



## Soil health card : Right to Sustainable Agriculture

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Agriculture always has and always will play an important role in man's activities. As was true with all arts and sciences the beginnings of agriculture were most elemental and development was slow. When man developed an inquisitive interest in his surroundings doubtless plant growth was one of the first phenomena to engage his attention. How to increase the production of plants which furnished food for him and his animals was of vital concern to him. Observation and the results of unplanned soil and plant treatments were virtually his only tools for advancement in food production. Soil is dynamic and living resource base whose condition is vital for the production of food and fiber, global balance and proper ecosystem function. The quality and health of soils



determine agricultural sustainability, therefore, pertinent that for sustenance of life on earth. Hence, soil health card is essential for maintaining soil quality level. Soil health card provides information to farmers on various aspects of soil quality which motivates the farmers

for proper management of soil. One of main causes of soil compaction is due to application of more chemical fertilizers and less or no use of organic manure on crop field which day by day is making the soil unfertile. Soil compaction nowadays is a common event due to less or no use of organic manure in soil due to mechanization which discourages animal rearing especially bullock and buffalo. Therefore, feeding the ever increasing population, depends only on chemical fertilizers is not sustainable as well as only depends on organic manure is not conducive for better production. So, the need is to apply chemical fertilizers as well as organic manures in such a combined way that soil fertility status never be degraded. Accordingly, application of fertilizers and manures depends on fertility status of the soil. In this direction, soil health card has brought a ray of hope.

**What is soil?** : Soils are the natural bodies on which plants grow. Soil supplies nutrients for growing plants and plants manufacture feed for animals and food and fibre for man. According to Joffe and Marbut—'Soil is a natural

body developed by natural forces acting on natural materials. It is usually differentiated into horizons of mineral and organic constituents of variable depths which differ from the parent material below in morphology, physical properties and constitutions, chemical properties and composition, and biological characteristics'. Some soils are naturally productive and support luxuriant crops of great value with every little human effort, while other soils are so unproductive that they support almost no useful plant life regardless of what is done to them. Between these two extremes lie the majority of soils which must be fertilized, irrigated, drained or limed to make them desirably productive.

**What is soil health?** : Soil health is a status or condition in respect to several parameters important for agriculture at a given time. The soil could be good, poor or problematic and accordingly, it had to be subjected to various treatments for sustenance to functioning and to sustain biological productivity, maintain the quality of air and water environments and promotes the plant, animal and human health. Soil health indicates both inherent and dynamic soil quality and both are interrelated with each other. Therefore, efforts have to be maintained a good environment for plant growth which ultimately affects crop production considering economical, viable, sustainable and environment friendly characteristics. Inherent soil quality connects to the natural characteristics of the soil (eg. texture etc.) which are the result of soil forming factors and that generally can not easily be amended where the dynamic soil quality component is readily affected by management practices and relates to the levels of biological functioning, root proliferation, compaction, etc. Farmers prefer dynamic component because good management allows the soil to come its full potential.

### Indicators of soil health :

**Physical indicators** : Bulk density, infiltration rate, water content, water holding capacity.

**Biological indicators**: Microbial activity, microbial biomass, carbon cycling, nitrogen cycling, biodiversity, bioavailability of contaminants.

**Chemical indicators**: pH, EC, ESP, CEC, organic carbon, macro and micro nutrient analysis.

**What is soil health card?** : Soil health card is a tool which provides the information assessment and

enhancement of soil quality which needs identification of relationships between measured soil attributes and soil function, and development of a practical index for on-site assessment of soil quality and health for use of farmers.

**Importance of soil health card :** Application of fertilizers on the basis of soil test, Preparation of farm fertility map of each farmer, It indicates all related information of farmers' field, Soil test based recommendation is productive, cost-effective and sustainable, Encourage balanced use of fertilities, Motives integrated use of fertilizers and manures, Bringing improvement in fertilizer use efficiency etc.

**Soil health card programme :** For preparation and distribution of soil health card to the farmers to enable them to keep record of fertility status of their soils on continuous basis, the Government of India had launched soil health card programme. This is a major programme of testing and analyzing the health of soil was taken up for all the villages in the State.

**Purpose of the soil health card programme :** (1) To develop scientific temperament, general awareness and sense of practical utility over a period of time. (2) To motivate to adopt scientific innovations quickly in their own farming situation.

**Objectives of the programme :** (1) Analyze the soils of all the villages of the state. (2) Recommendation of appropriate rate of manure and fertilizer to each crop. (3) Recommendation will help in restoring balanced nutrition of crops. (4) Based on soil analysis, farmers are motivated for crop diversification. (5) Convince the farmers about importance of application of manures in their field.

**Information in soil health card :** (1) Name of village (2) Name of Block (3) Name of District (4) Survey No. and its area (5) Farmer(s) name (6) Crops variety (7) Crop sequence (8) Land slope (9) Irrigation and its source (10) Existing fertilizer recommendation (11) Soil test values (12) Revised fertilizer and manure recommendation (13) Urea rates (14) DAP rates etc.

**Parameters in soil health card:** (1) EC (dS/m-1); <1.0 (safe): 1-3 (saline): >3 (harmful) (2) pH: <6.5 (acidic): 6.5-8.2 (normal): >8.2 (alkaline) (3) Organic Carbon (OC) (%): <0.5 (Low): 0.5-0.75 (Medium): >0.76 (High) (4) Available N (%): (O.C. % \* 0.0862) (5) Available P (Avail. P<sub>2</sub>O<sub>5</sub> kg/ha): <28 (Low): 28-56 (Medium) : >56 (High) (6) Available K (Avail. K<sub>2</sub>O kg/ha) : <140 (Low): 140-280 (Medium): >280 (High) (7) Fe rating (8) Zn rating. Soil health card is prepared on the basis of soil test report and recommendations.

**Soil sampling procedure for soil testing :** It is well known that one of the chief factors responsible for obtaining satisfactory crop yields is the presence of

essential plants nutrients in the soil in adequate quantities and in readily utilized form. For maximum production and rational soil management, knowledge of the fertility status and physical properties of a soil is essential. Soil testing is one of the methods of determining the fertility status of the soils, so that recommendations in regard to deficient nutrients or soil amendments can be made. In fact, soil testing forms an essential part of any scheme of agricultural development. Soil testing laboratories have been established in almost all the states, covering all districts in them, where soils are analyzed quickly and recommendations are made in respect of the fertilizer requirement for different crops.

**Soil sampling:** Soil tests and their interpretations are based on the samples analyzed. It is, therefore important that the soil samples should be properly collected and should represent the areas. Soil tests and their interpretations are as reliable as the samples drawn. For routine soil testing, the field is traversed, variation in slope, colour, texture, management and cropping pattern are noted down and it is divided into portions according to the variations. Separate samples are collected for each of the portions. Samples are taken, using proper tools, e.g. a soil tube, an auger, a spade or a pick-axe for the plough depth at several spots and then composited. The soil is mixed thoroughly and spread on a clean sheet of paper or on a piece of cloth and divided into four equal parts. Two opposite quarters are rejected and samples from the other two are mixed and the procedure is repeated till the desired size of the samples is obtained (1/2 kg) which is collected in a plastic bag and placed in a box or cloth-bag. Moist samples are dried before collecting and care is taken to avoid contamination. The bag or the box is well labeled and sent to the nearest soil testing laboratory, along with the sample information sheet.

**Size of soil sample:** Amount of soil to be collected will depend on the type of analysis. For soil fertility evaluation 100 gms of soil is sufficient but for detailed physico-chemical analysis above one thousand and five hundred gms of soil is essential. In general 0.5 kg is collected.

**Precautions in collecting and storing of sample :** (1) The sample must be representative one of the area under study. To achieve this, an individual field is treated as a single sampling unit only if it is appreciably uniform. Soil sampling must be taken into account to the variation of soil according to the profile depth, landscape area, colour, texture, management, crop growth and any other visual differences. Separate sets of samples are to be collected for variation in any of the above characteristics (2) For accessing the depth from which the samples are to be collected, the rooting zone of the crop/plant should be

considered. In general for cereal crops soil sample should be collected up to a depth of 15 cm. For deep-rooted crops all that growth under special soil management, soil sample should be collected from different soil depth or layers (3) Recently fertilized crops, old bunds, marshy spots, areas of compost pits or other non-representative locations must be avoided during the collection of soil samples (4) There should not be any contamination in the soil sample, possibility of contamination with fertilizer, ash or manures must be avoided (5) Cotton, plastic or jute bags which were previously used for fertilizer or lime should not be used at any stage in the process of collection and processing at the soil samples (6) Soil sample should preferably be stored in clean clothes or polythene bags (7) Sample bags can be reused after thorough washing and drying.

**Sample information sheet contains** (1) Sample No. (2) Date of collection of the soil sample (3) Name of the cultivator (4) Address (5) Village, Block, District name (6) Type of soil (7) Identification of the field (Survey no.) (8) Proposed crop and variety (9) History of the field for the past 3 years: Month and year of planting, Month and year of harvesting, Crop and variety, Yield, Kind of fertilizer used, Quantity (10) Wet/dry/garden (11) Extent of the soil area (12) Depth of sampling (13) Number of samples taken to make a composite sample. (14) Check the following: /Was the stand of the previous crop uniform? Yes/No/ Texture of the top soil: Sandy, loam, clay-loam/ Slope: Level, steep, moderate/ Drainage: Satisfactory, moderate, water-logged (15) Any other useful information (15) Quantity of farmyard manure available (16) Signature of the farmer ( In collecting the soil samples, the help of the local officials, namely, the village level worker or the extension worker can be taken. He can help to collect the data required to fill the information sheet).

**Soil testing:** In the soil testing laboratory, soil samples are analyzed by using standardized rapid methods for the following items: (i) pH or the soil reaction which indicates whether the soil is acidic, alkaline or normal. (ii) Total soluble salts, as determined by electrical conductivity which indicates the degree of salinity, alkalinity, etc. of the soil (iii) Organic carbon which is a measure of available nitrogen (4) Available phosphorus (5) Available potassium (The methods used are those standardized and tested for a particular area. In addition to the above items, other items, as considered necessary according to the problems, may be analyzed).

**Soil test report and recommendations contain :** Sample No./Date./Texture/pH/E.C. (mmhos/cm 25°C) - Quantity of nutrient to be applied in kg per ha;/Organic carbon (%) - Nitrogen (N)/Available phosphorus (kg per

ha)-Phosphorus ( $P_2O_5$ )/Available potassium (kg per ha)- Potassium ( $K_2O$ )/Compost or green manure-Tones per ha/Opening of drains, Flooding-Times/Application of lime kg per ha: /Application of gypsum kg per ha; /Signature of In-charge (Soil Chemist) of the Laboratory (If desired, additional information for individual requirements regarding the time and the method of application of fertilizers, precautions to be taken, etc. may also be obtained). On the basis of this soil test report and recommendations, soil health card is prepared.

**Causes of soil health deterioration** (1) Intensive cultivation (2) Mechanization (3) Limited crop rotation (4) Lack of organic matter addition (5) Mismanagement of soil resources (6) Soil erosion (7) Immediate gaining without any regards to long-term sustainability (8) Many agricultural practices can make soils less healthy etc.

**Soil health management** A. Maintaining organic matter in soil (1) Use of organic manure-FYM, compost prepared from crop residues and other farm wastes, vermin-compost, oil cakes, biological wastes (animal bones, slaughterhouse refuse etc), green manuring, (2) Adding off-field organic material (3) Growing of cover crops (4) Follow crop rotation. B. Avoiding tillage practices that harm soil structure-On many soils, using of tractor mounted cultivators over several seasons compresses a layer of soil at a depth of about 15cm (6 inches). This compressed layer can form a hardpan. C. Conservation of soil from erosion and other soil degrading effects. D. Adopting integrated nutrient and pest management practices E. Rectifying soil problems like acidity and alkalinity etc.

**Conclusion:** Sustainable agriculture is a form of agriculture aimed at meeting the needs of the present generation without endangering the resource base of the future generations. It should benefit rather than harm the natural environment and must at least maintain basic natural resources such as healthy soil, clean water, clean air and it should support viable rural communities. Land and water are the two basic resources of a nation. Productive land is the source of human sustenance and security. Economic stability and a wise use of land are inseparable. The future of a country and its crowded millions depend to a large extent on the conservation of land and water through the proper use and treatment of land. Among the various ways of maintaining soil health properly and on a sustainable basis, soil health card is one of reliable approaches where the soil is manured or fertilized only after knowing the nutrient status of the soil by proper soil test measures. By this way proper amount of nutrients are provided to crops so discourage wastes of fertilizers and manures. Number of nutrients is required for proper development and growth of crops which is only

possible to know through soil test. It is the general observation of persons engaged in agricultural production that application of manures and fertilizers and proper plant protection measures could in some cases, not result in targeted yields. The probable reasons have been ascribed micronutrient deficiency; therefore soil testing is very essential to know the hidden causes of low production or crop failure. To feed the growing population of our country more food has to be produced where population is day by day increasing and cultivable land is day by day decreasing,

in this respect only the option opened is intensive cultivation with modern crop production technologies. Therefore soil health is day by day getting more importance in the way of increasing agricultural production. It is better to say nowadays that soil health is rightly the health of nation. In this arena, application of fertilizers and manures without knowing the soil nutrient status is a blind practice just like consumption of medicines for curing a disease without knowing the doctor's prescription.

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