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Feasibility of soil health cards in terms of its attributes as perceived by the farmer

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Abstract
Soil test based nutrient management has emerged as a key issue in efforts to increase agricultural productivity and production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated areas because of which the soil health has been deteriorated. Many efforts have been made by the centrals and state government to know the health status of soils of farmers by introducing Soil Health Card scheme, but how far farmers had perceived the Soil Health Card and how efficiently use the information given in the Soil Health Cards. Considering the above stated information, now it is necessary to know the feasibility of Soil Health Card in terms of perceived attributes. The study reveals that more than half (66.67%) of the respondents belonged to medium category followed by high (17.50%) and low category (15.83%) respectively regarding over all feasibility of soil health cards.

Keywords: Soil test based nutrient management, soil health card, feasibility of soil health card and perceived attributes

1. Introduction
Soil is a key element of agriculture without which we wouldn´t be able to grow plants. Soil is a living medium which serves as a natural nutrient source for growth of plants. In India, intensive agriculture has resulted in impressive growth in food grain production powered by improved varieties of seeds, application of fertilizers and assured irrigation. The existing NPK consumption ratio in the country is skewed at 8.2:3.2:1 (Indian Fertilizer Scenario, 2013) [2] as against the preferred ratio of 4:2:1. Imbalanced application of fertilizers have caused deficiency of primary nutrients (i.e. NPK), secondary nutrients (such as sulphur), and micronutrients (boron, zinc, copper etc.), in most parts of country. Government of India has launched "Soil Health Card" scheme under National Mission for Sustainable Agriculture (NMSA) with an objective to issue soil health cards to all the farmers of the country so as to provide a basis to address nutrient deficiencies in fertilization practices. Soil Health Card Scheme is a very beneficial scheme for a farmer which carries crop-wise recommendations of nutrients and fertilisers required for the farmers to improve productivity through judicious use of inputs.
The present study was conducted on feasibility of soil health cards in terms of its attributes as perceived by the farmer.

2. Methodology
The present study was conducted in Telangana state. Out of the thirty one districts of Telangana state, Sangareddy district and Warangal rural district were selected for the study based on number of farmers covered under SHC scheme i.e. Sangareddy district with maximum number farmers and Warangal rural district with minimum number of farmers covered under SHC scheme. Out of the 20 mandals in Sangareddy district and 15 mandals in Warangal rural district two mandals from each district namely Sangareddy and Patancheru mandals from Sangareddy district and Wardhannapet and Duggondi mandals from Warangal rural district were selected randomly for the study. From each mandal two villages were selected at random thus making a total of 8 villages and from each village 15 farmers were selected randomly constituting a sample of 120 respondents. For collecting the data from the respondent, personal interview method was used. Index developed by Neema (2015) [3] was used for the study with suitable modifications. Data were compiled, tabulated and analyzed to get proper answers for objective of the study. The statistics tools used were frequency, percentages, class interval.

The feasibility index was calculated with the following formula

$$PFI = \frac{E\ (S + Pr + CoM + O + Cx + Co + Tr)}{P\ (S + Pr + CoM + O + Cx + Co + Tr)} \times 100$$

Where PFI = Perceived feasibility index
E = Extent to which innovation was perceived field feasible by the respondents with respect to suitability (S), profitability (Pr), Compatability (CoM), Observability (0), Complexity (Cx), Cost (Co), Trialability (Tr).
P = Maximum limit to which innovation was perceived field feasible with respect to suitability (S), profitability (Pr), Compatability (CoM), Observability (0), Complexity (Cx), Cost (Co), Trialability (Tr).
The feasibility level was categorised based on inclusive class interval technique and the results were expressed in terms of frequencies and percentages.

3. Results and Discussion

The perceived feasibility of the farmer has been discussed with the following sub headings.

3.1 Over all feasibility of soil health cards in terms of its attributes as perceived by the farmer.

From the Table 1 it is evident that more than half (66.67%) of the respondents belonged to medium category followed by high (17.50%) and low category (15.83%) respectively. Among the selected districts majority of the respondents belonged to medium category the reason might be due to moderate perception of farmers on the seven attributes selected for the study on most of the soil testing practices.

3.2 Feasibility of soil health cards in terms of its attributes as perceived by the farmer in rice.

It is evident from Table 2 that more than half (64.63%) of the respondents belonged to medium category followed by high category (24.40%) and low category (10.97) respectively. Among the selected districts majority of the respondents belonged to medium to high category since they are practicing rice cultivation from many years they could easily understand and follow information given in the soil health card and it is compatible to their farming situations.

3.3 Feasibility of soil health cards in terms of its attributes as perceived by the farmer in maize.

It is evident from Table 3 that majority (79.17%) of the respondents belonged to medium category followed by low (16.67%) and high category (4.16%) respectively. Among the selected districts majority of the respondents were medium to low category because most of the farmers apply more amount of fertilizers than the doses recommended in soil health card. Hence the farmers might be feeling that it is moderately feasible with respect to maize crop.

3.4 Feasibility of soil health cards in terms of its attributes as perceived by the farmer in cotton.

It is evident from Table 4 that more than half (57.14%) of the respondents belonged to medium category followed by low (42.85%) and high (0%) category respectively. Among the selected districts majority of the respondents were medium to low because the farmers felt that cotton being long duration crop requires more amount of fertilizers than the recommended dosage provided in the soil health card as it is a commercial crop and for getting good yield. Hence this might be the reason for the above trend.

3.5 Practice wise feasibility analysis

For a better understanding on the feasibility of soil health card, each of the practice was analysed for the level of feasibility as perceived by the farmers in terms of the seven attributes selected for the study.

3.5.1 Doing soil sampling through quadrate method

It is evident from the Table 5 that in case of rice majority (60.98%) of the respondents perceived doing soil sampling through quadrate method as medium feasible followed by low (19.51%) and highly feasible (19.51%) respectively. In case of maize most (45.83%) of the respondents perceived doing soil sampling through quadrate method as medium feasible followed by low (33.33%) and highly feasible (20.83%) respectively. In case of cotton more than half (64.29%) of the respondents perceived doing soil sampling through quadrate method as medium feasible followed by high (28.57%) and low feasible (7.14%) respectively. Among the selected districts majority of the respondents among rice, maize and cotton were having medium feasibility because most of the farmers thought that the practice of collecting soil samples through quadrate method was easy to learn and apply in the field conditions and by this method and were aware that the sample would represent the nutrient status whole field.

3.5.2 Cost associated in soil testing

It is evident from the Table 6 that in case of rice most (48.78%) of the respondents perceived that the cost associated in soil testing as medium feasible followed by high (29.27%) and low feasible (21.95%) respectively. In case of maize more than one third (37.50%) of the respondents perceived that the cost associated in soil testing as medium feasible followed by low (33.33%) and highly feasible (29.17%) respectively. In case of cotton more than half (57.14%) of the respondents perceived that the cost associated in soil testing as highly feasible followed by medium (28.57%) and low feasible (14.29%) respectively. Among the selected districts majority of the respondents among rice and maize were having medium feasibility because the farmers thought the cost associated in soil testing was affordable. In case of cotton more than half of the respondents perceived cost associated in soil testing as high feasible because the cost associated in soil testing is very low when compared to all the practices.

3.5.3 Application of FYM in the soil as per information given in the SHC

It is evident from the Table 7 that in case of rice most (58.54%) of the respondents perceived that application of FYM in the soil as per information given in the SHC as medium feasible followed by low (24.39%) and high feasible (17.07%) respectively. In case of maize more than half (62.50%) of the respondents perceived that application of FYM in the soil as per information given in the SHC as low feasible followed by medium (25%) and highly feasible (12.5%) respectively. In case of cotton more than half (64.29%) of the respondents perceived that application of FYM in the soil as per information given in the SHC as medium feasible followed by low (28.57%) and high feasible (7.14%) respectively. Among the selected districts majority of the respondents among rice and cotton were having medium to low feasibility and in case of maize it is low feasibility the reason might be the low/non observability of the incremental

yields with applications of FYM even though they followed soil health card recommendations as that of results observed after application of synthetic fertilizers. Hence the above trend has been observed.

3.5.4 Nitrogen recommendation as per Soil Health Card

It is evident from the Table 8 that in case of rice most (63.41%) of the respondents perceived that the nitrogen recommendation as per Soil Health Card is medium feasible followed by high (21.95%) and low feasible (14.63%) respectively. In case of maize more than half (62.50%) of the respondents perceived that the nitrogen recommendation as per Soil Health Card is highly feasible followed by low (20.83%) and medium feasible (16.67%) respectively. In case of cotton more than half (57.14%) of the respondents perceived that the nitrogen recommendation as per Soil Health Card is medium feasible followed by low (28.57%) and high feasible (14.29%) respectively. Among the selected districts majority of the respondents among rice and cotton were having medium to high feasibility and in case of maize it is high feasible, the reason might be that the farmers could observe the results soon after the application of nitrogen fertilizers. Hence the above trend has been observed.

3.5.5 Phosphorus recommendation as per Soil Health Card

It is evident from the Table 9 that in case of rice more than half (64.63%) of the respondents perceived that the phosphorus recommendation as per soil health card are medium feasible followed by low (28.05%) and high feasible (7.32%) respectively. In case of maize half (50%) of the respondents perceived that the phosphorus recommendation as per soil health card are medium feasible followed by low (37.5%) and highly feasible (12.5%) respectively. In case of cotton majority (85.71%) of the respondents perceived that the phosphorus recommendation as per soil health card are medium feasible followed by low (14.29%) feasibility. Among the selected districts majority of the respondents among rice, maize and cotton were having medium to low feasibility because of the high cost of phosphorus fertilizers leading to less relative advantage to farmers.

3.5.6 Potassium recommendation as per Soil Health Card

It is evident from the Table 10 that in case of rice majority (75.61%) of the respondents perceived that the potassium recommendation as per Soil Health Card are medium feasible followed by low (24.39%) feasibility. In case of maize more than half (58.33%) of the respondents perceived that the potassium recommendation as per Soil Health Card are medium feasible followed by low (37.50%) and highly feasible (4.17%) respectively. In case of cotton majority (85.71%) of the respondents perceived that the potassium recommendation as per Soil Health Card are medium feasible followed by low (14.29%) feasibility. Among the selected districts majority of the respondents among rice, maize and cotton were having medium feasibility because the farmers are having moderate knowledge on potassium fertilizers. Hence the above trend has been observed.

3.5.7 Secondary nutrients recommendation as per Soil Health Card

It could be observed from the Table 11 that in case of rice more than half (58.54%) of the respondents had responded for zinc and for remaining secondary nutrients i.e. sulphur (34.15%), boron (43.90%), iron (39.02%) and manganese (30.49%) less than half of the respondents had responded. In case of copper none of the respondents had responded. In case of maize majority of the respondents had responded for zinc (75.00%) followed by boron (54.17%) and iron (45.83%). In case of sulphur, manganese and copper none of the respondents had responded. In case of cotton majority of the respondents had responded for zinc (71.43%) followed by boron (54.17%), iron (45.83%) and manganese (50.00%). In case of sulphur, manganese and copper none of the respondents had responded. It could be inferred that the reason behind not responding by the respondents might be the area where the soil sample had collected did not show deficiency regarding any of secondary nutrients otherwise the secondary nutrient status is not mentioned in the SHC.

3.5.8 Perceived feasibility of fertilizer recommendation of sulphur, zinc, boron, iron, manganese and copper as per soil health Card

It was evident from the table 12 that in case of zinc and boron among rice, maize and cotton crops majority of the respondents had medium feasibility because of their more usage in the recent years where as remaining secondary nutrients like sulphur, iron, manganese and copper are having low feasibility, the reason might be that the farmers had low awareness and knowledge regarding the uses of secondary nutrients in plants metabolism and their application.

4. Conclusion

It was concluded from the study that majority of the respondent's belonged to medium category in case of over all perceived feasibility the reason be that moderate perception of farmers on the seven attributes selected for the study on most of the soil testing practices. The perceived feasibility of the farmers can be improved by creating awareness among the farmers, conducting trainings to improve the knowledge on Soil Health Cards and capacity building activities for the farmers in soil health management.

Table 1: Distribution of respondents based on their overall perceived feasibility index (N=120)

S. No	Category	Class Interval	Frequency	Percentage
1.	Low	55.78-64.17	19	15.83
2.	Medium	64.18-72.57	80	66.67
3.	High	72.58-80.97	21	17.50
Total			120	100

Table 2: Distribution of respondents based on their Feasibility of soil health cards in terms of its attributes of in rice. (N=82)

S. No	Category	Class Interval	Frequency	Percentage
1.	Low	55.78-64.17	9	10.97
2.	Medium	64.18-72.57	53	64.63
3.	High	72.58-80.97	20	24.40
Total			82	100.00

Table 3: Distribution of respondents based on their Feasibility of soil health cards in terms of its attributes of in maize. (N=24)

S. No	Category	Class Interval	Frequency	Percentage
1.	Low	55.78-64.17	4	16.67
2.	Medium	64.18-72.57	19	79.17
3.	High	72.58-80.97	1	4.16
Total			24	100.00

Table 4: Distribution of respondents based on their Feasibility of soil health cards in terms of its attributes of in cotton. (N=14)

S. No	Category	Class Interval	Frequency	Percentage
1.	Low	55.78-64.17	6	42.85
2.	Medium	64.18-72.57	8	57.14
3.	High	72.58-80.97	0	0
Total			14	100.00

Table 5: Distribution of respondents based on their perceived feasibility of doing soil sampling through quadrate method(N=120)

S. No	Category	Class Interval	Rice		Maize		Cotton	
			Frequency	%	Frequency	%	Frequency	%
1.	Low	61.90-69.83	16	19.51	8	33.33	1	7.14
2.	Medium	69.84-77.77	50	60.98	11	45.83	9	64.29
3.	High	77.78-85.72	16	19.51	5	20.83	4	28.57
Total			82	100	24	100	14	100

Table 6: Distribution of respondents based on their perceived feasibility of cost associated in soil testing (N=120)

S. No	Category	Class Interval	Rice		Maize		Cotton	
			Frequency	%	Frequency	%	Frequency	%
1.	Low	61.90-68.24	18	21.95	8	33.33	2	14.29
2.	Medium	68.25-74.59	40	48.78	9	37.50	4	28.57
3.	High	74.60-80.96	24	29.27	7	29.17	8	57.14
Total			82	100	24	100	14	100

Table 7: Distribution of respondents based on their perceived feasibility of application of FYM in the soil as per information given in the SHC (N=120)

S. No	Category	Class Interval	Rice		Maize		Cotton	
			Frequency	%	Frequency	%	Frequency	%
1.	Low	57.14-66.66	20	24.39	15	62.5	4	28.57
2.	Medium	66.67-76.19	48	58.54	6	25	9	64.29
3.	High	76.20-85.72	14	17.07	3	12.5	1	7.14
Total			82	100	24	100	14	100

Table 8: Distribution of respondents based on their perceived feasibility of Nitrogen recommendation as per Soil Health Card (N=120)

S. No	Category	Class Interval	Rice		Maize		Cotton	
			Frequency	%	Frequency	%	Frequency	%
1.	Low	47.61-57.13	12	14.63	5	20.83	4	28.57
2.	Medium	57.14-66.66	52	63.41	4	16.67	8	57.14
3.	High	66.67-76.20	18	21.95	15	62.50	2	14.29
Total			82	100	24	100	14	100

Table 9: Distribution of respondents based on their perceived feasibility of fertilizer recommendation of phosphorus as per soil health Card (N=120)

S. No	Category	Class Interval	Rice		Maize		Cotton	
			Frequency	%	Frequency	%	Frequency	%
1.	Low	57.14-63.49	23	28.05	9	37.5	2	14.29
2.	Medium	63.50-69.85	53	64.63	12	50	12	85.71
3.	High	69.86-76.20	6	7.32	3	12.5	0	0.00
Total			82	100	24	100	14	100

Table 10: Distribution of respondents based on their perceived feasibility of Fertilizer recommendation of potassium as per soil health Card (N=120)

S. No	Category	Class Interval	Rice		Maize		Cotton	
			Frequency	%	Frequency	%	Frequency	%
1.	Low	57.14-65.08	20	24.39	9	37.50	2	14.29
2.	Medium	65.09-73.03	62	75.61	14	58.33	12	85.71
3.	High	73.04-80.96	0	0.00	1	4.17	0	0.00
Total			82	100	24	100	14	100

Table 11: Distribution of respondents based on secondary nutrient status in the Soil Health Card (N=120)

S No	Practice	Rice		Not mentioned*		Maize		Not mentioned*		Cotton		Not mentioned*	
		F	%	F	%	F	%	F	%	F	%	F	%
1.	Sulphur	28	34.15	54	65.85	0	0	24	100	0	0	14	100
2.	Zinc	48	58.54	34	41.46	18	75	6	25.00	10	71.43	4	28.57
3.	Boron	36	43.90	46	56.10	13	54.17	11	45.83	8	57.14	6	42.86
4.	Iron	32	39.02	50	60.98	11	45.83	13	54.17	8	57.14	6	42.86
5.	Manganese	25	30.49	57	69.51	0	0	24	100	7	50.00	7	50.00
6.	Copper	0	0	82	100	0	0	24	100	0	0	14	100

Table 12: Distribution of respondents based on their perceived feasibility of fertilizer recommendation of sulphur, zinc, boron, iron, manganese and copper as per soil health Card

S. No	Category	Class Interval	Rice		Maize		Cotton	
			Frequency	%	Frequency	%	Frequency	%
	Sulphur							
1.	Low	47.61-53.95	20	71.43	0	0	0	0
2.	Medium	53.96-60.30	5	17.86	0	0	0	0
3.	High	60.31-66.65	3	10.71	0	0	0	0
	Zinc							
1.	Low	47.61-53.95	12	25	4	22.22	2	20.00
2.	Medium	53.96-60.30	30	62.5	12	66.67	7	70.00
3.	High	60.31-66.65	6	12.5	2	11.11	1	10.00
	Boron							
1.	Low	47.61-53.95	10	27.78	3	23.08	2	25.00
2.	Medium	53.96-60.30	20	55.56	8	61.54	5	62.50
3.	High	60.31-66.65	6	16.67	2	15.38	1	12.50
	Iron							
1.	Low	47.61-53.95	18	56.25	8	72.73	5	62.50
2.	Medium	53.96-60.30	9	28.13	2	18.18	2	25.00
3.	High	60.31-66.65	5	15.63	1	9.09	1	12.50
	Manganese							
1.	Low	47.61-53.95	16	64.00	0	0	5	71.43
2.	Medium	53.96-60.30	6	24.00	0	0	1	14.29
3.	High	60.31-66.65	3	12.00	0	0	1	14.29
	Copper							
1.	Low	0	0	0	0	0	0	0
2.	Medium	0	0	0	0	0	0	0
3.	High	0	0	0	0	0	0	0

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