

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.912.278>

Studies on Farm Crop Response to Plant Nutrients in Predominant Cropping Systems and their Impact on Crop – Livestock – Human Continuum under Central Vidharbha Zone of Maharashtra

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ABSTRACT

Keywords

On-farm experiment, Economics, Cropping systems, Central Vidarbha Zone

Article Info

Accepted:
17 November 2020
Available Online:
10 December 2020

A experiment was carried out on twenty four farmer's fields to study the response of major nutrients NPKS on soybean-wheat, soybean-chickpea and cotton-fallow crops sequences in Central Vidarbha Zone (Nagpur) Maharashtra during the year 2018-19. A set of eight treatments comprises of no NPK, 100 % N, 100 % N + 100 % P, 100 % N + 100 % K, 100 % N + 100 % P + 100 % K, 100 % N + 100 % P + 100 % K + 100 % Sulphur, use of organic manure / bio-fertilizers and farmers practice after categorization in initial similar factors by R statistical method analysis. Result indicated that application of recommended NPK + Sulphur recorded significantly higher yields in soybean (1302 kg ha⁻¹)– wheat (2042.69 kg ha⁻¹), soybean (1464.03 kg ha⁻¹) – chickpea (1654.99 kg ha⁻¹) and cotton (1889.35 kg ha⁻¹) crop, respectively. Similarly, the total increase in monetary returns by 10, 13 and 10 percent and net returns of Rs. 88645 ha⁻¹, 116358 ha⁻¹ and 100135 ha⁻¹ under soybean–wheat, soybean – chickpea and cotton – fallow sequential cropping system, respectively.

Introduction

The Central Vidarbha Zone comprises of Yavatmal, Nagpur, Wardha, and part of Chandrapur districts. The Central Vidarbha Zone is the VIIth Agro Climatic zone of Maharashtra State having assured rainfall zone. This tract has hot summer, moderate winter and rainy season which receive 950 to 1250 mm rainfall in 60 to 70 rainy days. Soils

are derived from basalt rock, black in color and having varying in depth. Vertisols, Inceptisols and Entisols are the dominant soil orders occurring in the zone. Soil type in these districts having deep black (43.4 %), medium deep black (13.8 %) and shallow soils (42.7 %) having with an area of 427.9, 136.4 and 421.5 (area 000 ha) hectare, respectively. Main agronomical crops of this zone are cotton, soybean, sorghum, pigeon

pea in *kharif* and wheat and gram in *rabi* season. Nagpur mandarin and vegetable crops viz., brinjal, tomato grown in Nagpur district.

During 2018-19 the experiments were conducted in two blocks of Nagpur district. One is high productive block of Katol and second low productive block of Narkhed. Major farming system of the district is crop + livestock. Soybean-wheat, Soybean-Chickpea and Cotton-fallow cropping system, a lifeline for the majority of the population in Central Vidarbha Zone is under stress, due to the imbalanced and indiscriminate use of fertilizers.

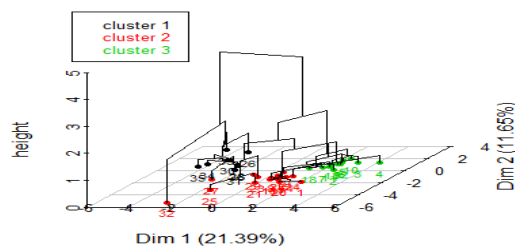
Therefore, we conducted an on-farm study at two locations (Katol and Narkhed in Nagpur District) covering Twenty Four Farmers to judge the response of NPK and S in Central Vidarbha Zone (Nagpur) Maharashtra.

Materials and Methods

Data employed in this study were taken from on-farm experiments conducted with Soybean and wheat, Soybean and Chickpea and Cotton-Fallow between 2018 to 2019 in the Indian districts of Nagpur in the Maharashtra state, under the umbrella of the All India Coordinated Research Project (AICRP) on Integrated Farming systems (IFS) by the Indian Council of Agricultural Research (ICAR). A experiment was carried out on farmers field to study the response of major nutrients NPKS on soybean-wheat (06 farmers), soybean-chickpea (06 farmers) and cotton-fallow(12 farmers) in crops sequences on twenty four farmer's fields in Central Vidarbha Zone (Nagpur) Maharashtra during the year 2018-19. Treatments comprises viz., T₁ – No NPK, T₂ – 100 % N, T₃ – 100 % N + 100 % P, T₄ – 100 % N + 100 % K, T₅ – 100 % N + 100 % P + 100 % K, T₆ – 100 % N + 100 % P + 100 % K + 100 % Sulphur, T₇- Use of organic manure / Bio-fertilizers and

T₈- Farmers practice, respectively with six replications in Soybean – Wheat, six in Soybean – Chickpea and twelve in Cotton – fallow sequence cropping systems after categorization in initial similar factors by R statistical method analysis. Similar farmer taken into the cluster for study. Information of farmers collected and identical farmers were chosen. The levels of applied nutrients were used as per the standard recommendation of the University.

Hierarchical clustering on the factor map



During *Kharif* 2018, Nagpur district received total 902.6 mm rainfall in 55 rainy days, 20.79 % less with reduced number of rainy days than normal. The total rainfall received and number of rainy days in operational block i.e. Narkhed 571.4 mm in 36 rainy days and in Katol block 581.7 mm in 40 rainy days which was 44% and 40% less than normal, respectively. During the crop growth stages particularly at the time of flowering to pod development stage of soybean crop, it was affected due to less rainfall. Also early withdrawal of monsoon resulted into low yield of long duration crop like cotton and pigeon pea.

The meager infestation of whitefly and *spodoptera* recorded on soybean crop which was controlled by spraying of recommended insecticides during the crop growing period. This year, some pockets of cotton were infested by boll worms which resulted into low seed cotton yield.

Results and Discussion

Soybean – wheat system

The yield benefit due to treatments is given in Table-1 and in Figure 1. The data indicated that the yields of soybean were increased significantly due to application of all treatments over control and Soybean yield 1302 kg ha⁻¹ was obtained by application of recommended dose of NPK + Sulphur which was significantly superior over application of

all treatments. The yields obtained from wheat were influenced significantly due to all treatments over control. Application of NPK with sulphur (2042.69 kg/ha) was significantly superior over all treatments. The highest net return under Soybean - Wheat system was recorded Rs 88645 ha⁻¹ due to application of NPK with Sulphur and lowest Rs 34887 ha⁻¹ with control treatment. Similar observations were reported by Bhattacharyya *et al.*, (2008).

Table.1 Influence of treatments on grain yield (kg/ha), economics (Rs/ha) and nutrient response (kg/kg & Rs/re) of crops for soybean – wheat cropping system

Treatments	<i>Kharif</i> (Soybean) Kg/ha	<i>Rabi</i> (Wheat) Kg/ha	SEY Kg/ha	SYS cost of cultivation	System net returns
	Grain	Grain	Grain	Rs/ha	Rs/ha
Control	445.57	896.93	1090.24	31025	34887
N	596.03	1070.53	1365.47	32634	43695
NP	891.15	1498.75	1968.37	34218	62987
NK	769.63	1232.56	1655.53	33113	52976
NPK	1139.97	1637.63	2317.02	36344	74144
NPK + S	1302.00	2042.69	2770.19	38869	88645
Organic	758.05	1267.28	1668.91	33835	53405
FP	688.61	1001.09	1408.15	29547	45060
CD (P=0.05)	111.93	187.11	192.13	-	-
CV (%)	11.64	12.05	9.25	-	-

Table.2 Influence of treatments on grain yield (kg/ha), economics (Rs/ha) & nutrient response (kg/kg & Rs/re) of crops for soybean- chickpea system

Treatments	<i>Kharif</i> (Soybean) Kg/ha	<i>Rabi</i> (Chickpea) Kg/ha	SEY Kg/ha	SYS cost of cultivation	System net returns
	Grain	Grain	Grain	Rs/ha	Rs/ha
Control	567.09	694.40	1478.49	28920	47311
N	729.12	908.51	1921.54	30290	61489
NP	1111.04	1249.92	2751.56	31958	88049
NK	1111.04	1058.96	2500.93	32519	80029
NPK	1232.56	1406.16	3078.15	34616	98500
NPK + S	1464.03	1654.99	3636.20	36360	116358
Organic	908.51	1151.55	2419.91	30538	77437
FP	792.77	810.13	1856.07	28374	59394
CD (P=0.05)	153.03	180.62	305.26	-	-
CV (%)	13.26	13.86	10.66	-	-

Table.3 Influence of treatments on seed cotton yield (kg/ha), economics (Rs/ha) & nutrient response (kg/kg & Rs/re) of crops for cotton- fallow system

Treatments	Kharif (Cotton)	Rabi (Fall.)	SEY	SYS cost of	System net
	Kg/ha	Kg/ha	Kg/ha	cost of	returns
	Seed cotton	Grain	Grain	Rs/ha	Rs/ha
Control	717.55	-	-	19162	38029
N	917.15	-	-	20175	48610
NP	1571.08	-	-	22171	83267
NK	1336.72	-	-	19572	70846
NPK	1744.68	-	-	25034	92468
NPK + S	1889.35	-	-	26338	100135
Organic	1102.36	-	-	20542	58425
FP	928.76	-	-	18702	49224
CD (P=0.05)	156.54	-	-	-	-
CV (%)	5.26	-	-	-	-

Fig.1

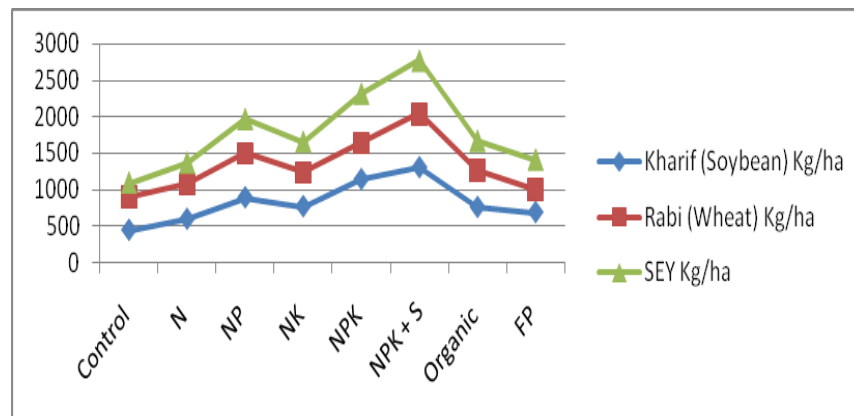


Fig.2

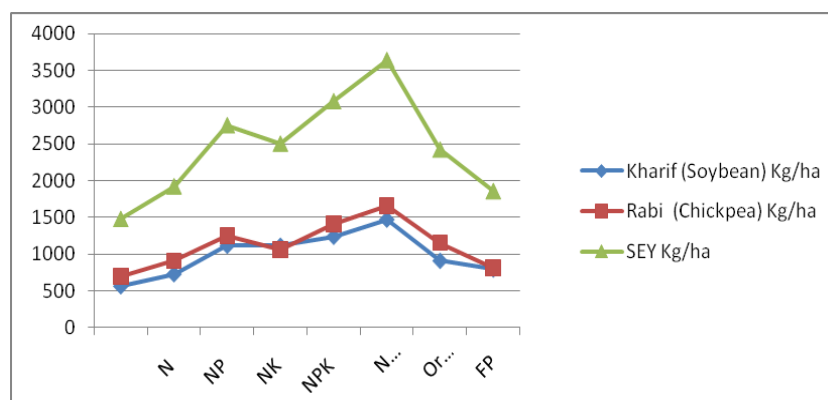
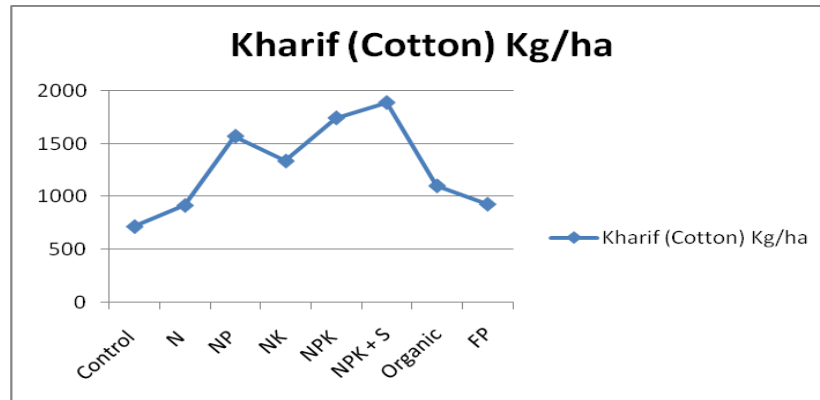


Fig.3



Soybean-chickpea system

The yields obtain due to the different treatments is given in Table 2 and Figure 2. The data indicated that the yield of Soybean was increased significantly due to application of N, NP, NK over control. Application of recommended dose of NPK + Sulphur increased the yields i.e. 1464.03 kg ha⁻¹ significantly superior over all treatments. The yields of Chickpea were influenced significantly due to all treatments over control. Application of NPK with Sulphur yielded (1654.99 kg ha⁻¹) significantly superior over all other treatments in chickpea. Highest System yield in soybean – chick pea system was noticed by application of NPK +S i.e. 3636.20 kg ha⁻¹ and more net returns 116358 Rs. /ha were achieved by application of NPK +S over farmers practice. Findings in lines with Singh *et al.*, (2008).

Cotton-fallow system

The yields obtain due to the different treatments is given in Table 3 and Figure 3. The data indicated that the yield of cotton was increased significantly due to application of N, NP, NK over control. Application of recommended dose of NPK + Sulphur increased the yields i.e. 1889.35 kg ha⁻¹ significantly superior over application of N,

NP and NK. However it was at par with application of NPK. Highest System net returns 100135 Rs. /ha was achieved by application of NPK +S over farmers practice. Similar results were recorded by Srinivasulu and Hema (2007).

In conclusion the result indicated that application of recommended NPK + Sulphur recorded significantly higher yields in soybean (1302 kg ha⁻¹)– wheat (2042.69 kg ha⁻¹), soybean (1464.03 kg ha⁻¹) – chickpea (1654.99 kg ha⁻¹) and cotton (1889.35 kg ha⁻¹) crop, respectively. Similarly, the total increase in monetary returns by 10, 13 and 10 percent and net returns of Rs. 88645 ha⁻¹, 116358 ha⁻¹ and 100135 ha⁻¹ under soybean–wheat, soybean – chickpea and cotton – fallow sequential cropping system, respectively.

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How to cite this article:

Charjan, Y. D., R. S. Wankhade and Deshmukh, M. R. 2020. Studies on Farm Crop Response to Plant Nutrients in Predominant Cropping Systems and their Impact on Crop – Livestock – Human Continuum under Central Vidharbha Zone of Maharashtra. *Int.J.Curr.Microbiol.App.Sci.* 9(12): 2345-2350. doi: <https://doi.org/10.20546/ijcmas.2020.912.278>