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Predominant cropping systems response to plant nutrients on farmers' field

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Abstract
A field experiment was conducted at 24 farmers field under Experiment on cultivars field scheme, in Wardha district (M.S.) of Central Vidarbha Zone to study predominant cropping systems response to plant nutrients. The trial consisted of two cropping sequences *viz*, soybean chickpea and cotton + pigeon pea (6:1) with 8 treatments (T_0: Control, T_1: 100% N, T_2: 100% N + 100% P_2O_5, T_3: 100% N + 100% K_2O, T_4: 100% N + 100% P_2O_5 + 100% K_2O, T_5: 100% N + 100% P_2O_5 + 100% K_2O + 100% S, T_6: 100% N + 100% P_2O_5 + 100% K_2O + Foliar application of micronutrient and T_7: Farmers practices were arranged in randomized block design and treating 12 different locations as replications. The highest yields of soybean, chick pea and cotton + pigeon pea (6:1) were recorded with the application of recommended dose of NPK + Sulphur in both the cropping sequences. The highest net monetary return and BC ratio was also obtained with applications of NPK + Sulphur at recommended level.

Keywords: Recommended fertilizer dose, cropping system, productivity, profitability and economics

Introduction
There's wide gap between the yield harvested by the farmers and yield obtained on research farms. The major constraints are imbalance and injudicious use of fertilizers, non-adoption of improved varieties and improved package of practices. Unbalanced fertilization is an uneconomic waste of scarce resources. Farmers hesitate to supply recommended dose to the crops because of varied problems which is quite inadequate considering requirement of mono or double crop in a year. Nitrogen is the most important fertilizer element playing vital role in yield improvement and the element is frequently reported as deficient in agricultural soils. More than 80% of soil P is unavailable for plant use which is critical for plant growth, especially in the early stages and for enhancing grain yield and yield components. Potassium is third most important plant nutrient, vital to many plant processes owing to its requirement for activation of at least 60 different enzymes involved in plant growth, important for osmoregulation, cation-anion balance, protein synthesis, water balance, reducing lodging, imparting disease resistance and improving quality and shelf life of crop produce. Nutrient K is less mobile in soils because of the strong affinity with exchange sites of clays V. Ramamurthy *et al*., (2017) [6]. Sulphur plays important role in formation of amino acids, proteins, and oils. It is necessary for chlorophyll formation, promotes nodulation in legumes, helps to develop and activate certain enzymes and vitamins, and is a structural component of two of the 21 amino acids that form protein. The relationship between S and N is not surprising since both are components of protein and are involved in chlorophyll formation K. Karthika Vishnu Priya and Abha Manohar K (2022) [5]. Keeping this in view the present investigation entitled "predominant cropping systems response to plant nutrients on farmers field" was carried out.

Immediate objectives
To study the impact of application of recommended fertilizer dose on the cultivars field in terms of yield and monetary returns.

Long term objectives
To popularize the impact of application of recommended fertilizer dose to increase the productivity of crops.

Materials and Methods

Field experiments were conducted at six villages in year 2022-2023 with 8 treatments and treating 12 locations as replications. Villages were selected in Karanja Ghadge and Ashti block of Wardha district (M.S). Treatments consisted of $T_{o:}$ Control, $T_{1:}$ 100% N, T_2: 100%N + 100% P_2O_5, T_3: 100% N + 100% K_2O, T_4: 100% N + 100% P_2O_5 + 100% K_2O, T_5: 100% N + 100% P_2O_5 + 100% K_2O + 100% S, T_6: 100% N + 100% P_2O_5 + 100% K_2O + Foliar application of micronutrient (Grade II) before and during flowering and T_7: Farmers practices - Application of 18.33+47+26 kg NPK ha^{-1} in soybean, 21.35+35.52+18.28 kg NPK ha^{-1} in chick pea and 78.60+40+18 kg NPK ha^{-1} in cotton + pigeon pea (6:1). The soils of the experimental sites were black in colour, medium to heavy in texture, fairly high in clay content with medium in organic carbon %, low in available N and P kg ha^{-1}, medium in available K kg ha^{-1} and low in available sulphur mg ha^{-1}, with soil pH ranging from 7.53 to 8.09 (neutral) and electrical conductivity ranging from 0.25 to 0.39 ds/m. The recommended dose of fertilizer for soybean is (30:60:30 NPK kg ha^{-1}), chickpea (25:50:30 NPK kg ha^{-1}) and cotton (120:60:60 NPK kg ha^{-1}). For soybean, cotton 30 kg sulphur ha^{-1} and for chickpea 20 kg sulphur ha^{-1} was applied in treatment NPK + Sulphur. The micro nutrient (Grade II) consist of Fe – 2.5%, Zn – 3.0%, B – 0.5%, Mn – 1.0% and Cu – 1.0%. The total rainfall received in operational block i.e. Karanja Ghadge was 1458.9 mm in 67 rainy days and in Ashti block it was 1303.6 mm in 71 rainy days which was 190.06 and 156.61 percent of rainfall.

Results and Discussions

Table 1: Influence of treatments on grain yield (kg/ha) and economics (Rs/ha) of crops in soybean – chickpea system

Treatments	Kharif (Soybean) Kg/ha	Rabi (Chickpea) Kg/ha	SEY Kg/ha	SYS cost of cultivation	System net returns	B:C Ratio
	Grain	Grain	Grain	Rs/ha	Rs/ha	
Control	519.45	712.53	1184.48	34530	27322	1.79
N	641.19	897.82	1479.16	35164	42172	2.20
NP	1011.37	1162.14	2096.03	41122	67145	2.63
NK	878.51	1068.64	1875.90	36864	60375	2.64
NPK	1043.82	1409.69	2183.71	42822	80273	2.87
NPK + S	1349.97	1595.15	2838.78	45902	100985	3.20
NPK + Micronutrients	1289.27	1492.15	2681.95	45372	93221	3.05
FP	1022.10	1214.29	2142.59	40709	72882	2.79
CD (P=0.05)	325.26	399.64	500.50	-	-	
CV (%)	14.38	14.34	10.19	-	-	

Yield

Data on yield of soybean and succeeding chickpea (Table no.1) indicated that highest yield 1349.97 kg/ha was obtained from treatment NPK + Sulphur which was at par with treatments NPK + Micronutrients and NPK and recorded 25 and 61 percent more yield over farmers practice and control respectively results are in conformity with the findings of Similarly in chickpea highest yield 1595.15 kg/ha was also obtained from treatment NPK + Sulphur which was at par with treatments NPK + Micronutrients, NPK and farmers practices and recorded 24 and 55 percent more yield over farmers practice and control respectively similar observations was found by Boini Jyothi Kumar and Biswarup Mehera (2021). In soybean – chickpea system highest system equivalent yield 2838.78 kg/ha was obtained from treatment NPK + Sulphur which was at par with treatment NPK + Micronutrients and lowest yield of 1184.48 kg/ha was obtained from control.

Economics

Data on economics of soybean-chickpea sequence as affected by nutrients application recorded highest total net monetary benefits of Rs. 100985/ha from treatment NPK + Sulphur which was 27% more over control with highest B:C ratio of 3.20.

Table 2: Influence of treatments on seed cotton / grain yield (kg/ha) and economics (Rs/ha) of crops in Cotton + Pigeon pea (6:1) system

Treatments	Kharif (Cotton) Kg/ha	Rabi (Pigeon pea) Kg/ha	SEY Kg/ha	SYS cost of cultivation	System net returns	B:C Ratio
	Cotton	Grain	Grain	Rs/ha	Rs/ha	
Control	702.43	71.46	775.99	24200	28567	1.18
N	827.60	98.95	900.04	25589	37614	1.42
NP	1107.35	134.91	1246.23	28833	55910	1.94
NK	908.25	112.50	1024.06	27289	42347	1.55
NPK	1326.12	165.91	1496.90	30533	71257	2.33
NPK + S	1548.58	193.53	1747.84	32315	86535	2.68
NPK + Micronutrients	1408.88	181.05	1595.26	31808	76669	2.41
FP	1134.40	135.94	1274.34	27788	58867	2.11
CD (P=0.05)	401.95	47.16	427.87	-	-	
CV (%)	15.37	14.78	14.58	-	-	

Yield

Data on yield of cotton + pigeon pea (6:1) (Table no.2) indicated that highest cotton yield 1548.58 kg/ha was obtained from treatment NPK + Sulphur which was at par with treatments NPK + Micronutrients and NPK and recorded 27 and 55 percent more yield over farmer practices and control respectively results are in conformity with the findings of Bhagchand Bairwa *et al*., (2020) [1]. Similar trend was observed in intercrop pigeon pea highest yield 193.53 kg/ha was also obtained from treatment NPK + Sulphur which was at par treatments NPK + Micronutrients and NPK and recorded 30 and 63 percent more yield over farmers practice and control respectively. In cotton + pigeon pea (6:1) system highest system equivalent yield 1747.84 kg/ha was obtained from treatment NPK + Sulphur which was at par with

treatments NPK + Micronutrients and NPK while lowest yield 775.99 kg/ha was obtained from control.

Economics

Data on economics of cotton + pigeon pea (6:1) as affected by nutrients application the highest total net monetary benefits of Rs. 86535 / ha was obtained from treatment NPK + Sulphur which was 33 percent more over control with highest B:C ratio of 2.68.

Conclusion

It was concluded that for getting higher yield and profitability of soybean – chickpea and cotton + pigeon pea (6:1) cropping sequences application of recommended dose of NPK + Sulphur was essential.

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