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Research Paper

Soil health index– an initiative of ARF for the farmers of district Sonipat, Haryana.

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Abstract: Soil Health card is a Government of India's scheme promoted by the Department of Agriculture & Co-operation under the Ministry of Agriculture and Farmers' Welfare, being implemented through the Department of Agriculture of all the State and Union Territory Governments. SHC, apart from giving the health index of soil, will also indicate fertilizer recommendations and soil amendment required for the farm. In Haryana, Department of Agriculture (DoA) has been working closely with the farmers to improve their agricultural productivity. Generation and distribution of Soil Health Card to know and improve the fertility status is being carried out through its Soil Testing Labs established in different districts. To scale up the number of testing govt. rolled out the schemes to rope in the labs who have the capacity and competency to generate and distribute Soil Health Cards. ARF R& D center Sonipat is dedicated for integration of agriculture and animal husbandry for sustainability. The foundation approached Department and initiated the soil –testing in Sonipat. More than 1000 soil samples have been analyzed for different 12 fertility parameters using IARI, GOI approved STFR (Soil Test and Fertilizer Recommendation) digital machine for the farmers of district Sonipat and provided recommendations on suitable fertilizer and dosage as per deficiency.
Keywords: Soil health card, STFR, Fertility, Organic carbon, Fertilizer.

INTRODUCTION:

Soil health and fertility are the basis for gaining sustainable profit through higher productivity by the farmers. Using optimal doses of fertilizers and cropping pattern as per the scientific recommendations is the first step towards sustainable farming. Soil testing is a science-based and time-tested tool for assessment of the soil fertility status and soil ailments and nutrient amendment recommendations. Soil health is a holistic concept that includes the chemical, physical, and biological health of the soil. Keeping this in mind, the Government of India introduced Soil Health Card Scheme across India to enable the farmers to apply recommended doses of nutrients based on

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soil test values for improved and sustainable soil health and fertility, low costs, and higher profits. The scheme is being promoted by the Department of Agriculture & Co-operation under the Ministry of Agriculture and Farmers' Welfare and implemented through the Department of Agriculture of all the State and Union Territory Governments. Under the SHC scheme, cropped area is divided into grids of 10ha for rain fed and 2.5ha for irrigated and soil samples are collected as per methodology defined **(**Reddy et al, 2018**).** In the form of soil card, the farmers get a report which contains all the details about the soil of their particular farm. A farm gets the soil card once in every 3 years. SHC is a printed report that a farmer is handed over for each of his holdings. It contains the status of his soil with respect to 12 parameters, namely N, P, K (Macro-nutrients); S (Secondary- nutrient); Zn, Fe, Cu, Mn, Bo (Micro - nutrients); and pH, EC, OC (Physical parameters). Based on this, the SHC also indicates fertilizer recommendations and soil amendment required for the farm. The card will contain an advisory based on the soil nutrient status of a farmer's holding. It will show recommendations on dosage of different nutrients needed. Further, it will advise the farmer on the fertilizers and their quantities he should apply, and also the soil amendments that he should undertake, so as to realize optimal yields.

Ayurvet Research Foundation (ARF) is actively working with farmers of different districts of Haryana since 2007 for sustainable integration of livestock and agriculture. Recently it has been granted soil health card generation project from Govt. of Haryana in district Sonipat, Haryana. Near about 1000 soil samples have been analyzed from the villages of block Mundlana, tehsil Gohana, district Sonipat, Haryana for determining soil health index using IARI, GOI approved STFR (Soil Test and Fertilizer Recommendation) digital machine for the farmers of districts Sonipat and Panipat and provided recommendations on suitable fertilizer and dosage as per deficiency.

MATERIALS AND METHODS:

Ideal time for soil sampling

Soil Samples are taken generally two times in a year, after harvesting of Rabi and Kharif Crop respectively or when there is no standing crop in the field.

Collection of soil samples from farmers' field

Soil Samples are collected by a trained person from a depth of 15-20 cm by cutting the soil in a "V" shape. It is collected from four corners and the center of the field and mixed thoroughly and a part of this picked up as a sample. Areas with shade are avoided. The sample chosen is bagged and coded. It is then be transferred to soil test laboratory for analysis.

Figure 1- Soil sampling

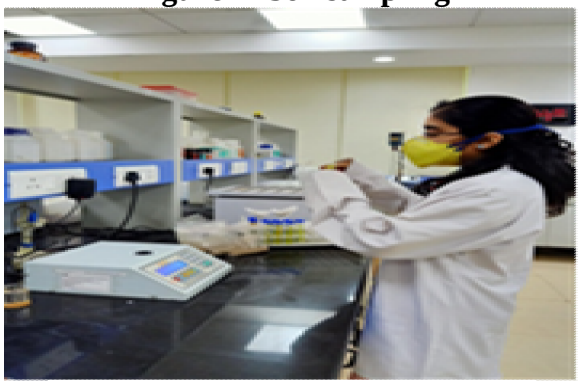

Figure 2 - Soil Analysis using STFR

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Processing of soil samples:

Air-dried the soil samples in shade, discarded the plant residues, gravels and other materials, crushed the soil lumps lightly and grounded with the help of wooden pestle and morter, passed the entire quantity through a 2 mm stainless steel sieve, for organic carbon grounded the soil further so as to pass it through 0.2 to 0.5 mm sieves, remixed the entire quantity of sieved soil thoroughly before analysis.

Methodology

1. ***pH (acidity or alkalinity)***

Calibrated the instrument with pH buffers 4, 7 and 9. Took 10 mL (12 g) soil with a syringe in a glass beaker and added 24 ml distilled water. Stirred the suspension for 2 minutes and then measured the pH by dipping pH electrode in soil suspension (STFR Manual).

2. ***Electrical Conductivity***

Calibrated the instrument with standard solution. Took 10 mL (12 g) soil with a syringe in a glass beaker and added 24 ml distilled water. Stirred the suspension for 2 minutes and then measured the EC by dipping EC electrode in soil suspension (STFR Manual).

3. ***Organic Carbon and Nitrogen***

Took twenty-one glass beakers (100 ml, each) and marked them as B (for blank) and 1-20 for samples. Added e 11 drops of distilled water in blank beaker and 0.4 ml or respective soil samples in marked beakers. Added reagents in all the beakers and kept undisturbed for 1/2hr. Added 47 ml distilled water with the help of 50 ml measuring cylinder to all the beakers and mixed them with a glass rod. Took another set of glass beaker and filtered the sample solutions. Took the readings of the blank solution first and then one by one of the sample solutions using cuvette on STFR machine which automatically calculates the amount of Organic carbon present in each sample. Calculated available Nitrogen from organic carbon content of soil (STFR Manual).

4. ***Phosphorus (P)***

Took twenty-one wide mouth shaking bottles and marked them as PB for blank and P1 – P20 for samples. Took 0.5 ml (0.6 g) soil from each of twenty samples by the syringe and transferred into the respectively marked bottles. Added 12 ml of extractant plus 0.3 ml charcoal with the help of syringe to each, closed the caps. Put all the bottles in the shaker for half an hour. Took twenty-one distilled water washed 50 ml dropping bottles with plastic funnels and filter paper, marked them as PB, P1 – P20. Filtered the contents into the P dropping bottles.

Colour Development: Took 21 disposable 15 ml tubes washed with distilled water, marked them as PB (for blank), P1- P20 (for samples) and put them on test tube stand.

For Blank: Took 2 mL filtered blank solution in the test tube marked as PB with the help of 2 ml syringe.

For Samples: Took 2 mL filtered sample solution in each of the sample test tube from respective dropping bottles marked as P1 – P20 with the help of 2 ml syringe. Washed the syringe with distilled water before each addition. Added reagents with 5 5 mL syringe in all test tubes, added distilled water up to mark, vortexed and waited for 15 minutes. Took the reading of blank and samples using cuvette on STFR machine which automatically calculates the amount of phosphorus present in each sample (STFR Manual).

5. ***Potassium (K)***

Took twenty-one wide mouth shaking bottles and marked them as KB for blank and K1- K20 for samples. Took 2.5 mL (3 g) soil from each of twenty samples in well-marked bottles. Added 15 ml of extractant and 0.3 ml charcoal with the help of syringe to each of the sample bottles as well as

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blank bottle, closed the cap. Put all the bottles in the shaker for half an hour and filter. Took twenty-one distilled water washed 50 ml dropping bottles with plastic funnels and filter paper, marked them as PB, K1 – K20. Filtered the contents into the K dropping bottles.

For Blank: Took 2 mL filtered blank solution in the test tube marked as KB from dropping bottle KB with the help of 2 ml syringe

For Samples: Took 1 ml filtered blank solution in each of the sample test tube marked as K1- K20 from dropping bottle KB with the help of 1 ml syringe. Added 1 mL filtered sample solution in marked sample test tubes from respective marked dropping bottles with the help of 1 ml syringe. Washed the syringe with distilled water before each addition.

For all the test tubes: Added reagents to all the test tubes, vortexed with cap closed. Waited for three minutes, added remaining reagents step wise quickly and water up to 10 mL mark. Vortexed and waited for 5 minutes. Took the reading of blank and samples using cuvette on STFR machine which automatically calculates the amount of potassium present in each sample. Calibrated the instrument with potassium standard (STFR Manual).

6. ***Secondary- nutrient:***

Zn, Fe, Cu, Mn, Bo (Micro - nutrients) were analyzed as per the methodology mentioned in manual **(**STFR Manual**).**

RESULTS:

The results of different parameters were compared against the standard specifications as shown in Table 1. pH of the soil of different filed was found to be in range of 7.06 – 9.93, which indicated it to be moderately to strongly alkaline whereas the pH of normal soil ranges from 6.5 – 7.5; EC ranged from 0.5 – 5.21 mS/ cm which indicated moderately to strongly alkaline nature ; available Nitrogen content was found to be in range of 20.0 – 549 Kg/ ha against the standard 280 – 560 Kg/ ha; available Phosphorus was found to in range of 1.39 – 87.0 Kg/ ha, low to high, against standard 12.5 – 25.0 Kg/ha; available Potash was found to in range of 24.0 – 623.6 Kg/ha, low to high, against standard 135 – 335 Kg/ha; Organic carbon was found to in range of 0.04% – 0.75% low to medium against standard 0.04% – > 0.75%.

DISCUSSION:

The type of soil found in the district of Rohtak, Sonepat, Panipat and Karnal district is arid brown soil. According to the Department of Agriculture, Govt. of Haryana, 20,33,770 soil samples were analyzed for macro and micro nutrients in two different cycles from 2015-16 to 2016-17 and 2017-18 to 2018-19 respectively from the region of district Sonipat, Haryana. pH, macronutrients such as nitrogen, organic carbon, potassium, phosphorous and micronutrients such as Copper, zinc, iron, etc. were observed to be different in districts of Haryana https://www.soilhealth.dac.gov.in/NewHomePage/StateWiseNPKChart**.** 93.0 % of the soil was found to be moderately alkaline, 4% strongly alkaline, 1% neutral and 1% slightly acidic in nature The phosphorous content present in the soil ranged from very low to very high. About 24.8% of soil contained very low Phosphorous content whereas 7.9% of the soil contained very high phosphorous content and 31.4% showed low content of phosphorous. 99% of

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the soil showed low nitrogen content and 1% showed very low nitrogen content, Potassium content in the
soil was found to be better as compared to nitrogen and phosphorous. 36% of the soil contained medium potassium content and 8% of soil samples showed very high and 27% high. Organic carbon was found to be very low in all the district of Haryana https://shodhganga.inflibnet.ac.in/bitstream/10603/113739/10/10_chapter%202.pdf

Analysis at ARF R&D Centre (Table 1) suggested 83% of the soil as moderately alkaline whereas 17% as strongly alkaline. 49.31% of the soil samples were found to contain low, 35.6% medium and 15% high potassium content. 78% of the soil samples contained low and 21.23% medium nitrogen content. The phosphorous content in the soil ranged from low to high i.e. 47% of the soil contained low, 10.9% medium and 42.1% high phosphorous content. Organic carbon content was observed to be low (46.70%) or medium (50.8%).

Table 1: Soil samples analyzed using STFR digital machine and observations made in comparison to standard specifications. Block Mundlana, District Sonipat; 1000 samples.

S. N.	Parameter	Specifications Hand Book of Agriculture Indian Council of Agricultural research New Delhi- 110 012			Observation of soil samples analyzed at ARF R&D Centre
1	**pH**	Normal soil 6.5 - 7.5	Acidic soil <6.5	Alkali soil > 8.5	Moderately to strongly alkaline 7.06 - 9.93
2	**EC (mS/cm)**	Non-Saline 0-0.4	Moderately saline 0.8-1.6	Strongly saline >1.6	Moderately to strongly saline **0.5 – 5.21**
3	**Available N (kg/ha)**	Low <280	Medium 281-560	High >560	Low to medium 20.0 - 549
4	**Available P (kg/ha)**	Low <12.5	Medium 12.5-25	High >25	Low to High 1.39 - 87
5	**Available K2O (kg/ha)**	Low <135	Medium 135- 335	High >335	Low to high 24.0 – 623.6
6	**Organic Carbon (%)**	Low < 0.4	Medium 0.40 - 0.75	High >0.75	Low to medium **0.04 – 0.75**

Benefits of the Soil Health Card Scheme experience by farmers

- The scheme monitors the soil of the farmers and give them a formatted report to help them decide well which crops they should cultivate and which ones they should skip.
- The authorities monitor the soil on a regular basis. Once in every 3 years, they provide a report to farmers.
- The soil card gives the farmers a proper idea of which nutrients their soil is lacking, which fertilizers they need, which crops they

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should invest in to help in taking more yield from their field https://www.india.gov.in/spotlight/soil-health-card#tab=tab-1

Limitations

- Many farmers are unable to understand the content, hence unable to follow the recommended practices.
- More coordination needed among agricultural extension officers and farmers.
- The soil health card is more focused on chemical nutrient indicators; among physical and biological properties only soil color is included.
- Some important indicators (i) cropping history, (ii) water resources (soil moisture), (iii) slope of soil, (iv) depth of soil, (v) color of soil, (vi) soil texture (bulk density) and (vii) Micro-biological activity etc. are not included.
- Inadequate soil testing infrastructure.

Way Forward

- There is a need for demonstration of benefits of SHC on an experimental basis in each block by adopting a comprehensive approach (systematic and scientific analysis of soil and water) and adoption of recommended doses.
- More number of governments, Institutional, Non- govt Soil testing Labs needs to be included for serving farming community in a better way
- SHC distribution and awareness campaigns needs to be arranged before sowing season, so that farmers will practice recommended crop choice and fertilizers https://www.drishtiias.com/to-the-points/paper3/to-the-point-paper-3-soil-health-card-scheme

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