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IN THIS ISSUE

International Decade of Soils 2015-2024

FROM THE PRESIDENT'S DESK

Increased human influences on soils frequently results in widespread processes of land and soil degradation. Associated with land and soil degradation there is a decrease in available good quality water for agriculture, urban and industrial needs, and decreased biodiversity. The processes of soil and water degradation are closely linked through unfavorable alterations in the hydrological processes determining soil water regimes. In the last 25-30 years there has been increased interest in human-induced climate change, associated with increased atmospheric concentration of greenhouse gases. Most of the present and future problems of land and soil degradation, water supply and natural disasters are mainly attributed to these climate changes. At the same time, and probably related to it, there has been a change in the foci of studies and research on soil and water conservation. With the increasing evidence of the growing global problems of land, soil and water degradation and their effects on food production and the environment, there was increasing interest, especially since the late 1960s, in stimulating studies related to soil and water conservation. Particular attention was paid to the processes of soil and water degradation in relation to their use and management for agricultural purposes. These efforts led to the development of models and evaluation systems mainly using empirical approaches. Later studies demonstrated the limitations of the generalized universal use of these empirical approaches. Concurrently with the renewed interest associated with soil and water conservation, there was an increase in related organizations, conventions, congresses and conferences. A global assessment of human-induced soil degradation (GLASOD) observed the paucity, difficult accessibility and poor quality of basic information required for adequate planning and effective application of practices to prevent soil and water degradation. The more recent conventions and programmes at international and regional levels generally are based on re-interpretations and different processing or representation of old information, using some times "new" terminology. "C sequestration" and "zero tillage" have become dominant paradigms, without due consideration and research

about both the beneficial and detrimental effects of them in relation to various environmental and productive soil functions. It is concluded that as climate, soil and socio-economic conditions differ greatly from one location to another, and as them are changing continuously, there can not be simple universal prescriptions regarding practices for a sustainable soil management for crop production and environmental protection, and to help mitigate the greenhouse effect by C sequestration in soils. The adequate selection of those sustainable practices must be based on research with a broader vision on soil conservation, where all the system components and their interaction are considered and understood with a far-sighted approach, to ensure that short term gains in one aspect or location do not induce long- term losses in other aspects or elsewhere. Research needs to be directed to better understanding of the processes and reactions in soils related to chemical recycling and water balance over a range of spatial and temporal scales, with the common objective of improving crop production and environmental protection. Lasting solutions will only be found if the complexity of problems is recognized by adequately trained researchers in soil science and hydrology, who then develop appropriate strategies.

Dr. Suraj Bhan
President SCSI

ICAR Flexi-Check Dam (Rubber Dam) for efficient soil and water conservation in watersheds

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What is rubber dam?

ICAR-flexi check dam (rubber dam) is an inflatable structure build across a stream used for soil and water conservation in watersheds. During long dry spells/ lean seasons, the head wall can be easily inflated to store additional water due to its flexibility. During extreme events of cyclone, high intensity rainfall and flood situation, the structure can be easily deflated, so there is no damage to the structure and there is no breaching of stream bank/ levees and no scouring or erosion of stream bed. When inflated, serves as check dam and when deflated acts as sediment flushing device and flood mitigation. Also due to variable head, regulates the depth of flow in upstream side of diversion channel. The crest length of rubber dam varies from 2 to 100 m and height 0.5 to 3.0 m.

Operational domain

ICAR-flexi rubber check dam technology was introduced in the year 2010 in Khurda district of Odisha and at present, the rubber dams were installed in about 33 locations covering 8 States of India *viz.*, Maharashtra (6), Uttarakhand (4), Himachal Pradesh (2), Meghalaya (1), Tamil Nadu (1), Gujarat (4), West Bengal (2) and Odisha (13) and the installation process is continuing in several other locations.

Advantages of rubber dam

The ICAR-flexi rubber check dams are useful for the farmers of rainfed ecosystem of India and provide huge scope for efficient soil and water conservation in watersheds. This technology has potential to create an additional water storage capacity of 4000- 10000m^3 for a 5 m width of rubber dam with height of 1.5 m and channel slope of 0.1% at any point of time. About 52,000 m^3 to 80,000m^3 of storage volume could be created during whole crop season. Overall, the installed rubber dams in different agro-ecological regions of India resulted in enhancement of irrigation command area by 400 ha during *kharif*, 130 ha during *rabi* and 45 ha during summer season. Further, this technology has a potential to contribute to groundwater recharge immensely.

ICAR Flexi-check dams installed in different agro-ecological regions of the country

Economic Benefits

The adoption of ICAR-flexi rubber check dams significantly increased productivity of *Kharif* season crops *viz.*, Rice (12-62%), pulses (24-46%) and vegetables (17-46%) and thereby contributing an additional net returns of Rs. 13,500 to Rs. 32,000 per ha under rubber dam command area. For example, the fruit yield of watermelon and cowpea has witnessed an increase from 9.2 t ha^{-1} and 5.2 t ha^{-1} to 12.9 t ha^{-1}and 7.6 t ha^{-1} respectively during corresponding period due to additional available water after installation of rubber dam at Chandeswar, Odisha. Similarly, the fruit yield of ridgegourd was enhanced from 5.5 t ha^{-1}during pre-installation stage to 6.9 t ha^{-1}during post-installation of rubber dam. The benefit-cost ratio of the system was worked out to be 2.30 with 14% internal rate of return (IRR).

Rainfed Areas Need Differentiated Policy & Management Approach for Water Management

Bisweswar Rath,
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The present perspective of water resource for agriculture mostly speaks of irrigation development. The growth in agriculture so far has been primarily from input intensive irrigated agriculture where as the rainfed agriculture and rainfed farmers have not been duly mainstreamed in the growth process, which currently account for about 52 per cent of the sown area. The water management in rainfed areas requires completely different approach as rainfed crops broadly meets its water requirement from rainfall and soil moisture with some protective/live saving irrigation during dry spells through two-three critical irrigations either from harvested surface water or replenishable ground water, whereas the irrigated crops mostly rely on assured irrigation sources. The rainfed crops just need about 100-150mm of supplemental water to meet the soil moisture deficits during critical dryspells, rather than large quantities, as in conventional irrigation.

Enhancing Water Productivity: A Relevant Paradigm of Water Management for Rainfed Areas

There is enormous potential in increasing and improving both production and productivity of rainfed crops all over India, through a combination of directly harvesting precipitation, strategic water application and judiciously managing groundwater. Rainfed Areas need to have two focused attentions:

(i) *Water Use Productivity:* Water productivity to be considered *as a metric for* public investment defined in terms of water security (which includes realised augmentation potential) and productivity achieved extensively (area and people) per unit of rainfall and ground water use and

(ii) *Water Stewardship:* Extensive efforts to empower community in deciding allocation, use and governance of all available water resources for life and livelihoods from the perspective of sustainability and equitable access.

Promising Water Management Solutions for Rainfed Ecosystem:

There are several proven technologies and practices to improve water availability to rainfed crops like conservation agriculture, rain water harvesting, precision water use, participatory water use etc. The in-situ water harvesting techniques like land levelling and field bunding have potential to increase the crop yield upto 61 per cent in low rainfall regions. Similarly, the conservation furrows in crop fields increase the crop yields in the range of 8-40 per cent. Mulching reduces soil moisture loss caused by evaporation and insulates the soil. Artificial mulching using biological (crop-residue) increase crop yields up to 31 per cent and increase the soil organic carbon (SOC) content and improve soil carbon build up. Plastic mulching and gravel mulching depending on the location specific demands like areas with higher weed infestation or presence of small stones/ gravel in the land, also significantly increase soil moisture retention. In low and medium rainfall regions, the broad bed and furrow (BBF)system increases the crop yields upto 83 per cent. The ridge and furrow system and compartmental bunding perform well in medium rainfall areas. This system increases the crop yields upto 55 per cent. The sub-soiling with chisel plough in alfisols of medium rainfall region improves productivity upto 24 per cent. Besides above, mulching, green manuring, natural farming etc. also contribute towards retention of soil moisture. Appropriate alignment of crop / cropping systems, relay cropping, alley cropping, mixed farming etc. depending on ecological feasibility and better use of weather forecasts for planning and preparedness improve resilience to drought.

The construction of low cost check dams with available local materials, masonry check dams, and renovation of non-functional water bodies can significantly contribute in storing the rainwater, improving ground water recharge, bringing areas under protective irrigation and increasing cropping intensity in medium and higher rainfall regions. It is seen that one water harvesting structure of a capacity of 1 TCM (thousand cubic meters) can provide protective irrigation to about 2 to 3 acre land.

The protective irrigation source may not yield optimal result without linkage to micro-irrigation, since these sources can't support the conventional irrigation but are meant for only live saving purpose. It is estimated, that replacement of conventional irrigation area by micro-irrigation system even to the level of 50 percent will bring additional area of about 15 per cent in kharif and 23 per cent in rabi under irrigation. And at adoption level of 25 per cent, the estimated additional coverage is 8 per cent in kharif and 12 per cent in rabi.

Water is most efficiently used, if a proper water budget is developed for a particular village/watershed based on systematic analysis of demand and supply positions. Water resource management through appropriate allocation and scheduling its availability to specific farmers/ household for growing crops in synch with the budget is of primary importance for rainfed areas.

Scope for Policy reforms in Rainfed Areas

The water management principles for rainfed areas need an innovative framework to enable 'local solutions' to emerge to the area specific problems/ opportunities.

A progressive movement towards 'Water and its Access as Commons', at least in the period of droughts across rainfall zones is an important policy measure to meet contingencies for small and marginal farmers at large.

Policy tools like incentivised minimum support price, storage & market facility, value addition etc. for crops having higher water productivity for specific ecosystem to be emphasised.

Farmers should be incentivised in terms of higher prices and procurement, input availability for adhering to crop/ cropping systems in synch with agro-ecology ensuring better use of available rainfall with more emphasis on green water use.

There is also need to dissuade farmers from growing water intensive crops not suitable to the water balance of the region, by phasing out the government support like MSP, procurement, subsidy for agriculture inputs, assistance from government programmes etc.

All agriculture commodities should indicate the water foot print and a definite range be prescribed for each commodity for being considered eligible for export and even for government procurement and pricing of commodity to encourage farmers for giving more thrust on water productivity.

The scope, intensity and coverage of Watershed Development component of PMKSY needs to be expanded to bring accelerated economic growth in the less endowed rainfed areas of the country, and narrow the gap that exists in relation to more advanced irrigated agriculture systems.

The policy of ground water use in rainfed areas should clearly aim at equitable use and for enhancing the water productivity and supplementing rainfall deficits.

More emphasis on awareness generation, training and building community driven water management systems at village level are crucial for enhancing water use efficiency in rainfed areas.

Jammu and Kashmir State Chapter of SCSI celebrated World Soil Day (Dec 05, 2021, Jammu) at SKUAST-Jammu

Jammu and Kashmir State Chapter of SCSI celebrated World Soil Day on "Healthy Soil Healthy Life" on Dec 05, 2021, at Advanced Centre for Horticulture Research (ACHR), Udeywalla, SKUAST-Jammu under the able guidance of Prof. J. P. Sharma, Vice Chancellor of SKUAST-Jammu. More than Two hundred participants including farmers/ farmwomen, students and faculty members attended the programme. Many events like. Quiz competition for UG students, painting competition for school children, awareness camp for farmers, invited lectures by eminent scientists and demonstrations of latest technologies and field visits were organized on this occasion. In his address, Vice Chancellor emphasized that soil is integral part of our lives and under present scenario of increasing human population and depleting natural resources, conservation of soil health is even more important. He directed that the soil health cards issued to farmers are very important and the scientists should make all efforts to translate the information given on these cards for practical utility of farmers. He also insisted that different government schemes must reach the farmers and all government machinery should aware the farmers about these schemes. Sh. Ram Sewak, Director Horticulture, Jammu addressed the gathering and assured the orchardists that the department will always come up with farmer friendly schemes. He also stressed upon the farmers to go for high density plantings and also to adopt strawberry cultivation in Jammu plains. Dr. S. K. Tyagi, Programme Coordinator AICRIP, CIPHET Ludhiana told the gathering that their centre is collaborating with SKUAST Jammu for slow release fertilizer experiments. He also said that nano technologies in soil science holds the future. Sh. Sohan lal Sharma, I/C Comptroller, Dr. Pradeep wali, ADR, Sh. C. L. Sharma, Joint Director Horticulture, S. Sarabjeet Singh, CHO, Jammu along with district SMS and other officers from department were present.

Describing soil testing as the imperative to soil health management, Dr. Vikas Sharma, Head, Division of Soil Science and Councilor of the SCSI highlighted the importance of nurturing soil health for improved and sustainable horticulture. Dr. P.K. Rai, Sr. Scientist and Councilor of the society also made the farmers aware of management practices for maintaining healthy soil and demonstrated the use of soil health card and sue of soil testing kit for on-spot soil testing to the participants. Dr. Vikas Tandon, Professor, briefed farmers about ongoing initiatives by Centre of Excellence, Horticulture, ACHR for the farmers.

Dr. Parshant Bakshi, highlighted the importance of healthy soil. Dr. Vivak Manohar Arya Assitant Professor, Soil Science gave important tips for soil test based nutrient application in Jammu soils, Dr. Akash Sharma, Asst. Prof. explained roof top gardening to participants. Dr. Sheetal Dogra, Asst. Prof., Dr. A.P. Rai, Jr. scientist and Dr. Brinder Choudhary also spoke on the different aspects of Soil testing.

During the interactive discussion on soil health card, participants displayed their keen interest in soil testing kit. Packets of bio-stimulant and bio-fertilizers also provided to the participants. Winners of quiz competition were given prizes by the chief guest. Participants and guests appreciated the efforts of Jammu and Kashmir State chapter of SCSI for successful organizing the mega event.

Tamil Nadu State Chapter celebrated foundation day of SCSI

Tamil Nadu state chapter celebrated foundation day of SCSI on 24th September 2021. As a part of foundation day celebration district level inter college elocution competition was conducted for the college students on the topic "Impact of climate change on soil and water resources" Preliminary round of elocution competition was conducted for the college students of Nilgiris & Coimbatore districts in their respective colleges during the third week of September. The best performed the students from preliminary round were called on the foundation day for final round of competition. On the occasion of foundation day Dr.V.Kasthuri Thilagam Treasurer, TNSCSI welcomed the gathering. Dr. S.Manivannan, Vice President (South) inaugurated the foundation day celebrations were by lighting of lamp. In his address he appraised the history of SCSI and the contributions of SCSI in natural resource management. He

also appealed to all the participants to become member of SCSI and actively participate in the SCSI activities. Followed by his address the final round of elocution competition was held. The students from various backgrounds spoke about the effect of climate change in the natural resources. They have indicated the negative effects of climate change on soil, water, forest and wild life. They also discussed the possible solution to overcome these problems.

Shri M. Jayaraman, Project Director, District Rural Development Agency, The Nilgiris was the Chief Guest for the programme. He distributed the prizes to the winners and delivered a special lecture on Role of individual on soil and water conservation. He elaborated the importance of soil and water for agriculture production and maintaining various ecosystems. He told the participants to impart small habits of natural resource conservation in their day to day like. He also appreciated the efforts of SCSI in soil and water conservation. The programme ended with vote of thanks by Dr.H.C. Hombe Gowda. Totally 50 participants including members of TNSCSI, professors from Ooty Arts college and college students participated in the programme.

Bamboo Drip Irrigation: Coupling Tradition and Innovation for Wider Applicability

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Meghalaya is well-known for having the highest rainfall in the world of about 11500 mm recorded annually. This makes Meghalaya the wettest places on earth. Though, the state gets plenty of rainfall during the monsoon season, a well-managed irrigation system is required during the dry spell. Hill farming is subject to a number of serious constraints such as undulating topography, steep-slops, poor and shallow soils (prone to erosion). Majority of the fields in the region are situated across the hilly slopes. Therefore, the water-retention capacity of the terrain is poor and bringing water from distant water sources to the fields is a big challenge for the farmers in the rural areas. Ground channeling is also impractical due to the harsh landscape. Confronted with such adverse conditions for irrigation, the traditional farmers of Meghalaya have come up with an innovative way. The farmers of the Jaintia and Khasi hills have developed unique bamboo drip irrigation system of trapping springs and stream water normally to irrigate the betel leaf or black pepper crops planted in areca nut orchards or in mixed orchards.

Traditional bamboo drip irrigation system

The traditional bamboo drip irrigation system is based on gravity and the steep slopes facilitate in implementing it. Water from an uphill source is trapped and brought to the plantation by a main bamboo channel. Usually these water sources are far off from the plantations and the main bamboo channel runs hundreds of meters - in some cases even few kilometers. The water is then regulated through a complex bamboo network of secondary and tertiary channels to all the parts and corners of a plantation, right up to the bottom of the hill.

Bamboos of varying diameters are used to build the channels, support structures, diversion pipes and strips. Channels are held above the ground by bamboo or wooden *Y* shaped sticks. About a third of the outer casing in length and internodes of bamboo pieces have to be removed while fabricating the system. One stretch of channel is lashed

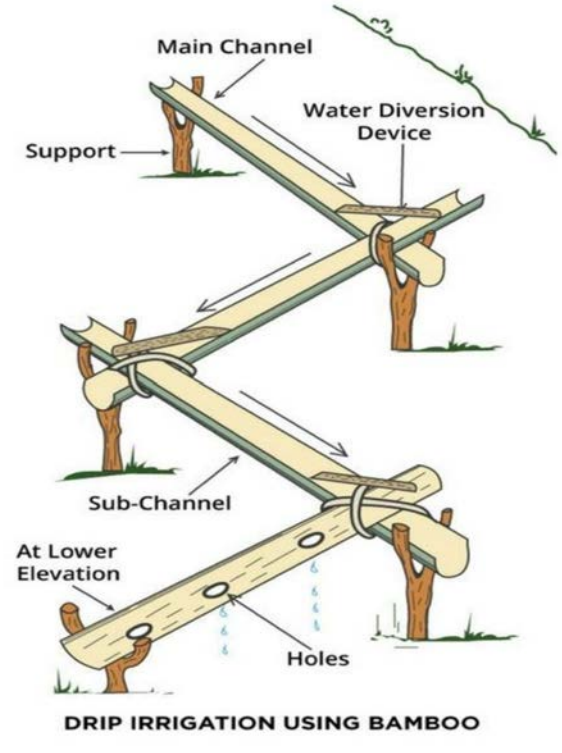
(Traditional bamboo drip irrigation system)

to another by thin bamboo strips. Indigenous tools like a *dao*, a type of local axe, and chisels of various shapes and design are used to build the bamboo network. Two laborers can construct a network covering 1 hectare of land in 15 days. They are built with such skill that water wastage by leakage is minimal. The construction is based on a simple thumb rule that the ratio of diameter of primary channel to tertiary channel determines the quantity of water which will reach the trees. It is a subtle skill which comes with years of observation and experience. It is so perfected that about 18-20 litres of water entering the bamboo pipe system per minute gets transported over several hundred metres and finally gets reduced to 20-80 drops per minute at the site of the plant.

The cost involved in building the system is minimal. Bamboo is available freely in this region. Usually the farmer himself sets up the system in his plantation with some help from 1 or 2 labourers. The region gets heavy rain and as a result each installation lasts for about 2-3 years. After the rainy season the undergrowth is cleared and reinforcements are provided. Old bamboo is left to rot, which over time returns to the soil as humus. Cooperatives are formed and each farmer provides his skill and labour to build and maintain the system. The distribution of water from one plantation to another is done by diverting water at fixed timings. This avoids the occurrence of conflicts between various farmers. By this method the whole community works harmoniously - sharing the limited resources judiciously.

Innovation in bamboo drip irrigation system

The bamboo drip irrigation system has been further refined and modified to increase water use efficiency and to irrigate filed crops apart from plantation crops. Since the region faces lot of water scarcity during dry period due to hilly terrain and steep slope, and as most of the crops are cultivated in upland condition, water harvesting tanks (*Jalkunds*) at the top of the hills can be the solution of this problem. During wet period, water can be collected by making small ponds or tanks and can be saved for dry spell. Since water in bamboo drip irrigation is actually conveyed from higher elevation to the downstream with the help of gravity up to plantation crops, water harvesting tank should also be constructed at the top of the hills or above the cultivated crops so that water can be easily conveyed through bamboo with the help of gravity.



(Different stages of water distribution in traditional bamboo drip irrigation system)

(Modified bamboo drip irrigation system)

Bamboos are laid down from the water source which is the mainline and from there lateral line bamboos are connected. Bamboos are laid just above the properly spaced crop plants with the hole so that water can just drip on the particular plant only. The height of bamboo placed above the plant should be enough for the farmers to move under for inter-culture operations like manual weeding. Both the end of the mainline should be closed. Holes are made in the mainline through that water is conveyed to the laterals. The laterals also consist of small holes just above the individual plant to drip water. For efficient utilization of water, tying of some woolen thread with the cap in the holes of the laterals is also recommended to manage the speed of drip or to irrigate only the desired particular crop area. If the wetting is completed, it can be pulled down for seizing the flow of water for its efficient utilization. In the mainline, holes can be either closed with the help of mud or thread just like in the laterals for seizing the flow with respect to particular plant. It leads to better utilization of rainwater which would have been washed out if not harvested during rainy season. It has also been observed that about 25-30% water can be saved by modified bamboo drip irrigation followed by straw mulching, although it is cost effective only for cash crops like potato, capsicum, tomato, strawberry, etc. which are grown with definite spacing.

The uniqueness of bamboo drip irrigation system and modified bamboo drip irrigation system is their suitability to the local conditions, their economic feasibility and easy implementation.

Meghalaya Chapter Celebrated Mountain Day

Meghalaya Chapter of the Soil Conservation Society of India celebrated International Mountain Day on 11th December, 2021 at School of Natural Resource Management, College of Post Graduate Studies in Agricultural Science, Central Agricultural University, Barapani with the aim to encourage the young scholars towards sustainable development in mountains.

Dr. Sanjay Swami, Professor (Soils) & Chairman of the SCSI-Meghalaya Chapter while addressing the students highlighted that mountains cover more than 25 percent of the earth's land surface and are home to over 1 billion people. Mountains are important source of water, energy and biological diversity. As a major ecosystem representing the complex and interrelated ecology of our planet, mountain environments are essential to the survival of the global ecosystem. Mountain ecosystems are, however, rapidly changing. They are susceptible to accelerated soil erosion, landslides and rapid loss of habitat and genetic diversity. On the human side, there is widespread poverty among mountain inhabitants and loss of indigenous knowledge. As a result, most global mountain areas are experiencing environmental degradation. Hence, the proper management of mountain resources and socio-economic development of the people deserves immediate action.

He added that to most of us, mountain regions offer landscapes of spectacular scenic beauty—but what we don't see are the lives and struggles of the people who live in the hill and mountains, many of whom are poor and marginalized. Going by the global average, one in eight persons is food insecure, but in rural hill and mountain areas this ratio is one out in two. This means that around 300 million mountain people are food insecure, with half of them suffering from chronic hunger. To address all these issues, the UN declared 2002 as the UN International Year of Mountains and the first international mountain day was celebrated for the first time in the following year, 2003. He appraised the house that the theme of this year's international mountain day is *Sustainable Mountain Tourism* as it can contribute towards creating additional and alternative livelihood options and promoting poverty alleviation, social inclusion, as well as landscape and biodiversity conservation. It is a way to preserve the natural, cultural and spiritual heritage, to promote local crafts and high value products, and celebrate many traditional practices such as local festivals.

Dr. Swami also shared the various activities taken up by the Meghalaya Chapter, particularly the 2nd Asian Web Conference on *Managing Hill Resources and Diversities for Zero Hunger and Climate Resilience* organized during 12-13 February, 2021 wherein eminent mountain experts shared their views and chalked out a road map for sustainable mountain development in Asia. He added that this day gives us an opportunity to spread awareness about protecting the mountain biodiversity as these delicate ecosystems are under tremendous pressure from climate change, overexploitation, and pollution.

Many members of Meghalaya Chapter also participated in this event. The programme ended with vote of thanks proposed by N.J. Singh, Assistant Professor (Soils) & Secretary, Meghalaya Chapter of SCSI.

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