blackgram, Soy – Soybean, FM – Foxtail millet, Sun (GM) – Sunhemp (Green Manuring), Com-Compost, VC- Vermicompost, NC – Neem Cake

Table 2: Yield attributes of Pigeonpea, Blackgram, Soybean and Foxtail Millet as influenced by different cropping system and nutrient modules

Treatments	Yield attributes of Pigeonpea			Yield attributes of Blackgram			Yield attributes of Soybean			Yield attributes of Foxtail Millet			
A) Main Factor Cropping system	**No. of pods plant $^{-1}$**	**Seed Wt Per plant (g)**	**Test Weight (g)**	**No. of pods plant^{-1}**	**Seed Wt Per plant (g)**	**Test Weight (g)**	**No. of pods plant $^{-1}$**	**Seed Wt Per plant (g)**	**Test Weight (g)**	**Panicle Length (cm)**	**No of tillers per plant**	**Grain Wt (g)**	**Test Weight (g)**
T_1 -Cot + BG (2:1)				17.41	4.29	4.28							
T_2 - PP + FM (1:3)	118.94	41.94	9.13							7.21	10.62	3.05	6.97
T_3 - Cot + GM (2:1)													
T_4- PP + Soy (1:3)	131.35	49.36	9.17				30.58	6.15	11.35				
T_5 - Sole Cot													
B) Sub Factor Nutrient Modules													
N1- Com+VC	128.39	49.95	9.14	17.27	4.83	4.26	31.21	6.45	11.31	7.71	10.41	3.43	7.31
N2- Com+NC+VC	136.54	53.91	9.29	19.32	5.26	4.35	34.43	6.61	11.61	7.87	11.33	3.51	7.57
N3- Control (No Manure)	110.5	32.76	9.03	15.64	2.79	4.11	26.32	5.41	11.12	6.04	10.13	2.21	6.04
GM	125.14	45.54	9.15	17.41	4.29	4.23	30.58	6.15	11.35	7.21	10.62	3.05	6.97

Note: Cot – Cotton, PP – Pigeonpea, BG – Blackgram, Soy – Soybean, FM – Foxtail millet, Sun (GM) – Sunhemp (Green Manuring), Com-Compost, VC- Vermicompost, NC – Neem Cake

4. Conclusion

Higher yield attributing characters were observed in cotton + GM (Sunhemp) and pigeonpea + soybean under cotton based and pigeonpea based intercropping systems respectively with the application of organic integrated nutrient module N2 – 50% compost + 25% vermicompost + 25% neem cake.

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