



Pawan Kumar

pawan.kumar@smsfoundation.org

100

Deterioration of soil fertility is major concern for the sustainability of Indian agriculture. Soil function is vital for the production of food as well as the maintenance of local, regional, and global ecology. For centuries, the farmers of India practiced a cultural system that ensures modest but stable yields and still maintained optimum soil fertility. This balance interrupted by the widespread increase in production with the introduction of high-yielding varieties, intensive use of chemical fertilizers and pesticides and extensive tillage. This shift raises a concern about whether the Green Revolution in agriculture is sustainable and heading to a green economy.

Over the years, particularly in tropical and sub-tropical countries around the world, it is realised that change are still slow. Soils are continuously exhausted and mismanaged. Vast cultivable areas are lost every year and the trend is not slowing down. Concern about healthy fertile soil is greater than ever. India is one of the most highly affected countries in terms of land degradation and this issue is not being adequately addressed

at any level. Soil health is of such extreme importance that future land management decisions must be made to lead to more sustainable and resilient agricultural systems.

Rain-fed areas of India have a serious problem with soil degradation. Nearly 60% of total net sown are rain-fed, accounting 48% used for food crops and 68% used for non-food crops. In rain-fed areas, after access to fresh water, soil degradation is the key factor in creating agriculture subsistence for small landholders. There is no single, simple and unique solution to address the soil degradation problem universally. A local integrated and action-oriented soil fertility management strategy is a must.

Integrated soil fertility management adapts and maximizes the efficiency of nutrients and water use and improves land productivity. ISFM strategies include the combined use of chemical fertilizers (both macro and micronutrients) and organic matter (crop residues, compost, and green manure) followed by the use of appropriate crop rotation and intercropping with legumes (a crop that

There is no single, simple and unique solution to address the soil degradation problem universally. A local integrated and action-oriented soil fertility management strategy is a must.



fixes atmospheric nitrogen). Sehgal Foundation promotes the ISFM approach in district Nuh, a rain-fed district of Haryana. The soil of the district has become highly degraded due to injudicious use of chemical fertilizers. The traditional practices of leaving no crop residue on farmland and a decreasing supply of organic manure adversely affect physical, chemical, and biological properties of the soil. As a result, the average productivity of major crops such as wheat, mustard and millet are lower than the state average. To revitalize soil of small landholders, Sehgal Foundation encourages farmers to adopt several interventions such as crop-specific soil nutrient management, the cultivation of legume crops (pigeon pea and chickpea), new methods to prepare organic manure quickly, green manuring and the adoption of crop rotations.

Providing the solution locally, in 2012, Sehgal Foundation, in collaboration with the state agriculture department, developed a soil fertility map of the district Nuh, which covered 432 villages. One sample represent one square kilometer are a.GPS was used to mark the location of each sample. Samples were tested on Haryana government's soil testing laboratory, Karnal.

The images below show the status of different nutrients in the soils of district Nuh.

Major findings of soil analysis:

- Except sulphur and manganese, the samples were found deficient in nitrogen, phosphorus, potash, zinc, and iron.
- Nitrogen and phosphorus were found to be low in 87% and 97% samples respectively.
- Zinc was critically low in 40% samples.
- Except for a few pockets in Taoru, the general status of iron in the district was normal.
- Approximately 60% of samples had soil salinity.
- The soil alkalinity was normal in most samples.

The district agriculture department and Sehgal Foundation launched a campaign to bring about mass scale awareness of the importance of soil health management. In village meetings, farmers were trained on the use of crop-specific fertilizer recommendations and were motivated to increase the supply of good quality organic matter in their soil. In consultation with a researcher and



plant nutritionist, a customized package of practices was developed for wheat, onion, mustard, millet, and cotton. For quick learning, demonstrations of balanced fertilizer application were done on one acre. Crop specific nutrients were provided for half of the acre (demo plot) and on the remaining half-acre (control plot), farmers used their own practices. The results showed that balanced fertilizers reduce cultivation costs and increase productivity. In addition, the use of micronutrients improve grain quality and enhance plant tolerance to stress. With support from corporate donors, Sehgal Foundation initiated various related projects that provided these same benefits to more than 10,000 farmers. The application of a crop-specific package of practice results increased crop productivity by 20%, 19%, 25%, 27%, and 24% in wheat, mustard, cotton, onion, and millet respectively.

ISFM demonstration in millet and wheat

Soil organic matter plays a key role in improving the physical, chemical, and biological properties of soil. Over the years, due to a decline in the animal population, the supply of organic matter to farmland has been reduced considerably. In current practices, farmers are supplying smaller amounts of poorer quality (partially decomposed) manures. The application of poorly decomposed organic matter invites termite attacks in the field. Sehgal Foundation introduced compost beds, which allow farmers to prepare good-quality manure 40-45 days in summer and 80-90 days in winter, whereas traditional practices took 180-270 days. A compost bed can be used year round and farmers can prepare compost three times a year. The capacity of one bed is 18-20 quintal per unit. The application of well-decomposed manures increases the moisture holding capacity, soil aeration and improves microbial activity in the soil.

Pulses are legume crops considered as climate-resilient in a rain-fed farming system. Pulses requires less water, improve soil organic content, and fix atmospheric nitrogen in the soil. The high market value of pulses bring a high return. Sehgal Foundation introduced short-duration pigeon pea into the existing crop rotation, which matures in 170-180 days and allows farmers to grow a winter crop. The cultivation of short-duration pigeon pea provides additional income of Rs14,338 per acre compared with millet, the alternative crop of kharif season.

102





Maintaining or improving soil health is essential for sustainable and productive agriculture. Healthy soil will help push agricultural productivity. ISFM strategies assist farmers in following a scientific process for agriculture without losing soil's inherent capacity to produce more if its fertility level is maintained

In India, dhaincha (*sesbaniabispinosa*) is traditionally used for green manure. It is mixed with the soils to improve soil's physical and chemical properties. The plant is also cultivated for its skin fiber, wood

and seeds. Sehgal Foundation works with farmers to follow crop rotation with dhaincha, which can grow on the field's bund or as pure plantation. For green manuring, dhaincha is mixed into the soil through harrow or cultivation once it attains the age of 45–60 days and a height of 120–150 cm. A 60-day crop provides 23.2 tons of dry matter per ha and accumulates 133 kg nitrogen per hac. In addition, green manure improves soil structure and the water-holding capacity of the soil and improves microbial activities that are good for soil health.



Maintaining or improving soil health is essential for sustainable and productive agriculture. Healthy soil will help push agricultural productivity. ISFM strategies assist farmers in following a scientific process for agriculture without losing soil's inherent capacity to produce more if its fertility level is maintained. Sehgal Foundation adopted the ISFM approach using multiple tools such as soil mapping, techniques for producing quality manures, developing a customised package of practices, conducting field demonstrations and field days, promoting green maturing, and following a legume-based crop rotation. The adoption of this multiple approach helps more than 10,000 farmers and increases the productivity of major crops of the region. The increased level of awareness and adoption of these tools can help turn current subsistence farming into productive farming.