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Use of fertilizer on major crops by farmers in Abhanpur block of Raipur district

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Abstract
Fertilizer consumption measure the quantity of plant nutrients used per unit of arable land. Fertilizer product covers nitrogenous, potash and phosphorus fertilizers. In Chhattisgarh state, area under net sown has 4800.66 thousand hectare. Major crops are paddy, wheat, jowar, pulses and oil seeds. Paddy is grown in 3756.80 thousand hectare which occupies about 78.25 percent of the net sown area of the state, whereas wheat grown in 177.78 thousand hectare and gram in 356.52 thousand hectare in the state. The average size of holding was 2.78 ha in Abhanpur block. The sample farmers comprised pre-dominantly of other backward caste. Farmers were growing paddy crop in kharif season, gram and wheat in rabi season and paddy in summer season. Tiwara were sowing as an utera and some farmers grown tur in bunds. Paddy crop covered highest cropped area 61.07 percent under kharif season in Abhanpur block. The cropping intensity was found in 163.74 percent.

Keywords: Fertilizer, major crops, farmer

Introduction
The use of fertilizer depends largley on the availibility of irrigation facilities and availibility of working capital with the farmers for acquiring the purchase inputs. As the small farmers have inadequate capital base, the non available of adequate credit may be problem in exploiting the production potentials by them. The farmers may also have different attitudes to different crops grown on the farm regarding to application of fertilizer. This may be influenced by the relative profitability of the crops, degree of yield and price risks involved and the personal likings and consumption needs of the farm family. Thus, institutional, financial, and behavioural constraints condition, the farmer's decisions concerning his farm practices in general and use of fertilizer in particular. These constraints must be evaluated for the level of their incidence and their impact of fertilizer use at farm level.

India imports mainly urea, DAP and MOP. The country has almost reached self sufficiency in urea production. As regards DAP, the level of imports was between 1.5 and 2 million tonnes in the 1980s and 1990s. A great deal of DAP capacity came on stream in the early2000s. Consequently, the importation of DAP fell to less than 1 million tonnes after 2000-01. In 2003-04, DAP imports were 0.73 million tonnes. Imports meet the entire MOP requirement as there are no known natural potash deposits in the country. In 2003-04, MOP imports were 2.58 million tonnes in addition, India also imports a small quantity of monoammonium phosphate (MAP) and potassium sulphate (SOP) (65 000 and 10 500 tonnes, respectively, in 2003-04).

In Chhattisgarh State, area under net sown has 4800.66 thousand hectare. Major crops are paddy, wheat jowar pulses and oil seeds. Paddy is grown in 3756.80 thousand hectare which occupies about 78.25 percent of the net sown area of the state where as wheat grown in 177.78 thousand hectare and gram in 356.52 thousand hectare in the state.

The NPK consumption of the State increased to the level of 613074 Mt during 2014-15 showing sharp increase of 162.33 percent over 2000-01 The Nutrient wise consumption shows that potash(K_2O) and nitrogen (N) consumption increased by 167.04 percent and 177.37 percent respectively and phosphate (P_2O_5) consumption increased by 131.97 percent over 2000-01.

Keeping in view, the importance of fertilizer use pattern in development of the state the study entitled "Use of fertilizer on major crops by farmers in Abhanpur Block of Raipur District" were taken:

Materials and Methods

A stratified random sampling has been used for selection of the samples. Abhanpur block have been divided into five strata as their farmer size as marginal, small, semi-medium, medium and large farmer under proportional allocation. Sample sizes were at 95% confidence coefficient with marginal error of 10%.

Results

Profile characteristics of the sample farmers

It can be seen from the Table 1 that, average size of holding was 2.78 ha. It varied from 0.60 ha (marginal farmers) to 6.35 ha (Medium farmer) The sample farmers comprised predominantly of other backward caste 56.67 percent followed by scheduled tribe 14.95 percent, scheduled caste 21.49 percent and others 7.47 percent. 67.28 percent farmers having below one ha, 20.56 percent between 1- 2 ha. Medium farmers (4-8 ha) found only 2.80 percent in Abhanpur block.

Table 1: General characteristic of sample farmers in Abhanpur block

S.N.	Particular	Sample Farmers				
		Marginal	Small	Semi-medium	Medium	Total
1.	Total no. of farmers	72 (67.28)	22 (20.56)	10 (9.34)	3 (2.80)	107 (100)
2.	Average Size of house holding	0.60ha	1.31ha	2.85ha	6.35ha	2.78ha
3.	Education of farmers a. Illiterate	25 (34.72)	8 (36.36)	4 (40.00)	- -	37 (34.57)
	b. Primary	18 (25.00)	5 (22.72)	1 (10.00)	- -	24 (22.42)
	c. Middle	15 (20.83)	4 (18.18)	2 (20.00)	1 (33.33)	22 (20.56)
	d. Higher	10 (13.88)	3 (13.63)	2 (20.00)	2 (66.66)	17 (15.88)
	e. Graduate	4 (5.55)	2 (9.09)	1 (10.00)	- -	7 (6.54)
	Total	72 (100)	22 (100)	10 (100)	3 (100)	107 (100)
4.	Cast wise house hold a. OBC	39 (54.16)	14 (63.63)	5 (50)	2 (66.66)	60 (56.07)
	b. ST	10 (13.88)	4 (18.18)	2 (20)	- -	16 (14.95)
	c. SC	15 (20.83)	4 (18.18)	3 (30)	1 (33.33)	23 (21.49)
	d. others	8 (11.11)	- -	- -	- -	8 (7.47)
	Total	72 (100)	22 (100)	10 (100)	3 (100)	107 (100)

Note: Figures in parentheses indicate percentage to total.

Cropping pattern

Farmers in Abhanpur block taking crops mainly paddy in kharif, gram and wheat in rabi and few farmers were paddy in summer season. Tiwara were sowing as an utera and some farmers grown tur in bunds. Paddy crop covered highest cropped area 61.07 percent in kharif season, yet it decreased and come down on 2.03 percent in summer season. The cropping intensity was found in 163.74 percent. (Table 2)

Table 2: Cropping pattern of the sample farmers in Abhanpur block

S.N.	Crop Season	Marginal	Small	Semi-Medium	Medium	Total
1.	(A) Kharif - Paddy	43.43 (62.69) (36.26)	28.78 (58.65) (24.03)	28.50 (64.33) (23.79)	19.04 (56.93) (15.89)	119.75 (61.07) (100)
2.	(B) Rabi - Gram	11.94 (17.23) (36.94)	8.98 (18.30) (27.78)	5.40 (12.18) (16.70)	6.00 (17.94) (18.56)	32.32 (16.48) (100)
	Wheat	13.90 (20.06) (34.74)	11.31 (25.49) (28.26)	8.40 (18.96) (20.99)	6.40 (19.13) (15.99)	40.01 (20.40) (100)
3.	(C) Summer-Paddy	0 (0) (0)	0 (0) (0)	2 (4.51) (50.00)	2 (5.98) (50.00)	4 (2.03) (100)
4.	Total operated area	43.43	28.78	28.50	19.04	119.75
5.	Total cropped area(A+B+C)	69.27 (100)	49.07 (100)	44.30 (100)	33.44 (100)	196.08 (100)
6.	Cropping intensity (%)	159.49	170.50	155.43	175.63	163.74

Note: Figures in parentheses indicate percentage to total.

Crop wise Expenditure on Fertilizer use

It is evident from Table 3 that farmers of Abhanpur block used more fertilizer 17.16% of fertilizer expenditure to the cost of cultivation on paddy crop followed by wheat 14.74% and gram 11.09%. In paddy crop, maximum fertilizer expenditure was incurred (Rs. 7771.50 per ha.) of semi-medium farmer which accounted for about 20.57% of the total cost of cultivation. Minimum expenditure was recorded for medium farmers of Rs. 5877.13 per ha. In case of gram maximum expenditure observed in small farmers 2754.37 Rs/ ha accounted 14.66% to total to the total cost of cultivation. Minimum was observed in medium farmers 1360.55 accounted 5.91% to the total cost of cultivation. Marginal, small semi-medium and medium farmer not used phosphorus for cultivation of gram. In wheat as maximum expenditure was observed 15.33% (4563.24 Rs/ha) to the cost of cultivation of small farmer and minimum recorded 13.96% (3898.80 Rs/ha) to total cost of cultivation.

Table 3: Fertilizer expenditure on sample farmers under different crops in Abhanpur block

Farmer	Crop	Fertilizer expenditure (Rs./ ha)				Average cost of cultivation (Rs./ ha)	% of fertilizer expenditure to total cost of cultivation
		N	P_2O_5	K_2O	Total		
Marginal	Paddy	1669.68	3502.24	1119.86	6291.79	35017.97	17.96
	Gram	314.97	2276.13	-	2591.10	19348.82	13.39
	Wheat	1039.40	2392.75	466.64	3898.80	27918.27	13.96
Small	Paddy	1555.92	3143.29	1020.17	5719.38	35053.85	16.32
	Gram	305.62	2448.74	-	2754.37	18777.87	14.66
	Wheat	1076.69	2698.67	787.87	4563.24	28815.07	15.33
Semi-medium	Paddy	2033.41	4336.83	1401.27	7771.50	37788.50	20.57
	Gram	265.30	2061.34	-	2326.63	20312.50	11.45
	Wheat	1139.90	2262.27	696.93	4099.10	29110.42	14.02
Medium	Paddy	1699.76	3269.97	907.40	5877.13	41666.67	14.11
	Gram	165.47	1195.07	-	1360.55	23033.33	5.91
	Wheat	1071.97	2496.97	1036.85	4605.79	30591.67	15.06
Total	Paddy	6958.77	14252.33	4448.69	25659.79	149526.99	17.16
	Gram	1051.36	7981.28	-	9032.64	81472.52	11.09
	Wheat	4327.97	9850.66	2988.30	17166.93	116435.43	14.74

Consumption Pattern of Fertilizers

Table 4 presented fertilizer use by marginal farmers in Abhanpur block. It is seen that marginal farmers were using on average 128.93 kg N, 72.85 kg P_2O_5 and 40.05 kg K_2O in one hectare with an average productivity 4282.20 Kg/ha for paddy crop. Percentage gap of fertilizer were found 28.93% in N, 21.41% in P_2O_5 and 0.12% in K_2O. Which showed that farmers were used less potassium for cultivation of wheat. In case of Gram, farmers were used only N and P_2O_5 as an average 24.32 kg and 47.35 kg in one hectare and productivity 1137.47 kg / ha. Percent gap of fertilizer were observed 21.6% in N and 18.37% in P_2O_5 respectively.

Table 4: Fertilizer use by the marginal farmers and Productivity of crops in Abhanpur block (kg/ha)

Crop		N	P	K	Productivity
Paddy	Mean	128.93	72.85	40.05	4282.20
	C.V	23.36	31.59	35.60	13.33
	Standard Error	3.55	2.71	1.68	67.28
	Minimum	45	30	0	2875
	Maximum	268.38	143.38	110.29	5500
	Skewness(β_1)	1.59	1.02	1.49	-0.14
	Kurtosis(β_2)	6.13	0.81	7.73	0.14
	Recommended dose	100	60	40	-
	% gap of fertilizer	28.93	21.41	0.12	-
Wheat	Mean	80.26	49.77	16.68	1232.92
	C.V	16.70	27.18	47.24	19.99
	Standard Error	2.44	2.47	1.43	45.01
	Minimum	53.53	20	10	750
	Maximum	108.75	85.18	37.5	1757.81
	Skewness(β_1)	-0.0006	-0.22	1.25	0.13
	Kurtosis(β_2)	0.25	1.01	0.89	0.13
	Recommended dose	100	60	40	-
	% gap of fertilizer	-19.74	-17.05	-58.3	-
Gram	Mean	24.32	47.35	-	1137.47
	C.V	13.89	24.26	-	24.92
	Standard Error	0.66	2.25	-	55.59
	Minimum	18.44	28.75	-	625
	Maximum	34.16	63.88	-	1750
	Skewness(β_1)	1.07	-0.06	-	0.41
	Kurtosis(β_2)	1.53	-1.60	-	0.16
	Recommended dose	20	40	20	-
	% gap of fertilizer	21.6	18.37	-	-

Fertilizer uses by small farmers in Arang block were presented in Table 5. It is seen that small farmers were using on average 120.14 kg N, 65.38 kg P_2O_5 and 36.48 kg K_2O in one hectare with an average productivity 4444.01 Kg/ha for paddy crop Percentage gap of fertilizer were found 20.14% in N, 8.96% in P_2O_5 and -8.80% in K_2O. Which showed that farmers were used less potassium. In wheat crop during rabi season average fertilizer were used 83.14 Kg N, 56.14 kg P_2O_5 and 28.17 kg K_2O.and productivity observed 1654.64 kg in one hectare. Percent gap of fertilizer were -16.86% in N, -6.43% in P_2O_5 and -29.57% in K_2O. This showed that farmers were used less nitrogen, phosphorus & potassium in cultivation of wheat crop. In case of gram, farmers were used only N and P_2O_5 as an average 23.60 kg and 50.94 kg in one hectare and productivity 1360.61 kg / ha. Percent gap of fertilizer were observed 18% in N and 27.35% in P_2O_5 respectively. This showed that farmers were used very less amount of potash.

Table 5: Fertilizer use by the Small farmers and Productivity of crops in Abhanpur block (kg/ha)

Crop		N	P	K	Productivity
Paddy	Mean	120.14	65.38	36.48	4444.01
	C.V	16.26	26.66	32.56	10.50
	Standard Error	4.16	3.71	2.53	99.51
	Minimum	80	52.73	7.5	3000
	Maximum	160	115	62.50	5248.30
	Skewness(β_1)	0.57	2.34	-0.24	-1.00
	Kurtosis(β_2)	0.29	4.94	0.80	3.59
	Recommended dose	100	60	40	-
	% gap of fertilizer	20.14	8.96	-8.80	-
Wheat	Mean	83.14	56.14	28.17	1654.64
	C.V	21.57	13.91	36.45	33.62
	Standard Error	4.23	1.84	2.42	131.13
	Minimum	53.33	38.33	15	1000
	Maximum	144.05	74.69	50	3658.53
	Skewness(β_1)	2.39	-0.68	0.38	2.89
	Kurtosis(β_2)	8.42	3.59	-0.84	17.07
	Recommended dose	100	60	40	-
	% gap of fertilizer	-16.86	-6.43	-29.57	-
Gram	Mean	23.60	50.94	-	1360.61
	C.V	28.34	17.66	-	19.86
	Standard Error	1.62	2.18	-	65.56
	Minimum	15	38.33	-	1000
	Maximum	45	62.5	-	2000
	Skewness(β_1)	2.06	-0.47	-	0.69
	Kurtosis(β_2)	6.48	-1.70	-	0.59
	Recommended dose	20	40	20	-
	% gap of fertilizer	18	27.35	-	-

Fertilizer use by Semi-medium farmers in Arang blocks were presented in Table 6 It is seen that semi-medium farmers were using on average 157.01 kg N, 90.21 kg P_2O_5 and 50.11 kg K_2O in one hectare with an average productivity 6393.00 Kg/ha. for paddy crop. Percentage gap of fertilizer were found 57.01% in N, 50.35% in P_2O_5 and 25.27% in K_2O for paddy crop.. In wheat crop during rabi season average fertilizer were used 88.02 Kg N, 47.06 kg P_2O_5 and 24.92 kg K_2O.and productivity observed 1743.84 kg in one hectare. Percent gap of fertilizer were -11.98% in N, -21.56% in P_2O_5 and -37.7% in K_2O. This showed that farmers were used less nitrogen, phosphorus & potassium. In case of gram, farmers were used only N and P_2O_5 as an average 20.48 kg and 42.88 kg in one hectare and productivity 1430.55 kg/ha. Percent gap of fertilizer were observed 2.4% in N and 7.2% in P_2O_5 respectively.

Table 6: Fertilizer use by the Semi-Medium farmers and Productivity of crops in Abhanpur block (kg/ha)

Crop		N	P	K	Productivity
Paddy	Mean	157.01	90.21	50.11	6393.00
	C.V	40.46	37.69	49.75	51.38
	Standard Error	20.09	10.75	7.88	1038.89
	Minimum	70.09	37.38	21.02	4209.84
	Maximum	268.29	143.33	93.49	12601.63
	Skewness(β_1)	1.04	0.42	1.06	1.67
	Kurtosis(β_2)	0.58	-0.34	0.23	1.18
	Recommended dose	100	60	40	-
	% gap of fertilizer	57.01	50.35	25.27	-
Wheat	Mean	88.02	47.06	24.92	1743.84
	C.V	14.06	31.87	88.12	16.31
	Standard Error	4.37	5.30	7.76	100.56
	Minimum	80	23.07	8.33	1333.33
	Maximum	115	57.5	60	2187.5
	Skewness(β_1)	1.78	-0.91	1.32	0.39
	Kurtosis(β_2)	3.11	-1.24	-0.17	-0.34

	Recommended dose	100	60	40	-
	% gap of fertilizer	-11.98	-21.56	-37.7	-
Gram	Mean	20.48	42.88	-	1430.55
	C.V	65.67	39.48	-	31.72
	Standard Error	5.49	6.91	-	18530
	Minimum	8.75	23.12	-	750
	Maximum	45	57.5	-	20000
	Skewness(β_1)	1.41	-0.36	-	-0.38
	Kurtosis(β_2)	2.24	-2.54	-	-0.63
	Recommended dose	20	40	20	-
	% gap of fertilizer	2.4	7.2	-	-

Table 7 presented fertilizer use by medium farmers in Abhanpur block. It is seen that medium farmers were using on average 131.25 kg N, 68.02 kg P_2O_5 and 32.45 kg K_2O in one hectare with an average productivity 5045.66 Kg/ha for paddy crop. Percentage gap of fertilizer were found 31.25% in N, 13.36% in P_2O_5 and -18.87% in K_2O. This showed that farmers were used less potassium. In wheat crop during rabi season average fertilizer were used 82.77 Kg N, 51.94 kg P_2O_5 and 37.02 kg K_2O and productivity observed 2055.55 kg in one hectare. Percent gap of fertilizer were -17.23% in N, -13.43% in P_2O_5 and -7.45% in K_2O. This showed that farmers were used less nitrogen, phosphorus & potassium. In case of gram, farmers were used only N and P_2O_5 as an average 12.77 kg and 24.86 kg in one hectare and productivity 1944.44 kg / ha. Percent gap of fertilizer were observed -36.15% in N and -37.85% in P_2O_5 respectively.

Table 7: Fertilizer use by the Medium farmers and Productivity of crops in Abhanpur block (kg/ha)

Crop		N	P	K	Productivity
Paddy	Mean	131.25	68.02	32.45	5045.66
	C.V	10.82	11.97	67.10	24.82
	Standard Error	8.20	4.70	12.57	723.13
	Minimum	115	59.07	11.53	3750
	Maximum	141.26	75	55	6250
	Recommended dose	100	60	40	-
	% gap of fertilizer	31.25	13.36	-18.87	-
	Mean	131.25	68.02	32.45	5045.66
	C.V	10.82	11.97	67.10	24.82
Wheat	Mean	82.77	51.94	37.02	2055.55
	C.V	37.36	22.81	45.26	16.38
	Standard Error	17.85	6.84	9.69	194.44
	Minimum	53.33	38.33	25.00	1666.66
	Maximum	115	60	56.25	2250
	Recommended dose	100	60	40	-
	% gap of fertilizer	-17.23	-13.43	-7.45	-
	Mean	82.77	51.94	37.02	2055.55
	C.V	37.36	22.81	45.26	16.38
Gram	Mean	12.77	24.86	-	1944.44
	C.V	43.30	7.55	-	12.37
	Standard Error	3.19	1.08	-	138.88
	Minimum	9.58	22.91	-	1666.66
	Maximum	19.16	26.66	-	2083.33
	Recommended dose	20	40	20	-
	% gap of fertilizer	-36.15	-37.85	-	-
	Mean	12.77	24.86	-	1944.44
	C.V	43.30	7.55	-	12.37

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