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2015
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Year of Soils
healthy soils for a healthy life

National Dialogue on

Efficient Nutrient Management for Improving Soil Health

September 28-29, 2015
BP Pal Auditorium, IARI, Pusa
New Delhi, India

New Delhi Soil Health Declaration-2015

Jointly organized by
Trust for Advancement of Agricultural Sciences (TAAS)
Indian Council of Agricultural Research (ICAR)
International Maize and Wheat Improvement Center (CIMMYT)
International Plant Nutrition Institute (IPNI)
Cereal Systems Initiative for South Asia (CSISA)
The Fertiliser Association of India (FAI)

Background

Soil is the most wondrous gift of nature to humankind. It provides us the basic needs like food, nutrition and good environment. In order that soils provide ecosystem services effectively and on a sustainable basis, it is essential that they remain healthy. Some attributes like fertility, compaction, erodibility and bio-wealth are the measures of soil health. Basically, the soil organic carbon (SOC) supports and sustains soil health. Often led by faulty land use and gross mismanagement/over-exploitation, the SOC content gets declined. This sets in motion a vicious cycle of events that spark fall in soil health. Incidentally, weakening of SOC is not new and its trail can be traced to the entire 10,000 years old history of agriculture. What is new is the intensity of decline, which rather got accelerated since Green Revolution period starting in mid-1960s. The United Nations Environmental Program (UNEP) has estimated that since then, world compromised quality of ~2 billion ha good farmland to degradation – all of which is caused by anthropogenic activities. The problem does not stop here, since every year 2 to 5 million ha land is added to this category; a loss of nearly 10 ha good land/ minute! In terms of food grain production, wearing down of soil health costs an annual loss of ~20 million tons or 1% of the global annual food grain production. Worldwide, 1.5 billion people and 42% of the poorest of the poor live on degraded lands. Share of India in global degraded land area is about 10% and of population that thrives on degraded land is 17%.

Confronted with the persistent mortification of soil health, United Nations (UN) declared the year 2015 as an International Year of Soils (IYS). The primary intent of IYS was to raise awareness among all stakeholders on the crucial role healthy soils play in sustaining world food secure and climate change safe. In view of this, TAAS in collaboration with ICAR, CIMMYT, IPNI, CSISA and FAI steered a National Dialogue on '*Efficient Nutrient Management for Improving Soil Health*'. By design, the discussions largely centered around fertilizers, since without their effective and efficient use, sustaining food security is rather not possible and with their ongoing inefficient management halting any decay in soil health and mitigating climate change effects is not possible. Drawn from national and international institutions/ organizations/agencies, about 150 scientists, administrators, policy makers, professionals from the fertilizer industry, representatives of the civil society organizations and farmers participated in the two days dialogue. Held at IARI, New Delhi, the deliberations were broadly categorized into 3 thematic sessions as follows:

- Panel discussion on 'Soil health concerns and opportunities'
- Challenges for improving soil health
- Organic recycling and soil health

In order to capture the essence of thematic presentations and discussions thereon, the participants formed different working groups to debate specifically the following issues:

- Organic recycling in agriculture: What, how much, where and how?
- Soil health card and beyond
- Soil pollutants and soil degradation
- Fertilizer nutrient use trends, scalable technological innovations and tools for improving nutrient use efficiency
- Institutions, policies, partnerships, scaling strategies, and capacity for a Healthy National Soil Resource

Detailed deliberations finally culminated in some very concrete action oriented recommendations. These were adopted unanimously as ***'New Delhi Soil Health Declaration-2015'***. Accordingly, the key recommendations were:

Recommendations

1. Create an enabling environment for fertilizer use efficiency

- Fertilizer use efficiency continues to be deplorably low. Typical case is that of N, which unrelentingly suffers maximum from wasteful use (almost up to 50%). Poor efficiency costs enormous economic losses and results in soil health degradation. This state of affair continues, despite availability of good knowledge and know-how on N use management. Group agreed that farmers were either unaware of required knowledge on scientific use or the recommendations given were not relevant to their specific needs/ conditions. In pursuance to this, it was decided that scientists must work hand-in-hand with farmers to validate practicality of their findings on improving the conventional methods of fertilizer management. Also, it was recognized that the extension services require improvement, particularly concerning fertilizers use advisory which should emphasize on adoption of improved methods of fertilizer application and management.

- Supplementation with organic manures was considered critical to sustain productivity growth attributed to fertilizer use. It was recommended to evolve institutional mechanisms and prioritize investments for linking Integrated Farming Systems (IFS) and Sustainable Intensification (SI) options for improving soil health, human nutrition and to reduce environmental footprints.

- Although India is the second largest consumer of fertilizers (NPK) in the world, intensity of use/ha lags behind many Asian countries (e.g., Vietnam, Malaysia, Bangladesh, South Korea). More than consumption, it is the imbalanced use which is a matter of great concern since it has led to multi-nutrient deficiencies. Continued soil mining of an important nutrient like K has led to spread of its deficiency across wide variety of soils and crops. Further, increasing dependence on relatively pure fertilizer sources and relatively less use of organic manures have amplified the deficiency of micro- (Zn and B) and secondary (S) nutrients. These changes are the dominant factors for diminishing nutrient use efficiency and factor productivity decline.

- Support small farm mechanization for proper fertilizer placement to minimize gaseous and runoff losses of fertilizers. Replacing/discouraging the current practice of broadcasting with proper fertilizers placement will improve NUE, reduce environmental foot prints and increase farm productivity as well as income.

- For enhancing fertilizer use efficiency, it was strongly felt to replace general fertilizer recommendations to tailor made advisory as per the site and crop specific nutrient needs. In pursuance to this, it was recommended to promote small scale industry for manufacturing appropriately designed fertilizer nutrient mixes by dry granulation (compaction). Such an enterprise may serve specific fertilizer needs of similarly placed villages (grouped on the basis of nearly analogous fertility status and similar cropping systems). The manufacturing can be contracted to educated rural youth and progressive farmers. Alternatively, it can be run by a village-based organisation such as a Farmers' Producer Organization (FPOs), Farmer cooperatives or a self-help group (SHG) involving educated rural youth and women.

- Since small scale agro-input dealers constitute an effective group for technology transfer, (i) make it mandatory for the existing ones to undergo a training to improve their techno-advisory skills within a given time frame, or else they be mandated to employ a trained agricultural graduate to provide good advice-giving services, and (ii) in future the agri-input dealerships be licensed only to those who undergo specialized vocational training for common field problem diagnostics and relevant agro-input management.
- Launch a scheme to incentivize good environmental services by the farmers/ farmer groups, who without sacrificing productivity, maintain soil health through efficient nutrient management practices.
- With a doable target of 10% increase in fertilizer nitrogen use efficiency (raising from average of 40 to 50%), it can save 1.7 million tonnes of fertilizer N costing ~Rs. 2000 crores annually with reduction in environmental foot prints to the tune of ~22000 t CO_2-eq yr^{-1}.

2. Mainstream organic recycling

- Despite clear understanding that soil health hinges on SOC content, sparing adequate quantities of farm yard manure (FYM) remains a major challenge. The problem is far more acute in the tropical regions, where SOC content is rather low. Hence, it was recommended to have interventions on maximizing returns of various organic sources by: (a) evolving community/ village biogas units to replace dung as fuel, (b) enacting legislative measures that obligate total ban on burning of vegetative materials of all kinds, (c) adoption of short duration multi-purpose varieties of legumes as catch crops in cereal-cereal rotations, (d) popularizing conservation agriculture practices, (e) promoting the integrated soil and nutrient management practices and (f) rewarding and incentivizing those who adopt (a) to (f). It was also felt that without an appropriate policy instrument in place, the year on year basis improvement in SOC is less likely to be achieved.
- In order to maximize recycling of rural and urban waste, there is need to put in place a national strategy on ***'Waste to Wealth'*** by encouraging setting up of fast composting units. Supporting economy of scale, these units could be established around rural/urban peripheries and can be contracted to willing entrepreneurs/unemployed youth. Besides, transport of waste to composting sites by the civic bodies, initial hand holding by providing subsidized dumping/storage sites, compost handling, sorting, manufacturing, bagging and packing machines, mentoring and marketing links are seen to fast-track these arrangements. The scheme on making wealth from waste could be funded by the ***MPLAD*** or it can become part of *Swachh Bharat Abhiyan* around cities and ***Model Village Scheme*** being implemented by the legislative members.
- In view of the limited coverage under conservation agriculture (CA), it be examined as to what are the specific constraints for out-scaling this innovation for improving soil health and farmer's livelihood. Accordingly, concerted efforts be made to prioritize investments and redesign interventions responding to farmers' specific needs and aspirations.
- Enact legislation to ban burning of crop-residues. Such provisions be made easy to implement and at the same time quite difficult to manipulate/evade. Adoption

of CA be linked to utilizing leftover straw as mulch. In order that residue does not impede zero-till sowing operations, the support be extended to make available the necessary machinery for cutting and evenly spreading straw on the ground using straw spreader and Happy seeders for direct drilling. Such an arrangement could be in the form of custom-hire basis or on cooperative basis.

- At the national level, there is an urgent need to target at least 10% replacement of chemical fertilizers by bio-fertilizers in the next 5 years. In pursuance of this goal, it will be necessary to strengthen quality standards, efficient production methods, shelf-life enhancing storage, followed by proper distribution and marketing.

3. Invest in arresting soil degradation

- Develop location (bio-physical attributes) and situation (socio-economic state of farmers and markets) specific land use alternatives that are more competitive and less exploitive of natural resources than those currently in practice.
- With pre-identified indicators, quantitatively assess soil degradation and classify soils as per degree of severity. Workout cost of soil amelioration practices and projected returns from them. An integrated approach combining professional criterion and indigenous methods of soil health analysis and cure is seen to be more acceptable requiring less lag time.
- On eco-regional basis, delineate whether the origin of pollutants/contaminants is geo-genic or anthropogenic. Based on such scientific enquiry, adopt appropriate strategy that minimizes the adverse consequences and further spread such as: (i) enforcing zero entry of contaminants from factories, (ii) promoting bio-remediation, (iii) selecting crops whose economic product does not enter the food chain, (iv) immobilization by treatment with appropriate ameliorants and (v) soil management practices that minimize crop uptake.

4. Promote site-specific nutrient management

- Incidence of multi-nutrient deficiencies has led to rise in soil degradation and climate change. Supplementation with K, Zn, B and S fertilizers, therefore, has become imperative for sustainability of farming systems.
- Based on soil test results, efficiency of fertilizer treatment will further enhance by popularizing site-specific nutrient management (SSNM) tools, e.g., Nutrient Expert, Green Seeker, Crop Manager etc. Hence, for spreading the correct message on SSNM, a country-wide multi-institutional portal on efficient nutrient management needs to be worked out on priority and promoted on large scale.
- Create centralized database on land use, attainable crop yields, cropping/farming systems, fertilizer use to facilitate fertilizer allocation through the ***Digital India*** Initiative. This can be achieved by three-pronged strategy: (i) operationalize a ***National Soil Database*** to identify zones of nutrient-deficient hot-spots, (ii) allocate fertilizer based on nutrient deficiency maps developed through the ***National Soil Health Card Program*** and (iii) consider crop requirement for a target yield and the cropping system while planning fertilizer allocations.
- Integrate to-be-received Soil Health Card Reports with ICT based tools such as Nutrient Expert for effective last mile delivery of site-specific nutrient management recommendations.

5. Revisit fertilizer subsidy policy

- A new-look ***Fertilizer Use Policy*** be devised in the current context based on available scientific knowledge. It is time now to comprehensively review the existing differential allocation of subsidy to urea as compared to P and K. Moreover, the change in fertilizer subsidy pattern must not be in one go. On the contrary, it must be gradual and consistent with rise in minimum support price (MSP) announced by the government from time to time.
- The demand for decontrol of urea should not be considered the same way as that for phosphatic and potassic fertilizers. Need is to take care of balanced interest of both farmers and industry. While ensuring reasonable return on investment can address Industry's concern, the provision of variable subsidy and stable price (MRP) would obviously help the farmers.
- There is full justification to create a new mechanism to ***incentivize efficient fertilizer users*** within the ambit of direct fertilizer subsidy system. Analyze the implications of direct transfer of subsidy to farmers in place of subsidy to the manufacturers. This shift, no doubt, has real implications on time availability of finances to the smallholder resource poor farmers since he will have to pay upfront while buying the fertilizers, whereas reimbursements may take their own time and may require farmer to run from pillar to post. Hence, a comprehensive dialogue/understanding is needed while implementing direct subsidy scheme, especially to ensure provision of advance payment by the banks for fertilizer purchases.

6. Prioritize Soil Health Research (SHR)

- Standardize soil health parameters – chemical, physical and biological, describing parametric values that determine sustainable productivity growth with efficiency, economics and zero land degradation. Typically, developing critical measures on assessing biological health needs renewed effort.
- Strengthen fertilizer product research ensuring practicability of use, efficiency and economy. Also, research needs to focus on site-specific product constructs that are feasible to manufacture at the local level.
- Set up long-term research sites across different agro-ecologies for progressive indexing of soil's physical, chemical and biological health and providing space for need-based adjustments in nutrient prescriptions suiting conventional and sustainable management interventions.
- Establish research sites representing different cropping systems and growing ecologies for mapping N loss hot-spots. The contributing routes and elements encouraging N loss thus identified, in turn, can be used both to fix new research objectives targeting development of improved products and N loss mitigating strategies. Also research on use of liquid nitrogen to minimize losses and improve fertilizer use efficiency would be desirable in the present context, especially to see whether a policy change is warranted to save the huge quantity of N-fertilizer losses annually.
- Launch nutrient management research in the context of climate change to explore adaptation and mitigation potential of balanced and site-specific nutrient management. A typical

objective could be to explore minimizing productivity loss due to developing possibility of terminal heat stress or due to crop lodging due to unseasonal rains at crop maturity.

- Evaluate the relative value of *in-situ* composting of organic residues and green manure vis-a-vis their natural turn over from the point of acceptability to farmers and effectivity in terms of improvement in soil health.
- Need is to develop an ***"Organic Fertilizer Calculator"***, which could be employed as a tool for comparing the cost, nutrient value, and nutrient availability of organic materials with improved understanding on real time nutrient release characteristics. Findings of this kind are seen to be useful for reckoning effective nutrient value of diverse organic materials and their role in improving management of fertilizers and reducing environmental footprints.
- Time is right to establish a ***National Mission on Sustainable Soil Health.*** One goal of this initiative would be to evaluate constraints that impede maintaining sustainable soil health. Another aim would be suggesting time bound near-term practicable interventions and long-term strategies to eliminate the delineated limitations. Not only will the focus be on sustainable intensification but it would also *inter alia* include so far neglected research on human and livestock health. The mission will have pluralistic setup and undertake multifunctional activities. Above all, it will network with community-based organizations placing their needs and concerns for maintaining soil health for long term productivity gains.

Towards the end of dialogue, all participants echoed, since onslaught on soil quality, more than nature, is the act of all stakeholders – farmers, builders and common folks, they have to be part and parcel of the protection and conservation programs also. Globally, 500 million small and marginal farmers out of a total of 525 million, are the largest interest group of agricultural land (~1.5 billion ha). Accordingly, their role in sustainable soil health management is of the top most significance. Not only are they needed to be empowered with right knowledge and know-how but that kind of knowledge and know-how has to be developed keeping in view their sensitivity. In that pursuit, convergence of diverse research and development programs, interventions and investments spread across institutions, agencies and development departments will have to be welded together for time-bound output and impact.

For additional information please visit:

Concept Note and Program:

http://sap.ipni.net/article/SAP-3116;
http://blog.cimmyt.org/indias-national-dialogue-on-efficient-nutrient-management-forimproving-soil-health/

Book of Extended Summaries:

http://knowledgecenter.cimmyt.org/cgi-bin/koha/opac-detail.pl?biblionumber=57111;
http://www.taas.in/documents/pub45.pdf