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SOIL TEST BASED FERTILIZATION TO IMPROVE PRODUCTION OF OIL SEED CROPS IN KAPURTHALA DISTRICT OF PUNJAB

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Abstract: The present study was carried out to demonstrate the beneficial effect of fertilizer application on soil testing. Further deteriorating soil health and declining water table made it necessary to divert some area from wheat-paddy to oil seed viz. sunflower, gobhi-sarson etc. But instead of diverting significant area under these crops farmer are not interested to include them in their cropping system. One main reason is lower yields because of non-judicious uses of fertilizers as application of fertilizers based on the soil testing is the mantra for the sustainable agriculture, which take care of inherent soil fertility. Fertilization on soil test basis results in yield increase of about 1.10-8.12% in sunflower and 10.9-15.0% in gobhi-sarson. With these demonstrations farmers were encouraged apply fertilizers after testing their soils.
Keywords: Soil testing; Fertilization; Sunflower; Gobhi-Sarson.

INTRODUCTION

The country witnessed yellow revolution through a phenomenal increase in production and productivity from 2.68 MT and 650 kg/ha in 1985-86 to 6.96 MT and 1022 kg/ha in 1996-1997, respectively. In spite of these achievements, there exists a gap between production potential and actual realization (Shekhawat, *et al* 2012). Sunflower (*Helianthus annuus* L.) and gobhi-sarson (*Brassica napus*) are the most important popular sources of vegetable oil. Sunflower cultivated on an area of 27.3 million hectares with an annual production and productivity of 26.46 million tones and 914 kg per hectare, respectively in the world. In India, sunflower is cultivated over an area of about 2 million hectares with a production of 1.18 million tonnes and productivity of 590 kg per hectare (Anon, 2006). One of the reasons for this wide gap between national and global level productivity is due to non-adoption of the recommended techniques for the cultivation of the sunflower and gobhi-sarson. Soil fertility management for intensive cropping system is a major component of sustainable agricultural development. Balanced fertilization of major crops should be based on soil testing. Presently in Punjab paddy cultivated on an area of about 2.8 M ha area and we are already withdrawing more than 1.3 M ha-m from the ground because of which the ground water table is declining at an alarming rate of 30 cm year^{-1} (Soni, 2012). Similarly soil

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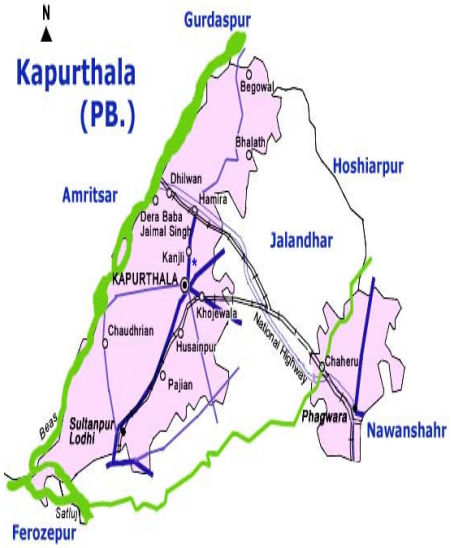
health is also declining day by day as micro-nutrients start appearing and we have to apply these micro-nutrients viz. iron, zinc and manganese. Therefore diversification is the must to eradicate these problems. Sunflower and Gobhi-sarson are the two most important oil seed crops which are popularize among the farmers under the FLDs for diversification. Under FLDs, demonstrations were conducted on to the farmer's field to transfer latest production technology generated by the Punjab Agricultural University, Ludhiana among the various development agencies for its further dissemination amongst the farming community. The objective of the carried out study is to demonstrate the effect of soil test based fertilization on the yield potential of the sunflower and gobhi-sarson so that farmers of the region got benefitted by judicious use of the fertilizers after testing their soil.

MATERIALS AND METHODS

For proper implementation of the Johl committee report, (2002) we must have to divert at least 1.0 M ha area from the rice (covering 2.8 M ha), then declining water table as then demand is as per supply viz. 3.0 M ha-m secondly cultivation of oil seed and pulses will certainly improve the inherent fertility of the soil. In Punjab, KVKs are doing excellent job in encouraging the farmers to divert maximum possible area from wheat –paddy to oil seed and pulses as KVKs are well equipped with FLDs under which demonstrations are carried with improved cultivation practices side by side with the farmers indigenous technologies and yield increments will certainly encourage the farmers to adopt those improved techniques for improving the production potential of these crops. Under FLDs during year 2010 we carried out 16 demonstrations on sunflower and 10 demonstrations on gobhi-sarson showing the importance fertilizer application on the basis of soil testing. Kapurthala (A formerly princely state) is one of the smallest district of Punjab both in terms of area and population. The district is divided into two non–continuous parts viz. Phagwara block in one part and the remaining four blocks in the other part. The agro-climatic conditions of the district Kapurthala coincide with the Central Punjab with smooth-plain topography. Kapurthala is located at 31°36' North and 75°37' East on the sultanpur road at an attitude of 221 meters. Inherent soil fertility of the



selected plots was analyzed in our soil and water testing lab. Soil test based nutrient management results in higher yields. Application of potassium results in yield increase from 2.8 to 6.3% in the region as compared to control plots in K deficient soils (Bhatt and Sharma, 20011). Under the Front line demonstrations, we selected 22 locations on the random basis, out of which 12 selected for sunflower and 10 locations selected for gobhi-sarson. Initial soil fertility status of all the demonstration plots were analyzed in the soil and testing lab of our Kendra after collecting surface soil samples from the 0-15 cm depth. Sunflower variety (PSH-569) were sown in the 2nd week of Feb and harvested in June while gobhi-sarson sown in the last of October and harvested in the middle of March. Soil organic carbon (SOC) content was determined by Walkley and Black (1934). The content of available P and K was determined as described by Olsen *et al.* (1954) and Mervin and Peech (1950) respectively. Grain yield data was statistically analyzed using Student t-test at 5% level of significance. For each demonstration we selected a plot of 0.4 ha and then divide into two parts of 0.2 ha. Subplots were allotted with T_1 (Plot receiving fertilizers as per soil testing) and T_2 (Plot receiving fertilizers as per farmer's tradition).

RESULTS AND DISCUSSIONS

To prove the importance of fertilizer management as per soil test reports over farmer's practice 12 demonstrations of sunflower and 10 demonstrations of gobhi-sarson were carried out in the year 2009-2010. As far as economics of sunflower and gobhi-sarson was concerned, it was reported that by spending 1 rupee we earn a benefit of upto 2.48 in sunflower and 2.66 in gobhi-sarson (Table 1) and a yield increase of 6.1% in sunflower and 13.2% in gobhi-sarson were reported which is mainly because of fertilizer management on the soil test basis.

Table 1: Yield obtained under FLDs and farmer's practice of oilseed and pulse crops

Sr. No.	Name of Crop	Variety	No. of FLDs	Area (ha)	Average yield (ha)		Percent increase over the FP
					FLD	FP	
1.	Sunflower	PSH 569	12	4.8	20.8	19.6	6.1
2.	Gobhi-Sarson	GSC-6	10	4.0	16.3	14.4	13.2

Economic impact (continuation of previous table)

Average Cost of cultivation (Rs./ha)		Average Gross Return (Rs./ha)		Average Net Return (Profit) (Rs./ha)		Cost - Benefit Ratio
Demonstration	Local Check	Demons-tration	Local Check	Demons-tration	Local Check	
18558	18058	46072	43414	27515	25357	1:2.48
9800	9000	26100	22680	16300	13680	1:2.66

The Table 2 shows crop wise performance of the demonstration in terms of yield increased over local check or farmers practice and there was a significant increase in yield of demonstration over farmers' practices, thus resulting in a net higher income. We selected 12 locations and analyze their inherent fertility status, then applying fertilizers accordingly. The fields of all the demonstrating farmers were low in organic carbon (%) therefore it was recommended to apply 25% more urea fertilizer than the recommendation viz 157 kg/ ha whereas muriate of potash was applied only when K was found to be low i.e. @ 137 kg/ ha. All the demonstrations were low in K-status also (table 2).

Table 2: Result of front-line demonstration on sunflower (PSH 569) during 2010.

Locations	Soil Fertility status			Yield (q ha^{-1})		% increase in yield over control
	OC (%)	P (kg ha^{-1})	K (kg ha^{-1})	FLDs	Control	
L_1	0.32	11.0	120.5	17.1	16.3	4.83
L_2	0.28	10.5	110.0	21.0	20.0	5.10
L_3	0.26	9.50	125.0	21.1	20.0	5.26
L_4	0.24	10.0	130.5	22.2	21.0	5.71
L_5	0.28	10.0	135.0	22.9	21.3	7.69
L_6	0.34	8.0	102.0	20.6	19.4	6.25
L_7	0.36	8.5	105.5	19.3	18.1	6.56
L_8	0.34	9.0	115.0	21.4	20.3	5.71
L_9	0.28	9.0	120.0	20.3	19.4	4.61
L_{10}	0.28	9.5	125.0	22.2	20.5	8.12
L_{11}	0.26	10.0	120.0	20.6	19.2	7.80
L_{12}	0.32	10.5	116.0	21.4	20.5	4.61
Mean	0.30	9.7	118.7	20.8	19.7	6.10
Median				21.0	20.0	
Mode				22.2	20.0	

The grain yield in FLDs plots recorded to be as high as 22.9 q/ha and to as low as 17.05 q/ha and the percent increase in FLDs plot over farmers plots was found to be 4.61% to 8.12%

(Table 2). Yield increase in FLDs plots was mainly due to application of higher dose of 25% urea and application of murate of potash @ 50kg/ha in nutrient deficient plots. Bhatt and Sharma (2011) in their earlier study also reported a yield increase of 2.8 to 6.3% with potash application in K deficient soils. Main idea behind this is that farmers must go for fertilization after knowing the inherent fertility of their fields. Similarly in the gobhi-sarson, the per cent increase in yield under FLD plots varied from 10.9% to 15.0% over the farmers practice with a mean increase of 13.2% (Table 3).

Table 3: Demonstration on gobhi sarson (GSC-6) during 2009-10.

Locations	**Soil Fertility status**			**Yield (q ha^{-1})**		**Percent Increase in yield**
	OC (%)	**P (kg ha^{-1})**	**K (kg ha^{-1})**	**FLD's**	**Farmer's Practice**	
L_1	0.32 (L)	10.2 (L)	154.4 (H)	15.89	14.00	13.5
L_2	0.28(L)	11.4 (L)	162.2 (H)	16.50	14.40	14.6
L_3	0.26(L)	14.2(M)	128.4 (H)	15.30	13.30	15.0
L_4	0.24(L)	14.0(M)	124.6(L)	16.40	14.50	13.1
L_5	0.28(L)	16.0 (M)	122.2 (L)	14.80	13.00	13.8
L_6	0.32(L)	10.4(L)	118.4(L)	14.20	12.80	11.0
L_7	0.34(L)	10.6 (L)	148.6 (H)	15.20	13.50	12.6
L_8	0.36(L)	11.4 (L)	150.2(H)	18.30	16.50	10.9
L_9	0.24(L)	16.2 (M)	158.4(H)	18.80	16.50	13.9
L_{10}	0.26(L)	14.2(M)	155.2 (H)	17.94	15.80	13.5
Mean	0.26	12.9	142.3	16.33	14.43	13.2
Median				14.6	13.9	
Mode				14.3	13.75	

- All demonstrations were conducted on an area of 0.4 ha. and variety was GSC-6.

The variation in grain yield was mainly due to the difference in soil fertility status as apparent from soil analysis done before laying out demonstrations. Statistically, it is revealed that FLD practice had significantly higher yield than the farmer's practice.

Highest grain yield (18.80 q/ha) was obtained at the location 9 which is mainly because of applying 25% higher dose of urea than recommendation where the inherent fertility status analysis of soil revealed that soils were medium in available phosphorous (16.2 kg/ha) and high in available potash (158.4 kg/ha). Further weather conditions at growing and harvesting

stage have also affected the yields obtained. The increase observed in the FLD plot over the farmer practice was mainly due to the application of fertilizers as per soil test reports which is statistically higher than the farmer's practice. Our study revealed the importance of soil testing in sunflower and gobhi-sarson. Thus, balanced nutrition concept focus on the use of plant nutrients in a definite proportion as required by the crops which is possible only if one knows the available nutrient status of his soils**.** Soil testing helps in understanding the inherent fertility status of the soils which further helps in improving the livelihood of the farmers of the region by improving the production and by effective fertilizer management. Therefore, soil testing is a must for every farmer before finalizing his fertilization schedule.

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