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Contents

Director's Column

Sugarcane Sector

Institute's/ Divisional News

- Summer School
- RAC meeting
- QRT meeting
- IISR Foundation Day
- Agro-Retailers' Meet
- A New beginning

Transfer of Technology

- KVK Round-up
- Kisan mela
- Training organized
- Visits organized
- Exhibition
- Demonstrations

Human Resource Development

Participation in Seminar/Symposia/Workshops

Personalia

Director's Column

Recent innovative agro-technologies for enhancing sugarcane yield in Sub-tropical India

There are two distinct productivity zones for sugarcane cultivation in India, sub-tropical North and tropical South. While the climatic condition of tropical South zone favours excellent sugarcane growth, the harsh climate of sub-tropical North zone restricts sugarcane growth. Further, due to predominance of rice-wheat cropping system in sub-tropical north zone sugarcane, planting is done after wheat harvest which further reduces growing period of sugarcane. In the new millennium, Indian Institute of Sugarcane Research started addressing these problems through innovative research projects. The research results have culminated into development of following agro-technologies:

1. CoLk 94184 - a new high sugar early maturing sugarcane variety

CoLk 94184 (Birendra) is an early maturing variety developed for the subtropical agro-climates, particularly the North Central Zone which is prone to waterlogging. CoLk 94184 was bred from the selfed progeny of CoLk 8001, another high sugar mid-late maturing variety. The variety has a potential of 75-80 t cane/ha and 18% pol in juice. It has an excellent ratooning potential, a rare feature for an early maturing variety. It combines tolerance to waterlogging and drought, both. It also possesses moderate resistance to red rot and smut. The variety is gradually becoming popular amongst cane growers in the East Uttar Pradesh and Bihar.



2. Cane node technology for sustaining high population shoot density and yield of sugarcane

To get maximum possible yield of sugarcane, about 1.8 to 2.0 lakh millable cane per ha, each of two kg weight are required. However, at present only 1,00,000 ± 20,000 millable cane per ha, each having 0.6 to 1.0 kg weight are obtained under varying conditions of growth and cultivation. Therefore, a great scope exists to improve cane productivity by only increasing number of millable canes per unit area. Efforts have been made for increasing shoot population density by sett transplanting (STP) but because of the extra costs involved in transplanting and requirement of the additional irrigation for settling establishment, the technology has not been taken up by farmers for large scale cultivation.



The Institute has now developed a primed cane node technology for sustaining high shoot density. In this technology, a cane node, having a bud along with root band after priming in organic slurry is kept under decomposed farmyard manure having 60% moisture for 4-5 days. During this period, the buds get sprouted. The sprouted buds are then planted in the field. The technology has the potential to break the yield barriers by raising the cane yield levels by two times.

3. Bio-fertilizers for reducing cost on chemical fertilizers

An efficient strain of a N₂-fixing endophyte, *Gluconacetobacter diazotrophicus* was isolated from sugarcane roots and developed into a bio-fertilizer. When the bio-fertilizer was applied to sugarcane crop along with farmyard manure at the time of planting, it provided a saving of about 30 kg N/ha through chemical fertilizers. Similarly, the use of *Trichoderma* inoculated farmyard manure economized about 45 kg N/ha through chemical fertilizers and increased the yield by 6.1 t/ha.

4. *Trichoderma* for improving soil health, cane yield and red rot management

Trichoderma, a common inhabitant of sugarcane rhizosphere, was used to promote sugarcane growth and soil organic carbon content. Farmyard manure enriched with *Trichoderma* when applied to sugarcane crop increased water holding capacity of soil and maintained optimum moisture of root zone for a relatively longer period. Inoculation of FYM with *Trichoderma* released the nutrients in slow manner thereby enriching soil fertility during sugarcane growing period. Significant plant growth promoting potential, retention of more soil organic carbon-nitrogen and nutrients in the plant-soil system through use of *Gluconacetobacter diazotrophicus* and *Trichoderma viride* reduce the need for fertilizer N, P and K.

The Institute has also developed an integrated red rot management schedule using healthy seed cane and application of *Trichoderma* through enrichment of pressmud. Potent antagonistic strains of *Trichoderma harzianum*, *T. viride* and *Gluconacetobacter diazotrophicus* were identified against *C. falcatum*. Field application of *T. harzianum* protects red rot infection to the tune of 50 per cent.

5. Ratoon Management Device (RMD) for enhancing ratoon cane yield

The Institute has developed a tractor mounted two row ratoon management device (RMD) to carry out stubble shaving, deep tilling, off-barring, earthing up and dispensing of fertilizer & liquid chemical in one pass of the tractor. The stubbles are cut above ground surface by a sharp edged concave spinning disc. The earthing unit provides soil cover over the stubbles in form of a ridge. This device place FYM and fertilizers simultaneously, adjacent to cane rows and dispense liquid chemicals in the soil gravitationally. An acre of ratoon field can be covered in about 1-1.5 hours as against 6 hours, if done manually.



6. On-farm water management – Farmers' participatory research

The annual water requirement of sugarcane in sub-tropical climates ranges between 1400 and 2000 mm. Farmers of sub-tropical India irrigate sugarcane crop unscientifically, therefore, irrigation efficiency at farmers' fields seldom exceed 35-45%.

Several water saving agro-techniques have been developed at IISR. Four such technologies *i.e.*, irrigation at critical growth stages, skip-furrow method of irrigation, trash mulching and ring pit planting method were validated on farmers' fields in the Central Uttar Pradesh with farmers' participation.

The Ring pit planting method and skip-furrow method of irrigation produced significantly greater yield compared to farmers' practice and improved irrigation efficiency of the crop. Ring-pit planting method improved irrigation water use efficiency by 142.6% while skip-furrow method of irrigation by 68.9% over that of farmers' practices.

7. Decision support software for precision farming

Institute has developed a decision support system for disorder diagnosis in sugarcane crop. It is a web based solution to diagnose occurrence of major insects-pests/diseases of sugarcane crop using a combination of textual and visual symptoms. Initially, system asks users to register crop status of sugarcane field for which diagnosis has to be made. After successful recording of sugarcane field status, the system provides textual and visual symptoms under various categories. User may select one or more symptoms in each category depending upon his problem appearing in the field crop. Inference engine of the software uses the selected crop status and disorder symptoms to diagnose the disorder. After diagnosis of disorder, it also provides information about control of these disorders as well as details about the disorders *viz.* biology, economic importance, etc. The software has also been updated for its accessibility through mobile phones.

8. Agro-techniques for alternative sugar crop: Sugarbeet

Agro-techniques for sugarbeet under tropical and subtropical growing conditions were developed. Complete agronomy of sugarbeet has been worked out and machines designed and developed to carry out planting and digging operations.

Sugarcane Sector

AICRP Zonal Breeders Meet

Zonal Breeders Meet of the Peninsular and East Coast Zones was organized at Sri Venkateswara Agriculture College, Tirupati on January 21, 2011. Inaugural session was chaired by Dr N. Vijayan Nair, Director, SBI, Coimbatore and Dr. T. Yellamanda Reddy, Dean, ANGRAU, Hyderabad was the Chief Guest. Dr. N.V. Naidu, Associate Dean, S.V Agriculture College, Tirupati welcomed the participants. Dr. O.K. Sinha, Project Coordinator, AICRP(S) briefed about two main agenda of the meeting, *i.e.*, promoting IVT entries to AVT directly by skipping multiplication stage which results in one year saving of ZVT programme and finalizing the new set of zonal crosses for each zone. The Chairman remarked that the productivity of tropical region must be improved to 125 t/ha from the present 80-85 t/ha to meet the sugar demand of 2025. One of the major contributors for achieving this goal is the development of improved varieties. New challenges like climatic change and high cost of cultivation demands varieties with temperature tolerance, erect cane and adapted to wider row spacing. Wider row spacing in AICRP(S) trials is one of the changes required for developing varieties to meet such requirements.

The zonal meeting of sugarcane breeders of North West, North Central and North East Zones was held at IISR, Lucknow on February 26, 2011. The meeting was Chaired by Dr. N. Vijayan Nair, Director, SBI, Coimbatore and Co-chaired by Dr. O.K. Sinha, Project Coordinator (Sugarcane). Dr. O.K. Sinha welcomed the participants and briefed the objectives of the meeting *i.e.* to shortlist the IVT (early and mid-late) entries based on field performance, sucrose (%) and red rot rating to promote the short listed entries to AVT-I and to make changes in the list of zonal crosses, if required. To update the database of clones maintained in the NHG, the breeders were requested to provide the required information. The monitoring team members were requested to classify the clones exclusively into four categories as Excellent, Good, Average and Poor. Later, the technical session was followed and technical programme for 2011-12 as well as zonal crosses was finalized.

National Consultation on Sugarbeet

The National Consultation on "Sugarbeet as a supplementary sugar crop in India" sponsored by the Directorate of Sugarcane Development, Government of India was organized at IISR, Lucknow on June 01, 2011. The meeting was attended by researchers, development workers, and representatives from seed industries, processing industries and officers from government of India and UP government. The inaugural session was Chaired by Shri. Shivajirao Deshmukh, IAS(Rtd) & Director General, Vasantdada Sugar Institute, Pune. The inaugural address was delivered by the Chief Guest Dr. Gurbachan Singh, Agricultural Commissioner, Government of India, New Delhi. The Guest of Honour, Dr. A.N. Mukhopadhyay, Ex.VC, AAU Jorhat highlighted the importance of this crop in India. Dr. R.B. Deshmukh, Director, VSI, Pune gave brief account of sugarbeet research and development activities in Maharashtra. Shri R.P. Bhagria, Chief Director (Sugar), Directorate of Sugar, Ministry of Consumer Affairs, highlighted activities of government of India in promotion of sugar industries and sugarcane. The chairman stressed the need of a sustainable policy for sugarbeet in XII five year plan, identification of areas for sugarbeet growing and implementation of programmes.



Ethiopian Delegates Explored Future Collaboration with IISR

An Ethiopian delegates comprising Ato Abay Tsehay, DG of a rank of Union Cabinet Minister, Ato Deroje Gutema, DDG, Factory Projects and Operations, Ato Shimelis Kebede, DDG, Corporate Planning and Monitoring, Ato Ambachew Darnie, DDG, Research & Training and Ato Zewdu Nigate, Director, Factory Projects visited IISR on March 31, 2011. They have shown their interest to collaborate with IISR for strengthening research, training and technology transfer activities in Ethiopia by learning the IISR way of training and information dissemination. They expressed the desire for future collaboration with IISR particularly in exchange of germplasm and water management in sugarcane. The IISR model of training to enrich human resource skills in sugarcane development impressed the visiting delegates and wanted to replicate these models in Ethiopia to strengthen sugarcane development work.



Institute/Divisional News

Summer School

ICAR sponsored summer school on "Adaptive production technologies for sugarbeet under Indian conditions" was organized at IISR from June 01 to 21, 2011. Twenty two participants belonging to eleven disciplines of agriculture from three states attended the summer school. Experts from IISR and various other institutions including multinational seed companies delivered lectures on diverse aspects of sugarbeet cultivation & processing. Dr. Muzzaffar Adiyaman from Turkey delivered a lecture on "International experiences". A trip to Sugarbeet Breeding Outpost, Mukteswar was also organized for orientation of participants to sugarbeet breeding and seed production.

RAC Meeting

The XVII meeting of RAC was held on June 16-17, 2011 under the Chairmanship of Dr. S. Nagarajan, Ex. Director, IARI, New Delhi & Former Chairperson, PPV & FRA Authority, Govt. of India. The members of RAC, Dr. Bhushan L. Jalali, Dr. Bachchan Singh, Dr. J.P. Mishra, Dr. V.P. Singh, Dr. R.L. Yadav and Dr. A.K. Sharma, were present in the meeting. Besides, the Heads of Divisions/Incharges of Sections and other senior members of IRC of the Institute also participated in the meeting. Dr. R.L. Yadav, Director, IISR, Lucknow welcomed the Chairman, members of RAC & other participants and apprised them with the research highlights of the Institute during the year 2010-2011.



The Chairman remarked that to achieve global competitiveness in sugarcane germplasm collection the efforts should be directed to make available best material anywhere in the world to the premier Sugarcane Research Institutes of India (SBI & IISR). He also emphasized the need for more collaborative work between SBI and IISR to complement each other in order to address national problems and new challenges.

QRT Meeting

QRT Meeting of IISR and AICRP (S) for the period 2005-2009 was held at the Institute on February 26, 2011. The Chairman, Dr. N.N. Singh, Vice-Chancellor, Birsa Agricultural University, Ranchi presented recommendations of QRT to the Institute Management Committee (IMC). After detail deliberations by members of IMC, the final Draft of QRT report was prepared and sent to ICAR on March 26, 2011 for its approval.

IISR Foundation Day

IISR celebrated 59th foundation day on February 16, 2011. Dr. A. N. Mukhopadhyay, Ex. VC, AAU, Jorhat was the Chief Guest at the occasion and he delivered Foundation Day lecture on "Trichoderma and sugarcane disease management". Dr. G. B. Singh Ex. DG, UPCAR & Ex. DDG, ICAR chaired the session. Dr. G. C. Tiwari, VC, CSA Univ. of Agricultural & Technology, Kanpur also addressed the scientists, farmers and entrepreneurs. Dr. R. L. Yadav, Director highlighted the accomplishments of IISR in sugarcane research and mentioned few of them viz., healthy seed production technique, development of MHAT, improved sugarcane varieties, planting methods, INM, ID&PM, sugarcane machines, jaggery making technique etc., the adoption of these technologies by the cane growers enhanced their income from cane cultivation and also helped sugar industry to grow. Three Ex-Directors of IISR, DR. G. B. Singh, Dr. V. P. Agnihotri and Dr. S. R. Misra were honoured by Chief Guest.



Agro-Retailers' Meet

Fertilizer Association of India (FAI) and IISR jointly organized Agro-retailers' Meet on "Balanced and Efficient Fertilizer Use" on June 30, 2011 at IISR, Lucknow. Sri Satish Chander, DG, FAI was the chief guest at the occasion and presided over the meeting. In this interaction meeting more than 100 fertilizer dealers, retailers, UP Agriculture department officials, Scientists and progressive farmers participated.

A new beginning

With the initiative of Dr. T.K. Srivastava, Head, Crop Production Division all the Scientists of division unanimously agreed to have an informal interaction once in every month under the umbrella 'Scientific Discourse' at divisional level with Dr. A.K. Sah, Sr. Scientist as Member-Secretary. This was conceived in true spirit of 'Buzz-session' to be conducted on voluntarily proposed topic relating to any sphere of life.

The first meet of 'Scientific Discourse' was held on May 20, 2011 on 'Sugarbeet'. Discourse tantalizes the participating scientists and technicals to discuss in detail on retrospection and perspectives of sugarbeet cultivation in India. The second meeting on "Industrial effluent and waste water irrigation: prospects and problems" was held on June 24, 2011. The discourse on this particular topic resulted in suggesting the

strategy to mitigate the expected problems like salinity, toxicity hazards and human health hazards due to recycling of industrial effluent and waste water for irrigation and other purposes.

Transfer of Technology

KVK Round-up

Seventeen groups comprising a total of 312 farmers from different states visited KVK, IISR, under schemes sponsored by ATMA, NHM, and NFSM etc. Visiting farmers were provided with latest know-how in sugarcane, horticulture, animal husbandry and general agriculture. They were enlightened in improved techniques of jaggery and khandsari processing, vermi-composting and sugarcane machines through live demonstrations.

KVK, IISR organized 20 trainings sponsored by State Horticulture Mission, Govt. of U.P. from March 23 to April 11, 2011. In these trainings 500 farmers from eight blocks of Lucknow district participated. As many as 63 FLDs on hybrid sweet sorghum, hybrid paddy and kitchen gardening were laid out on farmers' fields. In addition, 1000 milch animals were vaccinated against protection of HS and FMD diseases. A total of 12 on & off campus vocational trainings in which 260 farmers, farm women & rural youth were trained in seed production, vegetable production, paddy cultivation with SRI, soil testing, animal rearing, clothing & value added products of Amla.

Kisan Mela Organized at IISR

A Kisan Mela was organised on February 16, 2011 at IISR, Lucknow. About 1000 farmers from Uttar Pradesh and other states participated in this mela and 5 farmers were honoured for their achievements in agricultural production. An "Agri-Exhibition" was organized in which 20 different agricultural research organizations, agricultural implement manufacturers, Krishi Vigyan Kendras (KVKs), State development departments, agricultural input supply agencies and nationalized banks showcased their technologies/products/services through professionally managed exhibition stalls for the benefit of the visiting farmers. The demonstrations of sugarcane cultivation machines were organized to motivate visiting farmers to adopt these machines. In a 'Question-answer' session organized at the occasion, farmers got acquainted with practical and workable solutions of different problems/constraints faced in cultivation of sugarcane and other crops.



Training Organized

Five days Farmers' Training on "Ganne Ki Unnat Krishi Taknik" sponsored by Jan Kalyan Sansthan, Haridwar, Uttarakhand was organized from January 18-22, 2011. In this training 23 farmers from Haridwar district of Uttarakhand participated. Knowledge in various aspects of sugarcane cultivation like improved varieties, planting methods, nutrient management, water management, integrated diseases and pests management, weed management, mechanization of sugarcane cultivation, jaggery making etc. were provided through theoretical and practical sessions. Farmers' training on "Uttam gur utpadan hetu kisanon ka prashikshan" under Central Sector Scheme of AICRP on PHT was organized from January 03-09, 2011.



Visits Organized

Under ToT programme of the Institute about 300 progressive farmers from Bihar, U.P., Maharashtra, Gujarat and Rajasthan visited IISR. About 154 graduate and post graduate level students from different universities/institution of India visited IISR laboratories under their academic programme. More than 100 officials comprising cane inspectors of cane development department of U.P. from different districts, scientists, university teachers and cane managers of sugar mills visited the Institute and interacted with scientists for latest trend in sugarcane research and innovative technologies of sugarcane cultivation.

Exhibition

Exhibitions of sugarcane production technology were organized in Xth Agricultural Science Congress, February 10-12, 2011 at NBFGR,

Lucknow; in *Kisan Mela* organized at the occasion of IISR Foundation Day on February 16, 2011 at the institute premise; and in Agri-Expo on February 27, 2011 at Dashehri Village (Kakori) in Lucknow district. The major objective of exhibitions was to showcase the remunerative sugarcane production technologies through meaningful display of exhibits and sugarcane machines.



Demonstrations Conducted

Under FPARP 25 demonstrations on water saving sugarcane production technologies were conducted at farmers' fields in command areas of Biswan (Sitapur), Raузagaon and Hydergarh (Barabanki) sugar mills of U.P. Considerable saving of irrigation water (25-35%) and increase in cane yield (up to 80%) attracted the farmers of demonstrated villages and neighboring villages to adopt the water saving sugarcane technologies.

A total of 46 numbers of demonstrations on Ratoon Management Device (RMD) and Raised bed seeder cum planter were conducted at farmers' fields covering total area of 25 hectares in Biswan and Ramgarh Sugar Mill Zone of Sitapur district in U.P.

Human Resource Development

Success Story

Sri Rajesh Kumar, a farmer from Sidhawaliya, Gopalganj (Bihar) increased the cane cultivation income from Rs. 50,000 to Rs. 1,50,000 per hectare by adopting Ring-pit method of cane planting. Sri Rajesh learned the technique of Ring-pit method during a training at IISR. While returning to his native place, he has grown sugarcane with this technique at his field and harvested 175-200 t/ha cane in comparison to 50-60 t/ha with prevalent method. In recognition of his achievement one of Birla group sugar mills operating locally gifted him a Disc harrow along with a letter of appreciation. Sri Rajesh is also growing intercrops (wheat & lentil) on raised beds with the help of RBS machine as demonstrated by IISR, thus reaping maximum benefits from sugarcane cultivation. The additional income he receives from cane cultivation invest in other enterprises like dairying, fisheries etc. In this way he is gradually making himself more prosperous and serving as harbinger of sugarcane technologies in local farming community.

Award/Honour

Dr. R.L. Yadav was awarded for best research article in Hindi and honoured with certificate given by Shri Pradeep Aditya Jain, Minister of State for Rural Development, Govt. of India in a National Seminar organized by *Bharatiya Krishi Anusandhan Samiti*, Karnal held at Jhansi from January 21-23, 2011.

Dr. A.C. Srivastava Principal Scientist was elected as Fellow of Indian Society of Agricultural Engineers (ISAE) during ISAE Convention and Symposium held at Dr. P.D. Deshmukh Krishi Vidyapeeth, Akola during January 17-19, 2011.

Dr S.I. Anwar, Senior Scientist was conferred Distinguished Services Certificate (2008-09) during ISAE Convention and Symposium held at Dr P.D. Deshmukh Krishi Vidyapeeth, Akola during January 17-19, 2011. Distinguished Services Certificate (2009-10) was announced for Dr. R.D. Singh, Senior Scientist at the same occasion.

Dr. Jaswant Singh acted as Advisor to ASRB Screening Committee for the posts of HODs and Principal Scientists on March 23-24, 2011.

Dr. S. N. Sushil was elected Fellow of "Society for Bio-control Environment" by National Bureau of Agriculturally Important Insects, Bangalore on May 25, 2011.

Participation in ICAR inter-institutional sports meet

A total of 63 contingents took part in ICAR inter-institutional sports meet (North Zone) held at CSWCRTI, Dehradun during April 18-21, 2011. IISR took part in almost all the events of the tournament and bring laurels to the institute by securing winning positions in many events.

Participation in Seminar/Symposia/Workshops/Meeting

Dr. A.K. Sharma, Pr. Scientist attended workshop on "Result-Framework-Document: An effective tool for the improvement of the performance of Govt. work" at Vigyan Bhawan, New Delhi on February 22, 2011. and at NASC Complex, New Delhi from March 12-15, 2011.

Dr. Om Prakash, Mr. Brahm Prakash, Mrs. Neelam Singh and Mrs. Mithilesh Tiwari attendd 13th National Agricultural Science Seminar organized by *Bharatiya Krishi Anusandhan Samiti*, Karnal at NRC on Agroforestry, Jhansi from January 21-23, 2011.

Dr. Jaswant Singh attended the Institute Management Committee meeting of CIPHET, Ludhiana as its member on March 25, 2011.

Drs. R. L. Yadav, T. K. Srivasatava, A. Chandra, S. K. Duttamajumder, A. K. Sharma, A. K. Singh and K. P. Singh participated in National Seminar on "Fly ash based amendments for amelioration of degraded soils to increase crop production in the gangetic plains" organized by National Institute of Ecology & CSSRI Regional Research Station, Lucknow held at Lucknow on May 7-8, 2011.

Dr. T. K. Srivasatava participated as an Expert in RAC meeting of UPCSR, Shahjahanpur, U.P. on February 2-3, 2011. He also attended Seminars on "Role of IPR in business perspectives" organized by UP Council of Science and Technology, Govt. of UP at Lucknow on May 23, 2011 and on "Forest Biodiversity: Earth's living treasure" organized by U.P. State Biodiversity Board at Lucknow on May 22, 2011.

Drs. Raman Kapoor, S.K. Duttamajumder, A. Chandra and T. K. Srivastava attended Heads of Divisions meeting organized by ICAR at CIAE, Bhopal from June 14-15, 2011.

Dr. A.K. Sah attended regional workshop on "Agri. Services for Inclusive rural growth" jointly organized by USAID and IFPRI at Hotel Clarks Avadh, Lucknow on June 21, 2011. He also attended Agro-retailers' Meet on Balanced and efficient fertilizers use" jointly organized by IISR & FAI at IISR, Lucknow on June 30, 2011.

Personalia

New arrivals

Shri Ratnesh Kumar, Sr. Administrative Officer joined on 31.01.2011.

Shri Arun Kumar Srivastava, Finance & Accounts Officer joined on 10.03.2011.

Dr. Vinika Singh, SMS (Home Science) joined on 18.04.2011 on transfer from KVK, Chnyalisaur (Uttar Kashi) under VPKAS, Almora.

Shri A.M. Srivastava, Assistant joined on 28.04.2011 who was on deputation at CISH, Lucknow.

Dr. P.K. Singh. Sr. Scientist (Plant Breeding) joined on 12.05.2011, who was on deputation as Registrar, Protection of Plant Varieties and Farmers' Right Authority, New Delhi.

Dr. Chandra Gupta, Sr. Scientist (Agronomy) joined on 13.06.2011 on transfer from SBI, Coimbatore.

Superannuation

Shri Ram Nath, SSS retired on 31.01.2011.

Shri Shrawan Kumar, SSS retired on 28.02.2011.

Dr. Vijai Singh, Principal Scientist retired on 31.03.2011.

Shri N.M. Wadekar, T-3 retired on 31.03.2011.

Dr. Om Prakash, Principal Scientist retired on 31.05.2011.

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