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Sugarcane: a resource conserving crop

The dominant rice-wheat cropping system coupled with indiscriminate use of irrigation water, fertilizers and plant protection chemicals to increase the crop productivity level has led to various kinds of physical and chemical degradation of soil in the Indo-Gangetic plains. As a result, multiple nutrient deficiencies including micronutrients have emerged and are adversely affecting human and animal health. In addition, depletion of soil organic carbon content is causing soil health problems. This irrigated rice-wheat system has ousted legume from this region affecting natural balancing act of nutrient reorientation in soil layers. Gradually, a declining trend was observed in response to applied fertilizers. In this emerging scenario of Indo-Gangetic plains, sugarcane appears to be an intermediate crop which can be gainfully utilized to tide over this situation.

Sugarcane, a champion terrestrial plant is a unique crop in many aspects. It is the most efficient solar energy harvester and uses C_4 pathway (instead of common C_3) wherein CO_2 released due to respiration is also reutilized. It is unique in the sense that it also harbours symbiotic fungus root association (mycorrhiza) and thus increases its phosphorus crunching and water uptake ability from soil. Similarly, it harbours endophytic nitrogen fixing bacteria (*Gluconacetobacter diazotrohicus*) and receives an additional supply of nitrogen. Taking large quantity of sodium, it helps in amelioration of soil. It produces a large amount of root biomass with long roots penetrating in deeper soil layers and derives nutrition far beyond the root zones of grain cereals. In the processing scenario, it is also self-sustained in terms of energy requirement which is adequately met up from bagasse. Molasses is used for the production of biofuel-ethanol. The press mud (filter cake) contains the minerals and is used for manuring the fields. In commerce, it is also unique as only C, H, O are traded, no minerals leave beyond the factory premises and thus, gradual loss of soil nutrients does not takes place (if appropriate steps are taken to return the factory wastes to the fields from where supply of sugarcane to the factory originated). Sugarcane, though a luxury crop exercises tremendous influence in the politics of nations and today it is increasingly being recognised as an energy producing crop of the future to substitute fossil fuel.

In the Indo-Gangetic plains, applications of organic matters in soil have gone down drastically resulting in stagnation/ decline of crop productivity. The granary of India is now at cross road. In the green revolution period, rice – wheat has become dominant crop in this region. Share of sugarcane though has increased steadily but in comparison to rice/wheat, the increase is marginal. This extensive cultivation of rice-wheat has very little room for other crops including a crop of green manure. Farmers are reluctant to leave the field fallow or to grow a crop of green manure to restore soil fertility, as it is adversely affecting the farm income. The incorporation of organic matter to agricultural fields have got further setback due to increasing tracterisation of farm practices. Mechanisation reduced the use of animal power and farmers indirectly got discouraged to keep farm animals. This in turn reduced the output of dung which always remained a major source of organic manures for the farm. The phasing out of legumes, less availability of dung and farmers' reluctance to grow a sole crop of green manure have gradually affected the soil organic carbon status. Under such scenario, bio-agents like *Trichoderma* (trash decomposition and quick recycling of nutrients), *Mycorrhiza* (to increase P availability) and biological N fixers like blue green algae, *Azotobacter*, *Azospirillum*, *Gluconacetobacter*, etc. should be pressed in service to increase and sustain the productivity level.

Generally, sugarcane is regarded as a soil nutrient exhaustive crop. However, comparative analysis of different prevailing cropping systems in the Indo-Gangetic plain has indicated that sugarcane is acting like a life support system for the sustenance of soil health and crop productivity. It is rejuvenating soil like legumes. An analysis of wheat yield of districts where rice-wheat and sugarcane is dominant cropping system has indicated that wherever sugarcane area is 20% or more, yield of wheat has stabilised or increased over time in comparison to the districts with less than 20% sugarcane. In this region sugarcane occupies around 2 million ha whereas rice-wheat has about 10 million ha. There is enough scope to increase area under sugarcane. Sugarcane area may be increased in those districts where cane area falls short of 20% level. Contrary to the tagging of sugarcane as soil exhaustive crop, more and more information is forthcoming to dispel this myth and it is appearing as the most suitable soil health sustainable crop in the irrigated rice-wheat ecosystem of Indo-Gangetic plains. Increasing area under sugarcane will not only help in sustaining soil productivity and arresting environmental degradation but also will help in reducing the fuel import bill of India.

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Zonal Breeders Meet of North West and North Central Zones

Sugarcane breeders meet of these Zones was held at the Department of Plant Breeding, Punjab Agricultural University, Ludhiana on 29 January, 2009. While inaugurating the meeting, Dr. M. S. Kang, Vice Chancellor, PAU, Ludhiana remarked that CoJ 64 released in seventies brought the sweet revolution in the country and gave an impetus in developing early maturing varieties. CoJ 64 transformed the status of Punjab from low sugar recovery to high recovery zone. Currently CoJ 85 and CoJ 88 are extensively cultivated in this state and have gone across the international border. He also mentioned that researchers of this University are working for micro propagation of newly released varieties, somaclonal variation and transformation with *Bt* genes in sugarcane. Dr. O. K. Sinha, Project Coordinator briefed about the function of AICRP (Sugarcane) system and explained the importance of this meeting in finalizing test clones in IVT for directly promoting to AVT and thus, saving one year in varietal evaluation. Dr. Malhi, Director of Extension, PAU, Ludhiana emphasized the importance of developing new technologies to reduce the cost of cultivation and to sustain the sugarcane and sugar production of Punjab state. During technical session, Sugarcane breeders deliberated different aspects of varietal evaluation. For zonal varietal trials, AVT entries were shortlisted and technical programme for three zones were finalized.

RAC Meeting

Under the Chairmanship of Dr. H. K. Jain, Ex-Director, IARI, New Delhi, the XV meeting of the Research Advisory Committee of IISR was held on 2 May, 2009. Dr. B. L. Jalali, Dr. D.G. Hapse, Dr. D. N. Yadav, Dr. N. Balasundaram, Dr. T. C. Thakur, Dr. R. L. Yadav, Dr. D. V. Yadav and Sri Anil Choudhary were present in the meeting. The RAC members discussed the on-going research projects of this institute and appreciated the efforts of the scientists.

Brainstorming discussion on sugarcane and sugar productivity

A brainstorming discussion to identify the reasons for reduction in cane area, cane yield and sugar recovery in country during last year was held at IISR, Lucknow on 24 March, 2009. The discussion was chaired by Dr. S. P. Tiwari, DDG (Crop Science), ICAR, New Delhi. In this discussion, Dr. K. C. Jain, ADG (CC), ICAR, Dr. R. L. Yadav, Director, IISR, Heads of Divisions, representatives from Sugar Mills, cane development personnel and sugarcane researchers participated. In the discussion, it was felt that rate of increase in sugarcane productivity does not commensurate with the rate of increase in production cost (1971-72 to 2005-06) in six important sugarcane growing states of the country i.e. Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Tamil Nadu and Uttar Pradesh. Similarly, the considerable increase in irrigation and labour cost resulted into gradual reduction in income from sugarcane cultivation. The information related to a climate based (active) model developed for estimation of sugarcane productivity in Uttar Pradesh was also presented.

Interactive Meeting

An interactive meeting under the Chairmanship of Director, IISR on "Physiological efficiency and its improvement in sugarcane" was held on 18 May, 2009 in Plant Physiology and Biochemistry Division. Scientists of IISR, CIMAP and CISH participated in the discussion. Dr. Amaresh Chandra, Head, PP&B Division welcomed the participants and introduced the objective of the interactive meeting. Members emphasized the role of enzymes and precise regulation and better understanding of source and sink in relation to sugar as a signal molecule have to be studied in detail. It also emerged that hormones, which if manipulated will help in increasing dry matter and sugarcane productivity. The role of environment and genotype to maximize sugarcane production was also emphasized. The participating scientists also expressed their views addressed to enhance physiological efficiency in sugarcane.

Summer School

Summer School on "Quality Seed Cane in Sugarcane" was organized from 10-30 June, 2009 at IISR, Lucknow and it was inaugurated by Dr. Basant Ram, Vice Chancellor, NDUA&T, Kumarganj, Faizabad. The valedictory session was presided over by Dr. R. L. Yadav, Director, IISR. He stressed upon the importance of quality seed cane in improving cane and sugar productivity. The Summer School was attended by 11 participants; 1 from Andhra Pradesh, 2 from Tamil Nadu, 1 from Haryana and 7 from Uttar Pradesh. Of these, 6 were from SAU's, 2 from KVKs and 3 from ICAR Institutes.

MoU between IISR and Reuters India Pvt. Ltd.

The Institute has entered into a Memorandum of Understanding (MoU) with Reuters India Pvt. Ltd. on July 21, 2009 to provide information in respect of sugarcane cultivation in U. P. on package of practices, queries solution, sugarcane related IMD forecasts along with news and advisory on diseases and insect-pests, meetings/farmers' fair information etc. to the Reuters India Pvt. Ltd.

FPARP: More yield and income with less water

Under Farmers' Participatory Action Research Project (FPARP), 35 demonstrations on water saving technologies in sugarcane cultivation i.e. Skip Furrow method of irrigation, Ring-Pit method of planting, Irrigation at Critical Growth Stages of sugarcane and Trash mulching were conducted during crop season 2008-09 at farmers' fields in Sitapur and Barabanki Districts of U.P. In all the demonstrated plots, sugarcane yield was 30-40% higher than the conventional farmers' practice of irrigation. These technologies saved irrigation water to the tune of 16-38% with additional monetary benefit to the participating farmers (Rs.14000 to Rs.22000/ha).

Training for Sugarcane Development Personnel

One-month training was organized on "Sugarcane Management and Development" for cane development personnel of sugar mills from 1-31 July, 2009. A total of 22 cane managers/officers from U.P., Bihar, Madhya Pradesh and Uttarakhand participated. In the interactive session with the trainees, Dr. R. L. Yadav, Director, IISR stressed upon the importance of this training in accelerating large-scale adoption of modern technologies of sugarcane cultivation in sugar mill zones. He emphasized that trained cane officers will serve as "torch-bearers" in their respective mill zones to spread the technologies with expected dividends of high sugarcane and sugar productivity.

Training for Sugarcane Farmers

A six days farmers' training on *"Ganne Ki Unnat Krishi Taknik"* from 16-21 March, 2009 was organized at IISR, Lucknow in which 20 farmers from Bihar participated. This training was sponsored by ATMA, Samastipur, Bihar. A total of 18 interactive sessions were organized in different aspects of sugarcane farming. Lucid and informative presentations by the experts in areas of specialization followed by visits to demonstration plots, labs, engineering workshop and jaggery unit helped the farmers in learning different aspects of sugarcane cultivation.

Krishi Vigyan Kendra

The KVK, IISR, Lucknow imparted trainings to farmers, farm families, women and rural youth in diverse areas of agriculture, animal husbandry and home management. A total of 554 participants were trained in diverse areas, such as organic fertilizer, mentha cultivation, water management, soil reclamation, plant protection measures, rearing of dairy animals, preparation of different milk products, 'murabba' and pickles etc., under 24 on- and off-campus trainings. Apart from these, 8 trainings were also organized under Kisan Vidyalaya Scheme sponsored by Department of Agriculture, Lucknow. In all, 560 farmers in 19 groups from different states under ATMA scheme visited IISR. These farmers got *"seeing is believing"* experience of the various sugarcane production and protection technologies including different implements developed for sugarcane cultivation, the process of *jaggery* making and vermi-composting. A total of 72 FLDs were laid out on sweet sorghum, *arhar, til*, mentha and sugarbeet. Animal fertility camp was organized on 27 Feb., 2009 at Bachan Khera village in Gosaiganj block of district Lucknow; medicines and mineral mixture were administered to 255 animals on advice of veterinary officers.

ICAR Inter- Institutional (North Zone) Sports Meet

ICAR Inter- Institutional North Zone Staff Sports Meet was organized at IISR, Lucknow from 6-9 July, 2009. The sports meet was inaugurated by Mr. Ashwin Kumar Srivastav, Divisional Manager (Operation-NR), at Northern Railway Stadium, Charbagh, Lucknow. The Inaugural tune played by *Prisoners' Band of Adarsh Karagar, Lucknow* made the opening spectacular and memorable. Dr. R. L. Yadav, Director, IISR welcomed the participants and wished a memorable and happy stay in the city of Nawab. On this occasion, a *Souvenir* on sports meet highlighting the tournament schedule and tourist places in Lucknow was also released. Er. M. P. Sharma, Principal Scientist (Agrl. Engg.), IISR, Lucknow was the Chairman of the Games Organizing Committee.

In this sports meet, 763 sports persons from 23 ICAR Institutes located at Lucknow, Kanpur, Barelli, Varanasi, Mathura, Meerut (Uttar Pradesh), Almora, Nainital, Dehradun (Uttarakhand), Karnal, Hisar (Haryana), Ludhiana (Punjab), Shimla, Solan (Himachal Pradesh) and Srinagar (Jammu & Kashmir) participated. In the meet, 20 categories of *Track & Field* events (comprising of running, jumping and over throws), 10 categories of *Indoor Games* (badminton, table tennis, carrom and chess) and 4 categories of *Outdoor Games* (football, kabaddi, volleyball smashing & shooting) were played. NDRI, Karnal bagged the Champion Trophy of this sports meet. The closing ceremony was held on 9 July, 2009 and Dr. R. L. Yadav, Director, IISR, Lucknow distributed the shield and medals to winning teams and players.

Awards/Honour

Dr. S. I. Anwar, Dr. R. D. Singh and Dr. A. K. Singh have been elected as fellow of Institution of Engineers (India).

Dr. A. Chandra has been admitted as member of National Academy of Science, India (NASI) in the year 2009.

Dr. M. R. Singh and Dr. G. M. Tripathi have been elected Life fellow of the Entomological Society of India.

Dr. A.K. Sah received best poster presentation award in the 5th National Extension Education Congress organized by Society of Extension Education, Agra.

Dr. S. N. Singh, Sr. Scientist has been nominated as editorial board member in journals *Current Advances in Agril. Sciences*, Kanpur; *Bhartiya Krishi Anusandhan Patrika,* Karnal; and *Annals of plant and soil Research,* Agra.

Externally funded Project

The Department of Biotechnology, Govt. of India granted a Research Project on "Development of SSR markers for red rot resistance from ESTs database of sugarcane" to IISR, Lucknow with a budget of Rs. 38.22 lakh.

Under ICAR sponsored Outreach programme on "Diagnosis and management of leaf spot diseases of field and horticultural crops", IISR has recieved a budget of Rs. 33.10 lakh.

The ICAR has granted a network project on "Impact, adoption and vulnerability of Indian agriculture due to Climate change- sugarcane programme" with a budget of Rs.28.30 lakh to IISR, Lucknow.

Career advancement

In this period, following persons got promotion in their respective service career.

Promoted to Principal Scientist

Dr. Jyotsnendra Singh	w.e.f. 15.10.2006
Dr. Sangeeta Srivastava	w.e.f. 05.12.2006
Dr. A. D. Pathak	w.e.f. 11.08.2007
Dr. Sudhir Kumar Shukla	w.e.f. 15.12.2007

Promoted to T-6

Shri Vinayak Sawant	w.e.f. 04.05.2006
Shri Jasbeer Singh	w.e.f. 01.07.2007

Promoted to T-5

Shri Avadhesh Kumar Yadav	w.e.f. 01.04.2007

Promoted to UDC

Shri Arjun	w.e.f. 12.03.2009
Shri Ramesh Prasad Verma	w.e.f. 08.04.2009
Shri Pankaj Kumar Arora	w.e.f. 01.07.2009

Promoted to Assistant

Shri Kuldeep Singh	w.e.f. 12.03.2009
Km Maya Agarwal	w.e.f. 08.04.2009

Superannuation

Shri Sharif Ahmed, T-5 retired on 31.01.2009.

Shri Sarjoo Prasad, SS Gd.IV retired on 31.01.2009.

Shri A. K. S. Chauhan, Assistant retired on 28.02.2009.

Shri Rajendra Sharma, Assistant retired on 31.03.2009.

Dr. D. C. Srivastava, Principal Scientist retired on 31.03.2009.

Shri P. C. Misra, UDC retired on 30.06.2009.

Shri L. K. Lama, T-5 retired on 30.06.2009.

Shri Maikoo Lal, SS Gd.II retired on 31.07.2009.

Transfer/Relieved/Selection

Dr. D. V. Yadav, Principal Scientist joined as HoD, Crop Production w.e.f. 23.01.2009.

Smt. Poonam Manish Mishra, LDC joined IISR on 7 March, 2009 on transfer from ICAR headquarters.

Dr. Satyanand Shushil, Sr. Scientist joined IISR on 20 March, 2009 on transfer from VPKAS, Almorha.

Dr. Amaresh Chandra joined IISR as Head, PP&B Division on 01 April, 2009.

Shri Sant Ram, T-2 joined IISR on 1 April, 2009 on transfer from IARI, Regional Station, Indore.

Dr. P. K. Singh, Sr. Scientist was relieved on 12 May, 2009 to join PPV & FR authority, New Delhi as Registrar.

Dr. Archna Suman, Principal Scientist was relieved on 31 July, 2009 to join IARI, New Delhi.

Human resource development

Dr. Sanjeev Kumar, Dr. D. C. Rajak and Smt. Anita Sawnani attended Summer School on "Quality seed cane in sugarcane" from 10-30 June, 2009 at IISR, Lucknow.

Shri Prashant Kamal Srivastava, UDC participated in training on "Handling of CAT cases" at ISTM, New Delhi from 29-31 July, 2009.

Shri K. P. Yadav, AAO participated in training on "Handling of CAT cases" at ISTM, New Delhi from 26-28 August, 2009.

Participation in Seminars/symposia/meetings

Dr. S. N. Singh, attended meeting on "Calibration of WOFOST model under SAC-IISR collaborative project" from 5-9 Jan., 2009 at Ahmedabad.

Dr. Jaswant Singh and Dr. R. D. Singh, attended 43rd Annual Convention and Symposium of ISAE held from 15-17 Feb., 2009 at Birsa Agril. University, Ranchi.

Dr. G. M. Tripathi participated in expert meeting on "White grub problem in sugarcane" from 26-28 Feb., 2009 at Modinagar, Ghaziabad.

Dr. R. P. Verma, Dr. A. K. Sah, Shri K. Prasad, Er. R. Gupta, and Dr. K. P. Singh attended Workshop on "Surface Water Resource Development & Management" on 17 March, 2009, at Lucknow.

Dr. A. K. Singh (Agril. Engg.) attended National Seminar on "Energy and Environment- Problems and Prospects in 21st Century" held from 30-31 March, 2009 at CCS University, Meerut.

Dr. Amaresh Chandra, Head, PP&B Division attended seminar on "Management of Change" held on 18 April, 2009 at Bio -Tech Park, Lucknow.

Dr. P. K. Bajpai attended workshop on "Designs of Experiments" on 29 April, 2009 at IASRI, New Delhi.

Dr. M. Swapna, received specialized training on "Molecular marker technology for crop improvement" from 18-29 May, 2009 at ICRISAT, Hyderabad.

Necrology

Shri Ram Asrey, SS Gd.III expired on 08.02.2009.

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