ADOPTION OF RECOMMENDED DOSE OF FERTILIZERS BY SOIL TEST FARMERS IN WHEAT: AN ECONOMIC ANALYSIS

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Abstract
Madhya Pradesh has emerged as one of the leading wheat production states in the country in the last five years. Sharbati and Durum Wheat have given an international identity to Madhya Pradesh. The state has rich potential to grow Wheat in Central and Western zone in medium and deep black soil having high K_2O and medium N and medium P_2O_5. The application of recommended dose of fertilizers (RDF) i.e. 120 : 60 : 40 NPK kg/ha with 5 ton Farm Yard Manure per hectare is very essential for excellent yield of Wheat. To find out the extent of RDF adopted by the wheat grower and identify the constraints in adoption of RDF, this study has been carried out in Hoshangabad and Vidisha districts of Madhya Pradesh. It is observed from the study that there was found massive gap between recommended dose of fertilizers and actual quantity of fertilizers applied by the farmers, only 50 per cent soil test farmers applied recommended doses of the fertilizer, out of which very few of them (41.9%) willing to continue the recommended doses of the fertilizer in future. The majority of the marginal farmers were found to be applied RDF more efficiently as compare to rest of the farmers. The most important constraints in adoption of recommended doses of the fertilizer in Wheat as reported by the majority of soil test respondents were soil testing report not available in time, difficult to understand and follow the recommended dose, no technical advice on method and time of fertilizer application and high price of fertilizer and recommended fertilizers not available in local market. Hence, it is suggested that supply of recommended fertilizers should be ensured by the state government in the market, and new nutrient-based subsidy policy should be made a component of agricultural extension services with environmental education and awareness for the farmers.
Keyword: adoption, recommended dose of fertilizers, soil test, wheat.

Intriduction

India is second largest producer of Wheat in the world after China with about 13.1% share in total world Wheat production. (DGFT, 2015) Now, India is surplus and in a position to export Wheat in the International Market and can earn foreign exchange. Madhya Pradesh has emerged as one of the leading wheat production states in the country in the last five years. (M. Krishnamurthy, 2012) The State has also improved its position as the third largest wheat producing state in the country after UP and Punjab with a record-break production of 13.13 million tonnes of wheat in the fiscal year 2012-13 and 13.93 million tonnes in 2013-14. (Anonymous, 2013) Madhya Pradesh contributes 18.57% of the total wheat produced in the country. Sharbati and Durum Wheat have given an international identity to Madhya Pradesh. (Anonymous, 2015)

Madhya Pradesh has 4 different types of soil available in 4 distinct parts. The western and central regions are covered by shallow and medium black soils constituting 53% of the soil area. The eastern part of the state is primarily covered by mixed red and black soils which comprises of 25-26% of the total geographical area and remaining 22% northern and southern regions are covered Alluvial and medium & deep black soil in the state. (Anonymous, 2015) Most of the potential of wheat in Madhya Pradesh is lies in the central and western zones. Wheat is concentrated in Vindhyan Plateau (Bhopal, Vidisha, Sehore Raisen, Damoh, Guna), Central Narmada Valley (Hoshangabad, Harda, Nasinghpur) and Satpura plateau (Chhindawara, Betul) agro climatic zones of Madhya Pradesh respectively. These zones are rich in medium and deep soils rich in K_2O while medium in N and P_2O_5. (Anonymous, 2015)

Fertilizers have to be administered in optimum quantity for which soil testing is essential for ascertaining its chemical composition and thereby determining optimum use of nutrients in the form of fertilizers. However, in practice, farmers use fertilizers on the basis of tradition or on the advice of fertilizer dealers, which results in use of fertilizers in non-optimal quantities, which is not desirable. Hence, periodic analysis of soil is necessary with a view to use fertilizer/ nutrients in optimum quantities, which results in optimum agriculture production. (Anonymous, 2008)

The most important crop nutrients in agricultural systems are nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O) (Chude et. al. 2004). Integrated fertility management using chemical fertilizer and bio fertilizers along with manures will facilitate restoration, enhancement and maintenance of soil productivity at high level which in turn will ensure profitable and intensive agriculture. (Kumaraswamy, 2003)

The application of 10 kg Zn per ha with 100% NPK (120:60:40 NPK kg/ha) on wheat crop enhanced the productivity as well as plant height, plant population, number of leaves per plant, dry weight per plant and leaf area index, yield attributing characters like length of ear head, number of grains per ear head, number of effective tillers per meter and 1000-grain weight, grain and straw yields, harvest index and maintained the quality of wheat grain. (Keram et al., 2014)

There were found huge gap between recommended dose of fertilizer (RDF) and actual adopted doses of fertilizer. (Sharma et. al., 2014) A new nutrient based subsidy policy was introduced by Government of India in the year 2008 to accelerate soil testing facilities in the various states in India. (Anonymous, 2008) How far the soil test farmers adopted these RDF and constraints faced by them in adoption of these are the matter of in depth study.

Objective

To determine the adoption of RDF by the soil test farmers.
To find out the awareness and sources of information about RDF.
To analyse the gap between RDF and actual quantity applied by the soil test wheat farmers.
To identified constraints faced by farmers in adoption of RDF.

Materials and methods

The study is confined to Hoshangabad (4.9%) and Vidisha (4.6%) districts of Madhya Pradesh as these districts having highest area of Wheat in the state (5121.6 Thousand hectare). 2 blocks from each district were selected again on the basis of highest area in the selected districts. Hoshangabad & Babai blocks in Hoshangabad district and Vidisha & Gyaraspur blocks in Vidisha district have been selected for Wheat. A cluster of three villages in each selected block have been further selected for conducting the primary survey. A list of all the soil tested farmers in each village were collected from respective Soil Testing Laboratory and Department of Agriculture for the year 2012-13 and a sample of 60 farmers were selected randomly from each district for assessing the application of recommended dose of fertilizer and its impact on crop production. (Table 1)

Table: 1 Number of respondents selected for the study

S.No	Districts	Blocks	Villages	Number of Sample Wheat Growers
1	Hoshangabad	1. Hoshangabad	Ridodakheda, Deshmohani, Palashi	60
		2. Babai	Chandla,Chaplaser, Sagarkheda	
2	Vidisha	1. Vidisha	Dawar, Kuakhedi, Mirjapur	60
		2. Gyaraspur	Nolash, Bawaliya, Kherua	
Total	2	4	12	120

Thus, the study covers 120 Wheat growers in Madhya Pradesh. These selected households were further classified into four different groups according to their size of farms i.e. marginal (less than 1 ha), small (1-2 ha), medium (2-5 ha) and large (above 5 ha) farmers. Both primary and secondary data have been collected for the study. The primary data were collected from the sample households on different aspects of the study viz. application of fertilizer, actual quantity of fertilizer applied constraints in applying recommended dose of fertilizer etc. by the sample households through interview schedule and tested in local conditions of the Selected Districts.

The list of farmers who got their soil tested were collected from the respective soil testing laboratory and State Department of Agriculture for the year 2012-13 to assess the adoption of recommended dose of fertilisers in light of stated objectives. The quantity of fertilizer in nutrient form has been concerned by the proportion of that particular element in the fertilizer viz. UREA (46% N), DAP (18% N, 46% P_2O_5), Potash (60% K) and Zink Sulphate ($ZnSo_4$, 33%) applied by the sample farmer. The classification, tabulation and analysis of data have been done by using Statistical Package for the Social Sciences (SPSS).

Results and Discussion

The Extent of application and awareness of RDF, adoption gap between recommended and actual applied doses of fertilizer and constraints in adoption of RDF have been analyzed for the study.

Extent of adoption

Extent of adoption the application of RDF in the Wheat are presented in table 2 It is observed from the data that on overall basis only 46.1 per cent of soil test farmers applied RDF covering 52.37 per cent of net cultivated area under Wheat crop. Out of which, only 41.9 per cent of Wheat growers willing to continue applying the RDF in future.

Table: 2 Extent of application of RDF

Particulars	Marginal	Small	Medium	Large	Overall
Percentage of farmers applied RDF	43.1	37.0	49.3	55.0	46.1
Average area (acre)	1.3	2.9	3.5	6.9	3.7
Area covered as per cent of net operated area	59.52	72.22	44.01	33.73	52.37
Average number of seasons applied	1.0	1.0	1.0	1.0	1.0
Percentage of farmers willing to continue applying RDF	40.1	28.5	48.7	50.3	41.9

The soil test farmers applied recommended dose of fertilizers only for a season. It is also observed from the data that the maximum per cent of large (55.0%) followed by medium (49.3%), marginal (43.1%) and small (37.0%) farmers used to apply RDF in cultivation of Wheat.

Awareness and sources of information

The awareness and sources of information about RDF of Wheat are presented in table 3. It is observed from the data that on overall basis only 6.7 per cent of Wheat growers were found to be aware about the RDF. The main source of their awareness was found to be Department of Agriculture as reported by more than 80 per cent of respondents. The others sources of information as reported by the Wheat farmers were fellow farmers (15.4%) and private dealers (4.2%).

Table: 3 Awareness and sources of information about RDF by sample households. (% of farmers)

Sources	Marginal	Small	Medium	Large	Overall
Aware %	5.0	10.0	6.7	5.0	6.7
Agri. Department	100.0	66.7	80.0	75.0	80.4
Private dealer	0.0	16.7	0.0	0.0	4.2
Fellow farmer	0.0	16.7	20.0	25.0	15.4
NGO	0.0	0.0	0.0	0.0	0.0
Total	100	100	100	100	100

All the marginal farmers and 66.7, 80.0 and 75.0 per cent of small, medium and large farmers related to Wheat reported that they were kept aware by the officials of Agricultural Department regarding RDF application in Wheat.

Adoption and gap

Adoption and gap between average quantity of recommended doses and actual quantity of fertilizer given by the Wheat growers has been analyzed and presented in table 4. There is found 2.48 (P_2O_5) to 93.89 per cent (K_2O) gap in adoption of recommended dose of fertilizer on average farmers field. Amongst different nutrients the maximum gap was found in application of K_2O (93.89%) followed by $ZnSo_4$ (88.77%), N (42.53%) and P_2O_5 (2.48%).

Table: 4 Average quantity of RDF and gap of the wheat growers (kg/ha)

Particulars	Marginal	Small	Medium	Large	Overall
N	70 (41.61)	70 (42.08)	68 (43.03)	68 (43.40)	69 (42.53)
P_2O_5	59 (1.53)	59 (1.53)	59 (1.53)	57 (5.32)	59 (2.48)
K_2O	0 (100.0)	0 (100.0)	3 (91.85)	7 (83.70)	2 (93.89)
$ZnSo_4$	1 (91.85)	1 (91.85)	2 (83.70)	2 (83.70)	1 (87.77)
Organic Fertilizer (FYM)	24780 (50.44)	21267 (57.47)	18837 (62.33)	16234 (67.53)	20280 (59.44)

Figure in the parenthesis show percentage gap with recommended dose of fertilizer for Wheat i.e. 120kg N : 60kg P_2O_5 : 20kg K_2O : 10kg $ZnSo_4$ and 5 tons FYM per hectare .

The more gap in N (42.53%) as compared to P_2O_5 (2.48%) is might be due to the fact that majority of farmers applied fertilizers through DAP, which content more P_2O_5 (48%) as compared to N (18%). There was not found any remarkable difference in application of RDF in different size of farms, however the gap in N and P_2O_5 was found to be increased with size of farms from 41.61 (Marginal) to 43.40 per cent (Large) and 1.53 (Marginal) to 5.32 per cent (Large) respectively while the gap in K_2O and $ZnSo_4$ was found to be decreased with size of farms from 100 (Marginal) to 83 per cent (Large), and 91.85 (Marginal) to 83.70 per cent (Large) respectively. An average farmer of the study area also applied FYM in their field. An adoption gap of 59.44 per cent was observed in adoption of recommended doses of organic manure in the farmers field and it was also found to be increased with size of farms from 50.44 (marginal) to 67.53 per cent (Large) in the area under study.

Constrains in applying RDF

The most important constrains in applying RDF as reported by maximum number of soil tested farmers (Table 5) was difficult to understand and follow the recommended doses (95%) followed by adequate quantity of fertilizer not available (80.8%), soil testing report not available in time (73.3%), lack of capital to purchase fertilizers (60%), high price of fertilizers (57.5%) and no technical advice on method and time of fertilizer application (56.7%). Amongst all these constraints the most important constraints reported by majority of Wheat growers were difficult to understand and follow the recommended doses (61.7%), adequate quantity of fertilizer not available (46.7%) and soil testing report not available in time (64.2%). The least important constraints are reported by Wheat growers were lack of capital to purchase fertilizers (27.5%), soil testing report not available in time (23.3%) and high price of fertilizer (22.5%).

Table: 5 Constraints in applying RDF in wheat. (% of soil test farmers)

Constraints	Most Important	Important	Least Important	Total
Adequate quantity of fertilizers not available	46.7	18.3	15.8	80.8
High prices of fertilizers	18.3	16.7	22.5	57.5
Lack of capital to purchase fertilizers	7.5	25.0	27.5	60.0
No technical advice on method and time of fertilizers application	13.3	36.7	6.7	56.7
Difficult to understand and follow the recommended doses	61.7	24.2	9.2	95.0
Soil testing report not available in time	30.8	19.2	23.3	73.3

Conclusion

There was found massive gap between recommended dose of fertilizers and actual quantity of fertilizers applied by the farmers, only 50 per cent soil test farmers applied recommended doses of the fertilizer, out of which very few of them (41.9%) willing to continue the recommended doses of the fertilizer in future. The majority of the marginal farmers were found to be applied recommended doses of the fertilizer more efficiently as compare to rest of the farmers. The most important constraints in adoption of recommended doses of the fertilizer in Wheat as reported by the majority of soil test respondents difficult to understand and follow the recommended doses, adequate quantity of fertilizer not available and soil testing report not available in time. Hence it is suggested that supply of recommended fertilizers should be ensured by the state government in the market, and is the new nutrient-based subsidy policy (Anonymous, 2008) should be made a component of agricultural extension services with environmental education and awareness for the farmers.

Reference

Anonymous (2013) Agricultural Statistics at a Glance 2013, Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

Anonymous (2015) Commodity Profile for Wheat, Directorate General of Foreign Trade (DGFT) India.

Anonymous (2008), Guidelines on the National Project on Management of Soil Health and Fertility, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

Anonymous (2015) Madhya Pradesh at a Glance, National Information Centre, Government of Madhya Pradesh.

Chude V. O., Malgwi W. B., Amapu I. V., and Ano O. A., (2004). Manual on Soil Fertilit Assessment, Federal Fertilizer Department

(FFD) Incollaboration with FAO/National Special Programme for Food Security, Abuja, Nigeria.

Kamarswamy K. (2003). Eco-Friendly soil productivity management for sustainable farming system. Kisan World 30 (7): 50-2.

Krishnamurthy M., (2012). States of Wheat: The Changing Dynamics of Public Procurement in Madhya Pradesh, Review of Rural Affairs, Economic & Political Weekly (xlviI): 72-52.

Roos E E and Barthes B (2001). Organic matter management for soil conservation and productivity restoration in Africa: a contribution from Francophone research. Nutrient Cycling in Agro ecosystem 61: 159-70

Sharma H.O., Rathi D. & Chouhan R.S., (2014) Impact of Soil Testing Analysis in Madhya Pradesh, National Conference on "Soil Health: A Key to Unlock and Sustain Production Potential at Department of Soil Science & Agricultural Chemistry, JNKVV, Jabalpur (M.P.):84

Zaujec A. (2001). Soil Organic Matter as Indicator of Soil Quality and Human Influence on Agro Ecosystem and Natural Forest Ecosystem. Ekologia-Bratislava 20; 133-9.