Volume 17 No. 2 April-June 2011

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch

ICAR

ICAR NEWS

A SCIENCE AND TECHNOLOGY NEWSLETTER

RESEARCH UPDATE

PROMISING TECHNOLOGIES

Trends in crop phenology in Indo-Gangetic Plains

To study climatic, ecological and socio-economic drivers for changes in the Indo-Gangetic Plains (IGP) for sustainable policy planning, it is essential to derive spatial patterns of temporal trends in phenology and productivity at the disaggregated level. A methodology was developed using every ten-day satellite data of the NDVI (Normalized Difference Vegetation Index) separately for *kharif* and *rabi* to derive spatial patterns of trends in crop phenology and growth in the IGP in the past 24 years (1982-2006).

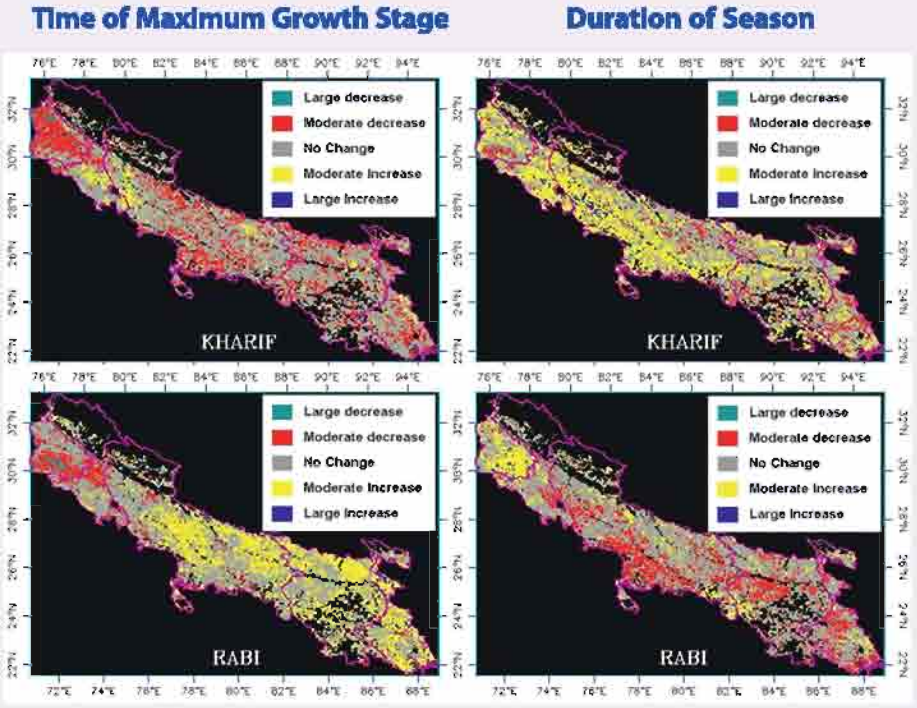
Crop productivity showed significant increasing trends in about 68% and 53% of the net-sown area (NSA) in *kharif* and *rabi*, respectively; 31% in *kharif* and 45% in *rabi* did not show any discernible trends.

During *kharif*, maximum vegetative growth stage of crops is early across most of Punjab, north Haryana, parts of central and eastern Uttar Pradesh and some parts of Bihar and West Bengal. Only central parts of Haryana showed delay in growth. During *rabi*, no visible trends in time of peak growth stage are observed in most of the Punjab and Haryana, excepting south Punjab and north Haryana, where earliness is seen. Most parts of central and eastern Uttar Pradesh, North Bihar and West Bengal are showing delay in the occurrence of maximum vegetative stage. Overall, across the IGP, 26% of the NSA is showing early occurrence of peak growth stage during *kharif* and 30% is showing delay in occurrence during *rabi*. On an average for the IGP, the peak growth stage is 16 days early during *kharif* and is 19 days delayed during *rabi*.

The trends in time of start of the *kharif* season show starting of the season early across Punjab, Haryana and Uttar Pradesh;

Indian Council of Agricultural Research
Krishi Bhavan, New Delhi 110 114, India
www.icar.org.in

and in some areas of east Bihar and West Bengal, it is delayed. During *rabi*, the time of the start of the season is being delayed across most of Uttar Pradesh, Bihar and West Bengal, but is early in south Punjab and north Haryana. Across the IGP, 26% of the NSA is showing early beginning of *kharif* and 6% shows delayed. For *rabi* season, in 10% of the NSA start of the season is early and is delayed in 27%.



Maps showing trends in time of maximum growth stage and duration of seasons

The duration of *kharif* is showing increasing trends across Punjab, Haryana, wesetrn Uttar Pradesh, central Uttar Pradesh and south Bihar, whereas in some parts of south Punjab, north Bihar and West Bengal, a decrease in duration is also observed. During *rabi* season, excepting Punjab and some pockets of Haryana, wheat dominating system is showing a significant decreasing trend in crop duration. During *kharif*, 9% of the NSA is showing decreasing trend in duration and 32% is showing increasing trend; during *rabi*, 21% of the NSA is showing decreasing trend and 11% is showing increasing trend.

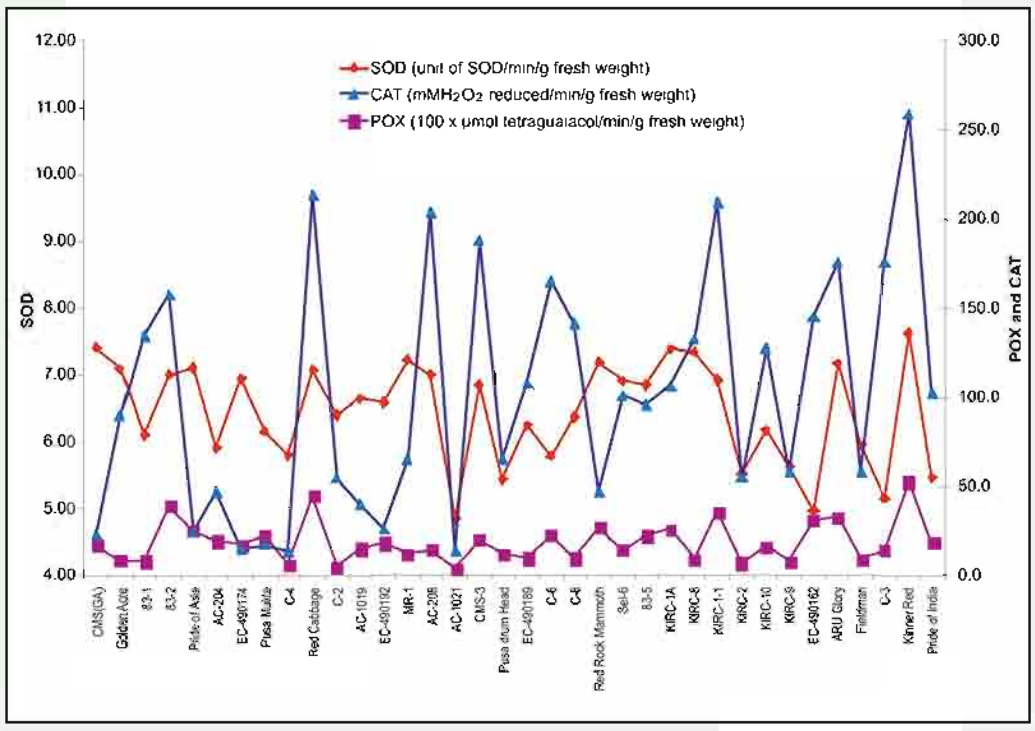
This study proves usefulness of multi-temporal satellite dataset for deriving spatial patterns in trends of crop phenology metrics. Such spatial and temporal patterns are important source to study impact of natural causes and anthropogenic interventions on the agro-ecosystem in a long-run. Further, long-term changes in climatic parameters can be related to spatial and temporal patterns of the crop phenology to quantify impact of climate change and variability on agro-ecosystem at the regional scales.

Vinay Sehgal
Division of Agricultural Physics
Indian Agricultural Research Institute, New Delhi 110 012
e-mail: sehgal@iari.res.in

Stress tolerance in cabbage

Production of deleterious reactive oxygen species (ROSs) such as singlet oxygen ($^1O_2$), superoxide radical ($\bullet O^-_2$), hydrogen peroxide (H_2O_2), hydroxyl ion (OH^-) and free hdroxyl radical ($\bullet OH$) is one of the reasons for poor productivity and lack of quality harvest under stressful conditions in cabbage. Plants possess well-developed defense systems against deleterious ROSs by limiting their formation and by triggering for their removal. If ROSs are not neutralized, they damage cells, causing susceptibility to biotic and abiotic stresses, yellowing and senescence. Pre-mature senescence leads to loss of vigour, productivity and quality of produce.

Antioxidant enzymes — superoxide dismutase (SOD), peroxidase (POX) and catalase (CAT) — have been touted as beneficial for mitigating effects of oxidative stresses induced by ROSs. SOD, localized in cytosol, chloroplast, mitochondria and peroxisomes, accelerates dismutation of $\bullet O^-_2$ to H_2O_2. POX, an iron heme protein, catalyses H_2O_2 reduction with a concurrent oxidation of a substrate, mostly located in the cell wall, and is involved in the oxidation of phenol compounds towards lignin synthesis. CAT also catalyses H_2O_2 reduction to water and molecular oxygen, and is localized in mitochondria and peroxisomes, and is absent in chloroplast.

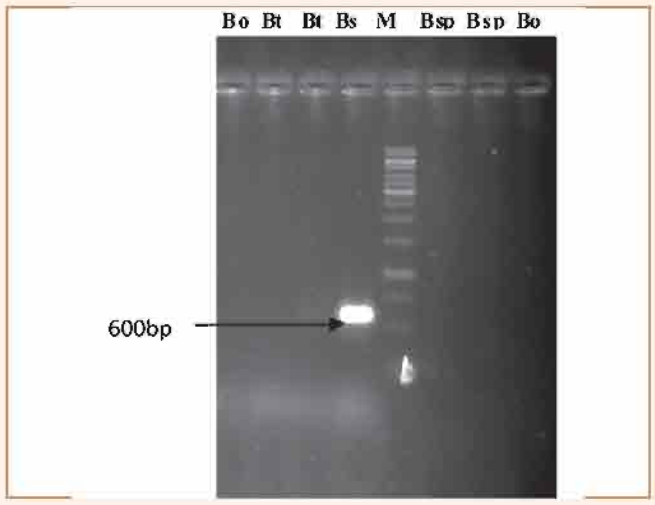


This study determined variability for enzymes SOD, POX and CAT activities, and their inheritance was studied in the cabbage samples harvested at the fresh marketable stage, frozen immediately in liquid nitrogen and placed at –80°C for assay. Enzymatic antioxidant activities showed 1.6, 12.8, and 18.2-fold difference for SOD, POX and CAT.

Red Cabbage, 83-2, , KIRC1-1, ARU Glory, Kinner Red, MR 1, AC 208, Red Rock Mammoth, KIRC 8 and KIRC1A showed higher activity of antioxidant enzymes. All enzymatic antioxidants expressed high heritability along with low genetic advance, as percentage of means indicated predominance of non-additive genes, and this provides good prospects for hybridization and hybrid breeding. The results indicate that breeding of antioxidant potential cultivars will enhance stress tolerance ability of cabbage and will result in healthy plant stand, and thus eventually mitigate climate change effects in cabbage cultivation.

B.K. Singh*, S.R. Sharma[1], Chandra Prakash[1], R.N. Barwal[1] and M.R. Dhiman[1]
[1]Regional Station IARI, Katrain (Himachal Pradesh)
*ICAR-RC-NEH Region, Mizoram Centre, Kolasib (Mizoram) 796 081
e-mail: bksinghkushinagar@yahoo.co.in

Diagnosis of spot blotch in wheat



PCR-based amplification of *Bipolaris* spp. using BSF1 and BSR2 (M: 1 Kb ladder; Bo: *B. oryzae;* Bt: *B. tetramera;* Bs: *B.sorokiniana;* Bsp: *B. specifera*)

Bipolaris sorokiniana causing spot blotch in wheat is an emerging disease in the changing climate. Efforts have been made to develop a specific-and-sensitive polymerase chain reaction assay for detection of this pathogen. A 650 bp amplicon identified through URP- 1F- PCR was cloned and sequenced. Out of the five primer pairs designed, primer pair BSF1 (5'GGTCCGAGACAACCAACAA3') and BSR2 (5'AAAGAAAGCGGTCGACGTAA3') specifically amplified sequence of 600bp only in *B. sorokiniana* isolates.

Rashmi Aggarwal
Division of Plant Pathology
IARI, New Delhi110 012
e-mail: rasshmi.aggarwal2@gmail.com

AgriDaksh
for building online expert systems

AgriDaksh has modules on Knowledge Model Creation, Knowledge Acquisition, Problem Identification, Knowledge Retrieval, Ask Questions to Experts and Administration. This enables domain experts to build online expert systems in their crops with minimal intervention of knowledge engineers and programmers. With its use, it is possible to build online expert systems for each and every crop in lesser time and resources.

Online expert systems have the capability to transfer location-specific technology and advice to farmers efficiently and effectively. Maize AgriDaksh is the first system that provides ICT-based advisories on maize-crop and allows interaction with experts using internet. Maize AgriDaksh is available online at http://expert.iasri.res.in/agridaskh.

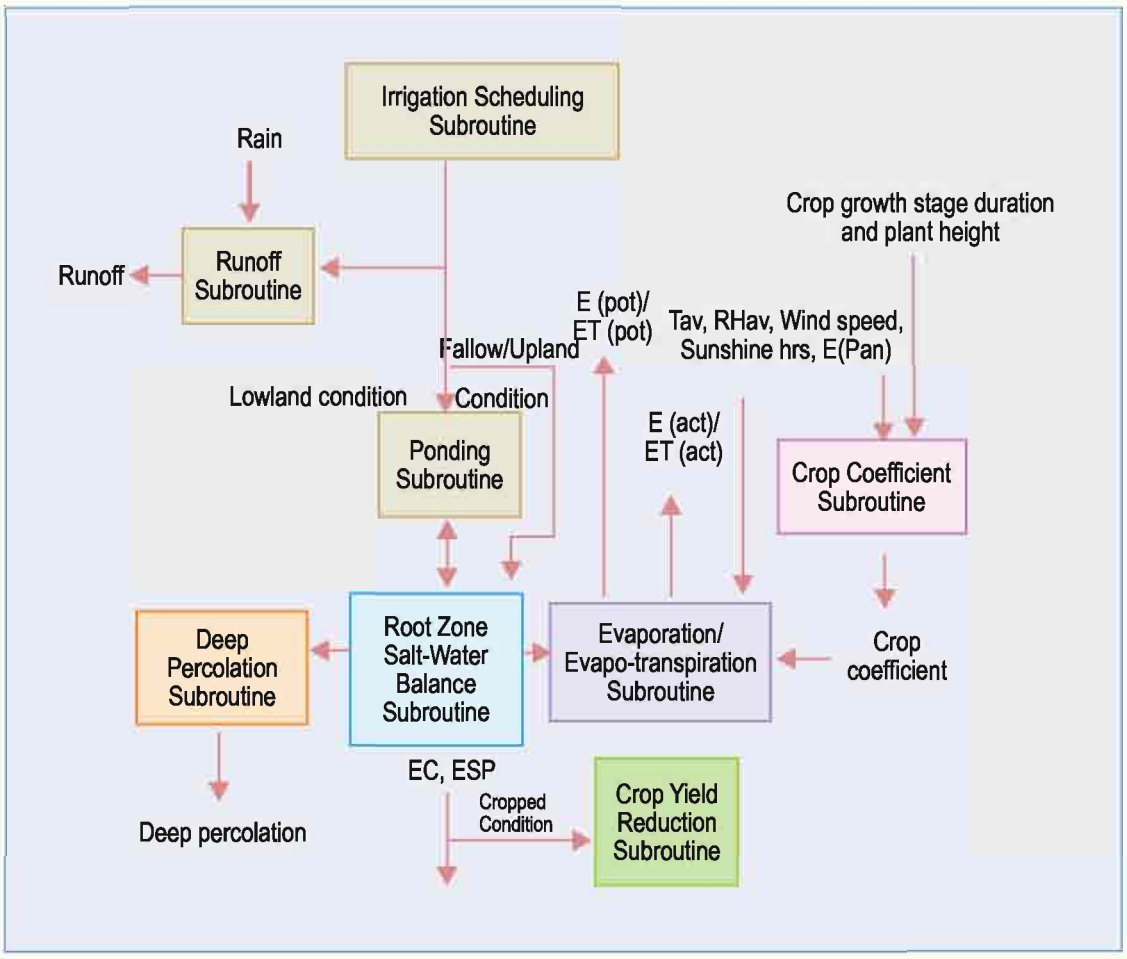
Another Expert System on Seed Spices(EXPSS) provides expert advice to farmers on variety selection, field preparation, fertilizer application, irrigation schedule, plant protection from pests/diseases/nematodes. EXPSS is available online at http://iasri.res.in/expss.

V.K. Bhatia
Indian Agricultural Statistics Research Institute
Library Avenue, Pusa, New Delhi 110 012
e-mail: vkbhatia@iasri.res.in

USAR© – for managing salt-affected lands and irrigation waters

Framing uniform guidelines for sustainable land- / water- use are seldom feasible. USAR© is a user-friendly field-scale Decision Support System (DSS); developed indigenously for managing environmental and agricultural productivity related situations created by saline or sodic soils and irrigation waters.

This Decision Support System is relatively simple in operation, and can be promoted to be used by field technicians and project planners. It can assess short- and long- term impacts for a range of (geo) hydrologic conditions, water-management options (including conjunctive use of saline and non-saline waters for irrigation) and crop rotation schedules on both root zone soil salinity/ sodicity build-ups and crop yield reductions. By selecting an appropriate time criterion, it can even generate crop-specific irrigation schedules and can plan length of long-



Schematic USAR©

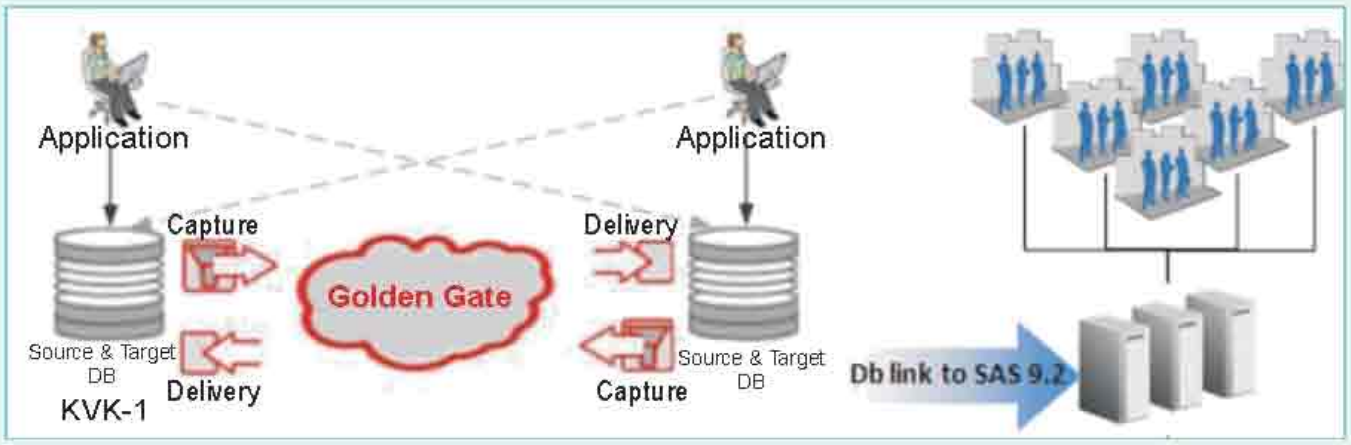
term field experiments. The generated technology/ know-how has been extensively validated on several controlled experimental and farmers' fields, and will be of immense value for environmental impact assessment/ resource management planning.

Ravinder Kaur
Indian Agricultural Research Institute
New Delhi 110 012
e-mail: rk132.iari@gmail.com

Automation of distributed databases for National Initiative on Climate Resilient Agriculture

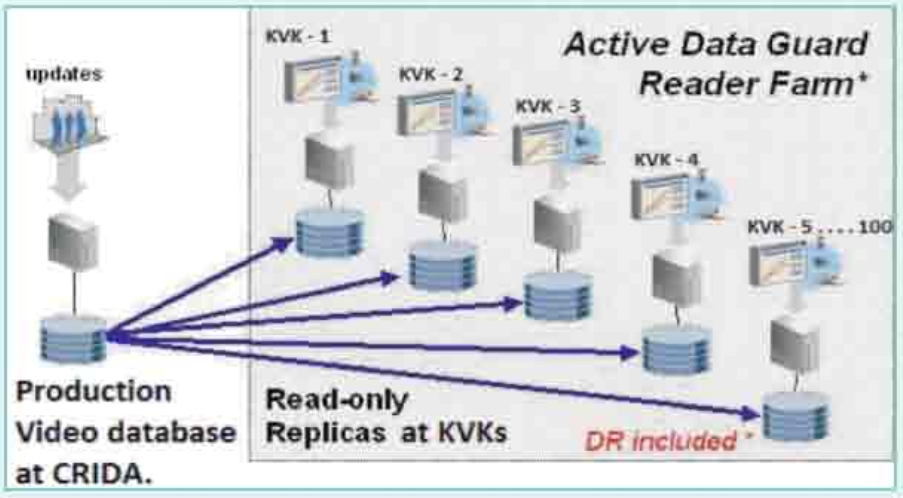
To ensure that the distributive databases are up-to-date and current, there are two processes: replication and duplication. Both processes can keep data current in all distributive locations. Most commonly used databases are DB2, MySQL, Oracle, MS-Access, Ingres, Firebird, MS SQL Server, Teradata, Sybase, Informix and postgresql. Use of a single or a combination of databases depends on the requirement.

A distributed database is a database under the control of the central database management system (DBMS) in which storage devices, not attached to a common CPU, are dispersed over a network of computers, interconnected through internet.



Applying Replication @ NICRA

Automation is essential in data collection, especially where data need to be collected from a large number of collection centres across the geographical regions. The data were sent from centres to the concerned institutes in Excel sheets by e-mail in different formats. Many a times excel sheets used to carry viruses detrimental to main system. These problems can be removed by automating entire data-flow from entry to data analysis for ensuring error-free data in a required format and also enabled with proper back-ups.



For implementation of this distributed architecture, a PC each is needed in all 100 KVKs with MySQL Database server installed (Community edition comes for free) and a High-end clustered server at the CRIDA with a Oracle Database server. The data generated at agro-meteorological station will be fed into MySQL, which will get replicated into Oracle database with the help of tools like golden gate.

Applying Duplication @ NICRA

Technology demonstrations under the *National Initiative on Climate Resilient Agriculture* (NICRA) are to be conducted in 100 most vulnerable districts (through KVKs) on the best-bet practices of climate-resilient technologies. A SAT Streaming Server is also proposed in the line of YouTube.

In this, production video server would be installed at the CRIDA, and standby databases are to be installed at the respective KVKs. The video can be stored in Oracle database itself and associated language audio also can be stored in different columns of the same record. This architecture can be implemented by using Oracle 11g Active DataGuard technology to allow same copies of databases running across all KVKs. KVKs will have read only access to all videos and multimedia fed into the master database at the CRIDA. The advantage is to have a quick response as the videos are loaded in every PC of the KVK. One can add a new language audio to the existing video and the entire video need not be developed again. This can be developed in Hindi, English and other 10+ regional languages.

Going forward, as the number of videos increases [with various local language videos], we can go for Oracle Real Application Clusters. Once the proposed streaming system is in place, the videos can be viewed "n" number of times by millions of farmers in the country. This application can be used by farmers who have got 3G compatible mobiles.

V.V. SumanthKumar[1] and B.M.K. Raju [2]
[1]NRC Citrus, Nagpur (Maharashtra) 440 010
[2]CRIDA, Hyderabad (Andhra Pradesh) 500 059
e-mail: sumanth_vv@yahoo.com; bmkraju@yahoo.com

Biofuels in India: Future challenges

Biofuels are globally considered as the sustainable and eco-friendly source of energy to enhance national energy security and to decrease dependence on imported fossil fuels.

Bioethanol produced from sugarcane molasses and biodiesel produced from non-edible oilseed crops like jatropha and pongamia are being promoted for commercial use.

With the government planning to bring into effect 20% blending of petrol with bioethanol by 2017, it is important to anticipate ethanol demand, so that necessary measures may be undertaken to achieve targets.

As in the case of petrol, demand projections for diesel suggest that nearly 3.21 million tonnes of biodiesel would be required for 5 % blending by 2011-12.

Even though the food *versus* fuel debate is quite relevant at the global level, it is largely irrelevant to Indian biofuel production programme due to country's policy decision not to use any edible feed-stocks for energy production.

It has become apparent that bioethanol production solely based on sugarcane molasses is neither economically viable nor sustainable in a long-run. Similarly, jatropha-based biodiesel production programme is bogged down with several obstacles like slow progress of planting, sub-optimal processing and marketing infrastructure, under-developed distribution channel, etc. While favourable government policies, renewed participation of local community and private entrepreneurs can sustain the programme in the short-term, it is important to have a sound long-term strategy. Substantial research thrust on developing second and third generation feed-stocks is crucial to address future bio-energy needs of the country.

During the past one decade, Government of India has initiated several measures to augment production and use of biofuels. The *'National Policy on Biofuels'*, released in 2009, foresees biofuels as the potential mean to stimulate rural development and generate employment opportunities, and aspires to reap environmental and economic benefits arising out of their large- scale use. The Policy aims at mainstreaming biofuels by setting an indicative target of their blending up to 20 % with petrol and diesel in the transport sector by 2017. The programme will be carried out based solely on the non-food feed-stocks that are raised on the degraded or wastelands, not suitable for agriculture; thus avoiding a possible conflict between food security and fuel security.

Projected ethanol demand for various uses in India (million tonnes)

Year	Petrol demand	Fuel ethanol demand			Potable ethanol demand	Industrial and other uses ethanol demand	Total ethanol demand		
		5 %	10 %	20%			5%	10%	20%
2008-09	11.25	0.56	1.13	2.25	0.65	0.60	1.81	2.38	3.50
2011-12	14.37	0.72	1.44	2.87	0.71	0.65	2.08	2.80	4.23
2016-17	21.61	1.08	2.16	4.32	0.84	0.76	2.68	3.76	5.92
2020-21	29.94	1.50	2.99	5.99	0.96	0.85	3.31	4.80	7.80

Projections of biodiesel demand and corresponding jatropha area required for meeting blending targets (Area in million ha; Demand in million tonnes)

Year	Diesel demand	At 5 % blending		At 10 % blending		At 20% blending	
		Biodiesel demand	Jatropha area	Biodiesel demand	Jatropha area	Biodiesel demand	Jatropha area
2011-12	64.19	3.21	3.42	6.42	6.85	12.84	13.69
2016-17	92.15	4.61	4.91	9.21	9.83	18.43	19.66
2020-21	123.06	6.15	6.56	12.31	13.13	24.61	26.25

S.S. Raju, P. Shinoj and **Ramesh Chand**
National Centre for Agricultural Economics and Policy Research,
ICAR, New Delhi 110 012
e-mail: director@ncap.res.in

Improved groundnuts increased net returns in Netrenahalli watershed

In Netrenahalli watershed in Chitradurga district of Karnataka - Bellary, two groundnut varieties improved K 6 and improved TMV 2 were introduced during *kharif*.

Groundnut yields of farmers' cultivars vs improved cultivars

Particulars	Yield (kg /ha) Grains	Cost of cultivation (₹/ ha)	Returns (₹/ha) Gross	Net	B:C ratio
Farmer's variety (control)	403	11,268	13,290	2,023	1.17
Improved TMV2	545	12,273	17,962	5,689	1.45
Increase over control (%)	35%		35%	181%	24%
Farmer's variety (control)	471	12,056	15,239	3,183	1.24
Improved K 6	613	12,776	20,334	7,558	1.57
Increase over control (%)	30%		33%	137%	27%

Cultivation of improved cultivars increased grains yield of groundnut by 30% and 35% over farmers' varieties, respectively. And gross returns augmented by 35% and 33% over control. B:C ratio increased from 1.17 to 1.45 in TMV 2 with increase in net returns by 24%. Similarly, B:C ratio varied from 1.24 to 1.57 in K 6 with net returns increase by 27%.

V.N. Sharda
Central Soil and Water Conservation Research and Training Institute
Dehra Dun(Uttarakhand) 248 195
e-mail: vnsharda2@gmail.com

Stability indicators at Chandigarh for mass-erosion prone sites

Eleven mass erosion prone sites (Vertical cliffs), representing Lower, Middle and Upper Shivaliks, were identified for development of stability indicators.

On the basis of the estimated soil loss, visual observations and angle of cliff, sites were classified as fragile, unstable, stable and highly stable. Samples from 36 representing strata comprising these sites were analyzed for texture, bulk and particle density, organic carbon and moisture content, water- holding capacity, volume expansion and soil aggregation. Properties of cliff related to stability were number, angle and stability of strata composing it. Stability of strata was related to their cementation, clay content and mean weight diameter (MWD) of aggregates.

To work out a single value defining stability of vertical cliffs, indicators were taken at two levels – at the cliff level and at the strata level, and different weights and scores were assigned. Cumulative rating ranged between 0 and 1. The sites were classified as fragile, unstable, stable and highly stable for indicator values of <0.40, 0.40-0.60, 0.60-0.80 and 0.80-1.00, respectively. The results were in conformity with the observed data. Thus, a single value indicator from 6 easily determined properties could be used for prioritization of reclamation of erosion-prone sites.

Cliff stability indicators

Indicator level I (Properties of cliff)			Indicator level II (Properties of strata)		
Parameter	Weight	Score	Parameter	Weight	Score
No. of strata	0.20	0.20	Cementation	0.60	0.36
Angles of strata	0.20	0.20	Clay content	0.20	0.12
Stability of strata	0.60	-	Aggregate size (MWD)	0.20	0.20
Total	1.00				

V.N. Sharda
Central Soil and Water Conservation Research and Training Institute, Dehra Dun (Uttarakhand) 248 195
e-mail: vnsharda2@gmail.com

Kiwi cultivation *preferred* in the Central Himalayan Region of Uttarakhand

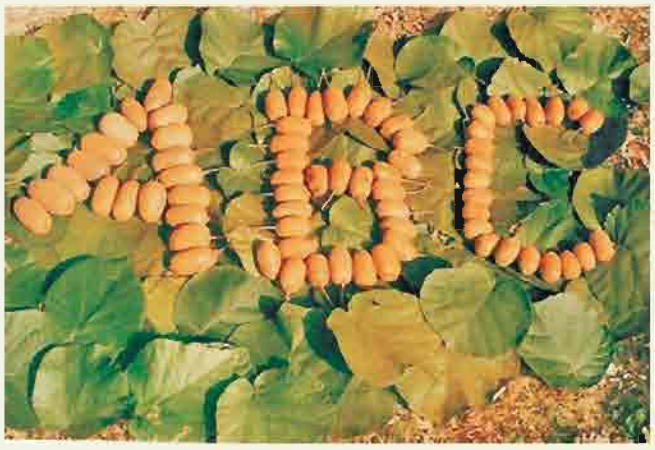
The Uttarakhand region is reeling under the impact of global warming, and high-chilling-requirement fruits like apple and a few of the apricot varieties (*Morpankh*), which were grown there, are shifting towards higher reaches of Himalayas. And Uttarakhand climate is found suitable at present for growing kiwi-fruits, off-season vegetables, and medicinal and aromatic plants (MAPs) as cash crops.

Farmers are taking keen interest to grow kiwi as compared to apples. Planting material demand of Hayward variety has increased due to large fruit size

Kiwi-fruits have a luxuriant growth, and they require very little or almost nil chemical sprays as compared to other temperate fruits. It is, therefore, a most appropriate crop for sustainable horticulture in hills.

Owing to highly nutritional value of kiwi (TSS: 11-16, vitamins: A, C, riboflavin, thiamine, niacin and minerals - Ca, Mg, P, K etc.), its demand in domestic and international market is increasing consistently.

Kiwi-fruits



Fruit grade system (A, B, C) of kiwi-fruits

(5.9-6.9-cm long; 4.5-5.0-cm dia.) as compared to Allison variety (6.5-7.0-cm long; 2.5-3.5-cm dia.)

Some of the fruit-growers in the region have started harvesting approximately 40-60 kg kiwi-fruits/plant, and are fetching attractive price ₹ 50-100 per kg in the local market.

It is gaining importance as a promising fruit during lean period of November to February among farmers of sub-temperate and temperate hills of Uttarakhand.

For the last nine years, a total of 10,043 grafted-plants of kiwi were distributed to 624 farmers of 274 villages in 16 blocks of seven districts of Uttarakhand. Five strains of female kiwi, Allison (6,976), Hayward (517), Abbott (129), Bruno (107), Monty (46) and one of male kiwi Tomouri (2,268) were distributed to farmers. The grafted plants of kiwi take three years to reach farmers' sites, and demand of kiwi-plant material is increasing year by year.

Presently, seven cultivars — Allison, Hayward, Monty, Bruna, Abbott (female) and Tomouri and Allison (male) are available for cultivation in the sub-temperate and temperate parts of the Central Himalayan Region of Uttarakhand.

K.S. Negi, R.R. Arya, S.K. Verma, A.K. Trivedi, K.C. Muneem and **P.S. Mehta**
National Bureau of Plant Genetic Resources, ICAR
Regional Station, Bhowali, Niglat
Nainital (Uttarakhand) 263 132
e-mail: officerinchargebhowali@yahoo.com

Directorate of *Knowledge Management* in Agriculture ICAR, New Delhi

The Directorate of Knowledge Management in Agriculture (DKMA), a constituent of the ICAR headquarters, New Delhi, is the communication arm of the ICAR, responsible for quick, effectual and cost-effective delivery of messages and sharing of knowledge among different stakeholders of the agriculture sector. Keeping pace with the current information diffusion and sharing trends, the Directorate is delivering and showcasing agricultural technologies, policies and other activities through print, electronic and web mode. The Directorate is the nodal centre for the management of the content, designing, maintenance and updating of the ICAR website along with the facilitation of network connectivity across the ICAR institutes and KVKs. The Directorate also provides public relations and publicity support to the National Agricultural Research System across the country. The DKMA is the major player and partner in executing one of the ICAR's mandates—*"to act as a clearing house of research and general information relating to agriculture, animal husbandry, home science and allied sciences, and fisheries through its publications and information system, and by instituting and promoting transfer-of-technology programmes"*.

GENESIS AND GROWTH

The publication and information programme of the ICAR is a deep-rooted one; with the publication of journals started since 1931. In the year 1955, the publication programme received an organized-and-professional structure with qualified editors and production personnel. To provide more thrust and impetus to the publication programme, the ICAR reorganized the erstwhile P&I Division as the Directorate of Information and Publications of Agriculture (DIPA) with a separate budget allocation and enhanced activities in consonance with the paradigm shifts in the National Agricultural Research System. Lately, realizing growing importance and potential of knowledge management in the agriculture sector, the DIPA has been rechristened as the Directorate of Knowledge Management in Agriculture. Consequently, the DKMA is marching ahead towards a new level of effectiveness, efficiency and scope of operation through a well-defined knowledge-management strategy.

MANDATE

- To act as a clearing house of information on agriculture and allied sciences;
- To publish research journals, semi-technical periodicals, newsletters, books, monographs, handbooks, technical bulletins, annual reports, research highlights and other materials;
- To produce information in the form of floppies, magnetic discs, microfiches, compact discs and other forms of electronic publishing;
- To produce audio-visual materials for dissemination and popularization of scientific knowledge relating to agriculture in the form of photographs, slides, audio-cassettes, video-cassettes and films;
- To organize refresher course training in agricultural communication technologies to update and improve agricultural information system of the ICAR;
- To collect, process, store, retrieve and disseminate information on agriculture and allied sciences using latest computer and digital technologies.

The DKMA is pursuing its mandated activities through professional expertise of Editorial (English &Hindi), Production, Business, Photography & Art and Public Relations & Media Units. Information and knowledge management support is provided by the Agricultural Research Information Centres and Agriculture Knowledge Management Centres. The DKMA also maintains scientific library resource at the Krishi Bhavan and Krishi Anusandhan Bhawan.

SALIENT ACTIVITIES

As its prime responsibility, the DKMA is striving to collate information and data from around the NARS to create information resources customized as per the needs of the different categories of the stakeholders. The Information Communication Technology platform is being effectively used for shaping, packaging and delivery of information to target groups.

The ICAR website (*www.icar.org.in*): This has been developed by using an open source content management system, called DRUPAL. The website is a unique platform for sharing and dissemination of

Milestones

1906: Predecessors of the ICAR journals — *Agricultural Journal of India* and *Memoirs of the Department of Agriculture in India*; Published by the Imperial Agricultural Research Institute

1931: Renamed *Agricultural Journal of India* as *Agriculture and Livestock in India;* Started *Indian Journal of Agricultural Science* and *Indian Journal of Veterinary Science and Animal Husbandry*

1940: *The Indian Journal of Veterinary Science and Animal Husbandry* renamed *as Indian Farming*

1948: *Kheti* magazine in Hindi started

1955: Publications and Information Division came into existence at the ICAR headquarters

1956: First book— *Rice in India*

1959: First monographs—*Zygnemaceae* and *Cyanophyta*

1961: First handbook—*Handbook of Agriculture*

1975: National input centre for the AGRIS database of the FAO

1996: Directorate of Information and Publications of Agriculture

1999: ICAR website

2000: First textbook— *Textbook of Dairy Chemistry*

2006: Integration of Public Relations and Media Units; and ARIS Cell

2009: First corporate film on the ICAR

2010: Research journals in free open-access mode

2011: Directorate of Knowledge Management in Agriculture

information to a wide range of users and stakeholders in agriculture sector. The **News** section is updated daily with inputs from different centres of the National Agricultural Research System. **Success Stories** of Indian farmers and entrepreneurs are presented weekly on the homepage to inspire and motivate farming community *vis-a-vis* to showcase potential of relevant technologies. The **Weather-based Agro-Advisory,** developed by the subject-matter experts, is being updated weekly for direct use of farmers. The website also provides links to international agricultural organizations and to the ICAR library and other libraries. A link on the site connects visitors to global agricultural news released from various international agencies. The website also supports some of the e-governance initiatives launched by the ICAR. More than 358,000 visits to the site from around 144 countries are recorded per month.

The ICAR research journals (*The Indian Journal of Agricultural Sciences* and *The Indian Journal of Animal Sciences*) are available in open-access mode and are being regularly visited and downloaded from a knowledge portal, developed and hosted by the DKMA. The online research journals provide user-friendly options like free registration for reviewers,

Screenshot of ICAR website

Screenshot of ICAR's research Journals online portal

authors, readers and also for submiting manuscripts for publishing. The publication and processing status of the research articles submitted can also be viewed at *http://epubs.icar.org.in*. A host of other useful publications including newsletters, reports, brochures, circulars, notifications etc. can also be viewed on the website. Hindi version of the website with regular updates is also available.

The website has proven its potential for sharing and delivering authentic contents at the national and global levels. A knowledge portal is also being developed to provide agricultural knowledge and information in a consolidated and user-friendly manner.

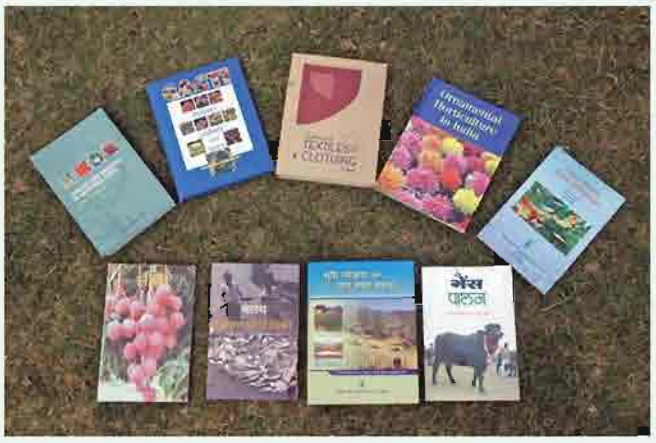
To promote and facilitate visibility of the ICAR among stakeholders, ICAR logo, video-spots, audio- jingles and punch-lines are available on the website as free downloads. Photo gallery of various events and occasions held across the ICAR system is also available as a media resource along with relevant newspaper clippings. The system to assign uniform e-mail Ids across the users of the ICAR system has been implemented as an initiative to enhance branding of the ICAR.

Networking: A centralized and secure state-of-art data centre is being established for providing e-mail and website hosting services for the ICAR system with 10,000 user nodes. A National Knowledge Network Project of Government of India has commissioned/provisioned links to 20 ICAR institutes/ SAUs, and rest of the institutes will be linked gradually to 100 mbps broadband. Video-conferencing and IP-telephony facility has been established at 23 selected ICAR institutes connected on the ICAR-ERNET network to facilitate real-time communication.

NAIP Projects at the Directorate

- **Mobilizing Mass Media Support for Sharing Agro-Information (Consortium Leader):**For strengthening agricultural communication in the country along with capacity-building
- **E-publishing Knowledge System in Agricultural Research (Leader):** For paradigm shift in research journal publishing
- **AGROWEB (Consortium Partner):** Digital dissemination system for Indian agricultural research
- **E-Granth (Consortium Partner)**: Strengthening of digital library and information management under the NARS

Information dissemination in print mode: The DKMA produces and disseminates a wide range of information products in-print mode to fulfill knowledge needs of students, scientists, extension-workers and farming community. With around 200 titles on the stacks, the Directorate is the leading publisher in the Asia of high-quality agricultural literature. Among periodicals, the research journals namely *The Indian Journal of Agricultural Sciences* and *The Indian Journal of Animal Sciences* are highly indexed journals; with subscribers and contributors even from foreign countries. Popular/ semi-technical periodicals are attractive in content-and-style, are demand-driven, and are competitive with a good subscriber base and rural penetration. These are effective tools of information dissemination as all stakeholders in agriculture sector, including farmers, share their views on the platform. Among newsletters, *Agbiotech Digest* in 13 Indian languages is the latest addition launched for creating general awareness on biotechnology issues across the country.



The *Textbook* series is popular among students and teachers due to explicit contents; based on syllabi of the agricultural universities. Currently, 19 titles are available, covering a range of disciplines across agriculture and allied sciences. The *Handbook* series comprise the most authoritative and benchmark publications on Indian agriculture; providing detailed latest knowledge. Among four titles in the handbook series, The *Handbook of Agriculture* is the most celebrated publication with more than two lakh copies reaching to users of diverse sectors and interest. The *Agri-Pop* series of publications have been launched with a view to impart technical know-how at the grass-root level in a popular style. Specialized and focused research reports are published to cater to specific needs of researchers in various agriculture and allied sectors, and they are available in the digital format as well.

e-publishing: The DKMA has launched an e-publication programme for dissemination of knowledge beyond geographical limits. The e-publishing has ensured significant reduction in delivery time of information to users. The Directorate has produced CD/DVDs of important publications, databases and archives of semi-technical periodicals. A CD of digital photo library has also been developed that contains also the photographs of historical importance related to the National Agricultural Research System.

National input centre for AGRIS database: The DKMA is designated as a input centre of the FAO since 1975 under the mutual co-operation agreement. The inputs/records are prepared as per the internationally accepted standards of indexing and abstracting; and so far nearly one lakh bibliographic references have been added to the AGRIS. The indexing process has been decentralized, and as a capacity-building measure, in-house and out-station database indexing trainings are being organized regularly. So far, about fifty personnel from the ICAR institutions, SAUs, Professional Societies etc. have been trained in indexing for AGRIS.

Publicity and public relations programme: The DKMA is the nodal centre for developing and maintaining linkages with media (Print and Electronic) for enhancing visibility and brand image of the ICAR. A country-wide programme has been launched covering ICAR headquarters and its network for wider coverage of agricultural research in print and electronic media. Under a regular arrangement, video-films presenting successful technologies are telecast over National and Lok Sabha channels. Facilitation is provided to All-India Radio and Doordarshan for co-ordination, planning and identification of suitable themes and experts for production of programmes on agriculture and allied sectors. Corporate films on the ICAR and on the subject matter divisions have been developed, including a film on the National Agricultural Science Museum.

The Directorate also participates, coordinates and facilitates showcasing of technologies in exhibitions/expos/melas of regional and national levels. Inputs are also provided for exhibitions of relevance, organized at the international platforms. The DKMA provides publicity and public relation services to major events organized by the ICAR and its constituents across the country.

The DKMA is steadfast in managing accession and dissemination of valuable information that the NARS already holds through various time-tested means and modes of communication so that better linkages are established with various stakeholders. It is also committed to promote ICT-driven technology and information dissemination system to reduce delivery time and transaction costs.

Jagdeep Saxena and **T.P. Trivedi**
Directorate of Knowledge Management in Agriculture
Indian Council of Agricultural Research
Krishi Anusandhan Bhavan
New Delhi 110 012
e-mail: tptrivedi@icar.org.in

Therapeutic samba wheat HW 1095

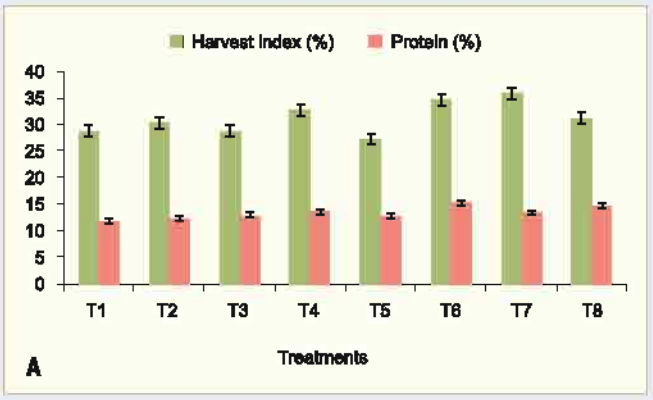
A semi-dwarf, disease-resistant, nutritionally-rich, economically-viable and high-yielding *dicoccum* (samba wheat) wheat HW 1095 developed using mutation technique has been released for the parts of Tamil Nadu and Southern hill zone, including non-traditional areas. This variety is the outcome of a planned *dicoccum* improvement programme. The variety is a NP200 mutant through gamma irradiation (200 Gray), maturing in 110 days. It is rich in protein (13.2%) and possesses high sedimentation value (25). The reddish colour grain provides good grain appearance score of 8. There is no major incidence of pests on this samba wheat variety.

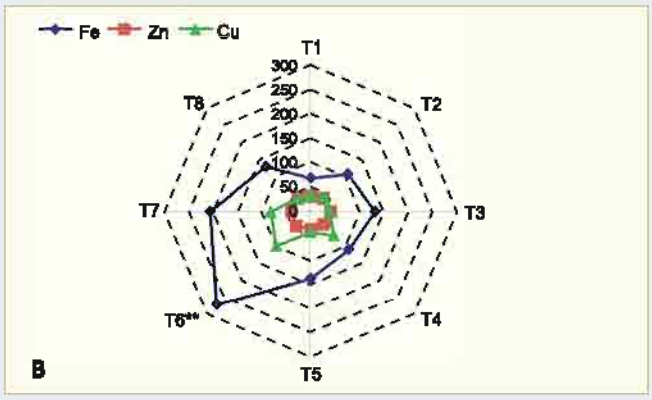
Dicoccum whole wheat flour in the regular diet of the diabetic patients significantly reduces total lipids (p d".01), triglycerides (p d".01) and LDL cholesterol (p d".05). Hulled grains of *dicoccum* are mainly used as alternative to expensive medicines in the health food market. Many results indicate that emmer (*dicoccum*) genetic material may represent a source of high-value dietary fibres.

Jagdish Kumar
IARI Regional Station
Wellington (Nilgiri) Tamil Nadu 643 231
e-mail: head_well@iari.res.in

Microbes-mediated biofortification in wheat-crop

Three bacterial (*Providencia* sp., *Bacillus* sp., *Brevundimonas* sp.) and three cyanobacterial (*Anabaena* sp., *Calothrix* sp. , *Anabaena* sp.) strains along with half the recommended dose of nitrogen and full doses of P and K fertilizers ($N_{60}P_{60}K_{60}$) were evaluated in pot experiments. Significant





Effect of microbial inoculation on **A.** Harvest index and protein content of wheat; **B.** Micronutrient content [T1: Absolute control; T2: Full dose $N_{120}P_{60}K_{60}$; T3: $N_{60}P_{60}K_{60}$; T4: $N_{90}P_{60}K_{60}$; T5: $N_{60}P_{60}K_{60}$ + *Anabaena* sp.; T6: $N_{60}P_{60}K_{60}$ + *Providencia* sp. PW5; T7: $N_{60}P_{60}K_{60}$ + *Anabaena* sp. + *Providencia* sp.; T8: $N_{60}P_{60}K_{60}$ + *Anabaena* sp. + *Calothrix* sp. + *Anabaena* sp.]

enhancement in plant biometrical parameters, protein content and nutritional parameters was recorded in all the treatments involving microbial inoculation. In terms of protein content, *Providencia* inoculation, followed by treatment with three cyanobacterial strains recorded higher values. In terms of micronutrient contents of wheat-plants, significant percentage enhancement of Cu, Zn and Fe was recorded in all the inoculated treatments compared to controls. Inoculation with *Providencia* sp. recorded highest value of Zn (41.73 mg/ kg), besides threefold increase in Fe (271.93 mg/ kg) and Cu (99.00 mg/ kg) as compared to absolute control. Multiple benefits of the plant growth promoting rhizobacteria inoculation in the integrated nutrient management strategies of wheat-crop in terms of quality and yield improvement, besides N-saving and micronutrient enrichment, are indicated. This research needs further validation and evaluation regarding cultivation-agroecology interactions.

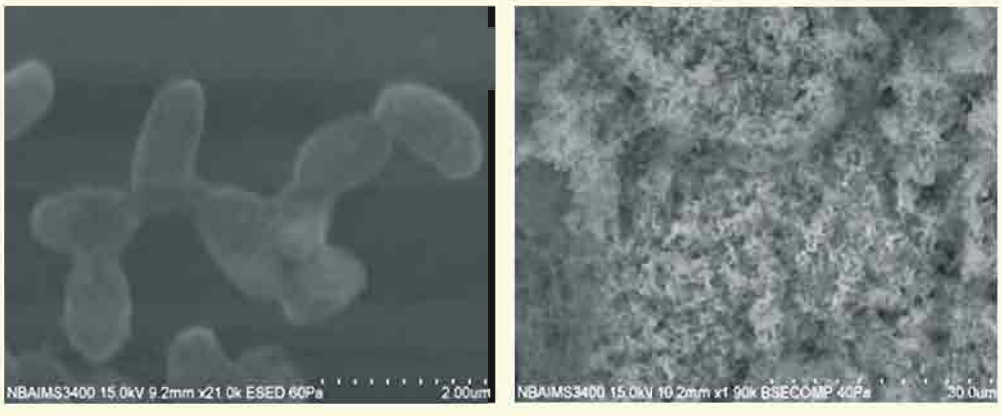
Lata, Radha Prasanna, Anuj Rana, Monica Joshi and Y.S. Shivay
Division of Microbiology and Division of Agronomy
Indian Agricultural Research Institute,
New Delhi 110 012, *e-mail:* latarajat@yahoo.co.in

Actinomycetes in bioleaching of copper

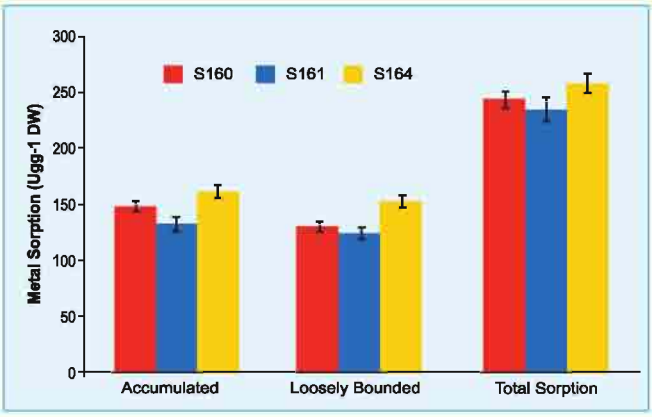
Three morphotypes of *Streptomyces* isolated from rhizospheric and non-rhizospheric soils of chickpea (*Cicer arietinum*) showed significant copper accumulation capabilities. The generation time at different Cu^{2+} concentrations (0.5, 0.75 and 1.0 mM) were recorded for *Streptomyces* strains S160, S161 and S164. Qualitative results showed that 100, 62 and 8% of non-rhizospheric isolates S161, S164 tolerated 0.075, 0.264 and 0.628 mM of Cu^{2+}, while rhizospheric isolate S160 showed tolerance to 0.264 mM $CuSO_4$. Semi-quantitative assay showed that rhizospheric strain has ability to withstand 3.14 mM, while non-rhizospheric isolates S161 and S164 were able to tolerate up to 3.14 and 1.88 mM $CuSO_4$. Acid-digested pellet of S160 indicated 68% reduction in copper residual concentration, confirming copper accumulation capacity of *Streptomyces*. The ability of growth of these strains in the presence of Cu^{2+} was co-induced in the presence of 3.1, 2.8 and 2.1 kb plasmids. Plasmids transformation into wild strain resulted in changes in metal resistance ability along with appreciable changes in resistance to antibiotics. Cultures were identified by 16S rDNA sequencing as *Streptomyces* sp. (S160 and S161) and *Streptomyces hygroscopicus* (S164), respectively. Isolate S160 showed ability to remove more than 65% of copper from the culture medium (0.47 mM) in only 72 hr, indicating that it is a suitable agent for bioremediation of soils or effluents with high concentrations of copper.

> Copper is an essential element required by all organisms as it is an important co-factor for many enzymes involved in vital cellular processes. It cannot be destroyed and tends to accumulate in the organisms at higher tropic levels and directs toxicity to vertebrates within a range of 100–1,000 mg/L. Copper has also been used in copper-based fungicides on agricultural crops.

The average density of *Streptomyces* was found greater in non-rhizospheric soils than in rhizospheric soils, and minimum inhibitory concentration for $CuSO_4$ was found higher in rhizospheric soils than non-rhizospheric soils of chickpea. The results of the study strongly propose that resistance-imparting factors are plasmid encoded, partially if not fully, in addition to antibiotic



Scanning electron microscopy of copper-resistant *Streptomyces* sp.



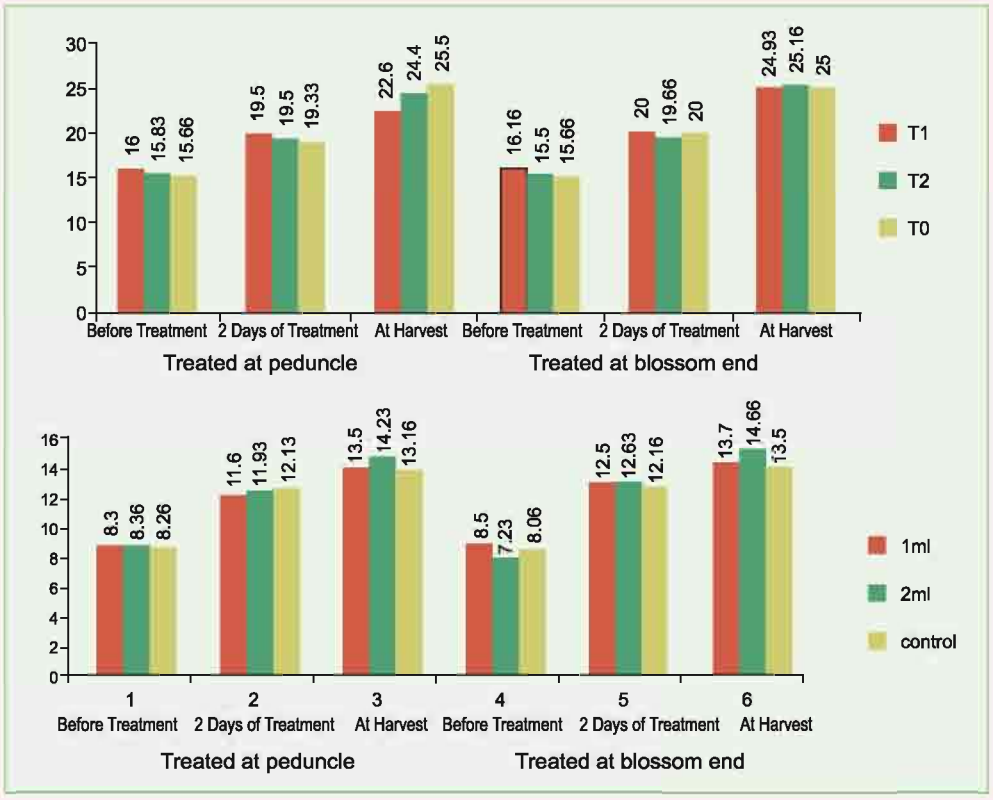
Copper sorption profile of *Streptomyces* strains

resistance; indicating that metal resistance and antibiotic resistance encoding genes are clustered together on the plasmids. Further genetic manipulation will help in understanding physiological and genetic basis of copper resistance locus in these microorganisms.

Mahesh S. Yandigeri, Arvind K. Yadav and **Dilip K. Arora**
National Bureau of Agriculturally Important Microorganisms
Mau Nath Bhanjan (Uttar Pradesh) 275 101
e-mail: nbiamicar@gmail.com

Oxytocin does not affect cucurbits' fruit size

Oxytocin, a mammalian hormone, has been in news for its role in increasing fruit size tremendously in cucurbitaceous vegetables overnight. This chemical was injected at the peduncle and blossom end of the bottlegourd fruits (4 days after fruit setting) at 1 and 2 ml per fruit. On trying this in 2 days old fruits, they busted. The length and circumference of the fruits injected with oxytocin on 4 days after fruit-set in hybrid US15 were measured 2 days after treatment and at harvest, 6 days after treatment.



Effect of oxytocin on fruit circumference of hybrid US 15

The data on fruit length and circumference did not show any increase in fruit shape and size compared to that of control, where only distilled water was used. However injected fruits do sometimes get infected and are not suitable for marketing. This indicates that it is simply a myth that oxytocin increases fruit size and yield of cucurbitaceous vegetable crops, and not the reality.

The farmers are advised not to use this chemical as it only adds to cost of production.

P. Kalia
Division of Vegetable Science
Indian Agricultural Research Institute
New Delhi 110 012
e-mail: pritam.kalia@gmail.com

LAMP for diagnosis of pasteurellosis

For Haemorrhagic Septicaemia diagnosis, a highly specific method, called Loop-mediated isothermal amplification method (LAMP), has been developed that allows an isothermal amplification; as an alternative method for conventional gene amplification. It is characterized by use of 6 different primers specific for the target gene, and the reaction process proceeds at the constant temperature using strand displacement reaction. Amplification and detection of the gene can be completed in a single step by incubating mixture of template, primers and *Bst* DNA polymerase at the constant temperature (about 60-65°C) that eliminates need for specialized equipment or expertise. It provides high amplification efficiency with DNA, being amplified 10^9-10^{10} times in 45-60 minutes. Because of its high specificity, presence of amplified product can indicate presence of the target gene.

The LAMP has been standardized for *Pasteurella multocida* detection. And primers for LAMP were designed with appropriate software using sequence specific to *Pasteurella multocida*. The reaction condition (viz, temperature, concentration of primers and other reagents) was optimized to obtain specific product. It was observed that a total volume of 25 µl reaction mixture containing template DNA, three pairs of primers (0.2 µm outer primers, 0.8 µm loop primers and 1.6 µm inner primers), 2.5 µl of 10X Bst DNA polymerase buffer, 8 units of Bst DNA polymerase, 16 µm of $MgSO_4$, 2.8 mM each of dNTPs, 1mM $MnCl_2$ and 50 µm Calcein gave specific coloured reaction at 61.5°C for 1 hour in thermocycler. The product was further subjected to electrophoresis in 2% agarose gel which showed typical ladder- like pattern of amplified product observed in the LAMP reaction. The reaction product of LAMP can be detected visually also using fluorescent metal indicator, which gives green colour in the day-light for positive reaction, while no colour change in the negative reaction.

Haemorrhagic Septicaemia is an acute and often fatal disease of cattle and buffaloes, caused by *Pasteurella multocida*. The organism also causes fowl cholera in chickens and turkeys, atrophic rhinitis in pigs, pneumonia in cattle and pigs, infections in deers and rabbits.

The LAMP is faster and easier to perform than PCR, besides being more specific. Furthermore, gel electrophoresis is not required because LAMP products can be visually detected.

P. Thomas, S.K. Gupta and **V.P. Singh**
Network Programme on Haemorrhagic Septicaemia
Division of Bacteriology and Mycology
Indian Veterinary Research Institute
Izatnagar (Uttar Pradesh) 243 122

Etiology established of large cardamom foorkey disease

Foorkey disease etiology remained unaddressed for a long time, though the disease was known since 1936. It is characterized by profuse vegetative growth of excessively stunted tillers; affected clumps become gradually unproductive.

Its viral etiology has been established by cloning and sequencing six distinct full-length DNA components, and the virus has been identified as the large cardamom bushy dwarf virus under the genus *Babuvirus* and family Nanoviridae.

Foorkey disease of large cardamom. **A.** Healthy clump bearing flowers, **B.** foorkey affected degenerated clumps and **C.** Detection by PCR Rep-specific primer pair, AV5 and AV6 (Lane 1 and 2: diseased samples; H: healthy control; M: 1 kb ladder)

Bikash Mandal
Division of Plant Pathology, IARI, New Delhi 110 012
e-mail: leafcurl@redilfmail.com

Mushroom cultivation at Dhalai

Mushroom cultivation has been successfully introduced in Balaram and Maracherra clusters of Dhalai district in Tripura.

Oyster-mushrooms were cultivated by 216 farmers in low-cost sheds and in their dwellings. And they produced 2,783 kg of fresh mushrooms, and earned a net profit of ₹150,137.

M. Dutta
ICAR Research Complex for NEH Region
Tripura Centre, Lembucherra
Tripura West (799 210) Tripura
e-mail: jd-icar@yahoo.com

Whole-genome sequence assembly of water-buffalo (*Bubalus bubalis*)

The first version of assembly of a single female Murrah buffalo was constructed with Illumina paired end and mate pair short read sequencing using the cattle genome (Btau 4.0 assembly) as a reference. The assembly has read depth of 17-19X. The buffalo assembly represents ~ 91%-95% coverage in comparison to the cattle assembly Btau 4.0. The assembly has 185,150 contigs with the median contig length of 2.3 Kb and the largest contig length of 663 Kb. The mitochondrial genome is fully covered by a single contig. Whole genome comparison between this assembly and of cattle revealed 52 million mismatches/indels. The present analysis also unveils about 300 structural variants in the buffalo genome. The buffalo assembly has been integrated into a publically available genome browser with tracks for read pair insert distances, read depth, nucleotide variations, coverage, and the availability of custom tracks for scientific community. This assembly of the water buffalo is the first deep sequencing project that provides resources to better understand genomic basis of adaptable traits and genetic variation that distinguishes buffalo from cattle. The genome resources are available at http://210.212.93.84/ and www.animalgenome.org. Future work will focus on the refinement of this genome and incorporation of *de novo* approaches to better identify large structural rearrangements in the buffalo genome.

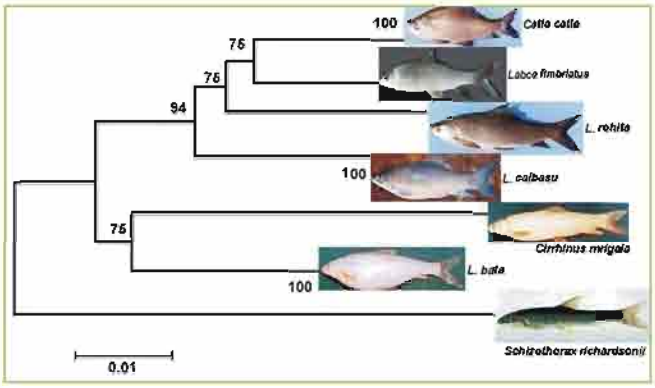
(The full length paper is published in *Indian Journal of Animal Sciences*, May 2011)

M.S. Tantia[1], R.K. Vijh[1], Vineet Bhasin[*], Poonam Sikka[#], P.K. Vij[1], R.S. Kataria[1], B.P. Mishra[**], A.K. Pandey[#], S.P. Yadav[#], R.K. Sethi[#], B.K. Joshi, S.C. Gupta[*] and K.M.L. Pathak[*]
[1] NBAGR, Karnal (Haryana) 132 001
*Animal Science Division, ICAR, New Delhi 110 014
**Indian Veterinary Research Institute, Bareilly, (Uttar Pradesh) 243 122
Central Institute for Research on Buffaloes, Hisar, Haryana 125 001
e-mail: tantiams@gmail.com

Cultured Indian Carps-phylogenetic relationship

Partial sequence of COI gene was used to elucidate taxonomic and phylogenetic relationships among *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Labeo calbasu*, *Labeo fimbriatus* and *Labeo bata* sampled from culture conditions using DNA barcoding. The data would provide valuable information for breeding, conservation, systematic, ecological and evolutionary studies.

Irrespective of the life stages, species could be unambiguously identified through phylogenetic reconstruction of sample mtDNA COI sequences.



Neighbour Joining (NJ) consensus trees of Indian carps, inferred from mtDNA COI sequencing. *S. richardsonii* was used as out-group

Sequence analysis could divide 5 species broadly into 3 groups with high bootstrap values and without any haplotype sharing or overlapping. Paraphyly was observed in genus *Labeo*. *L. fimbriatus* showed closeness to *C. catla* than to *L. rohita*, *L. calbasu* or *L. bata*. *C. mrigala* was found genetically most diverse.

Ambekar E. Eknath
Central Institute of Freshwater Aquaculture
Kausalyaganga
Bhubaneshwar (Odisha) 751 002
e-mail: cifa@ori.nic.in

Early breeding of grass carps on hilly terrains in Odisha

Grass carp (*Ctenopharyngodon idella*), a fast-growing herbivorous fish, has been successfully bred on the hilly terrains of Odisha. Its early breeding in April ensures availability of fingerlings in June with the commencement of monsoon months when most of the village community-ponds are ready for stocking.

Brood fish-ponds were dewatered and their bottom was treated with bleaching powder and exposed to sun for a week. It was then filled up with stored rain and stream water from hilly terrains. Mixed manure was applied to increase water productivity. Three years old grass carp broods were stocked along with Indian major carps in the water. Stocking density was maintained @ 2-3 tonnes/ha. Brood fishes were fed with freshly prepared diet daily @ 2-3% body weight. Grass carps were fed either with *Hydrilla* or terrestrial grass from pond embankments. From December onwards, grass carps were fed with concentrate feed only. Regular monitoring on the health and water quality was carried out. Grass carps spawning could be initiated from the first week of April 2011. Temperature of the stream water was recorded at 23-24°C, and in ponds, it was 25-32°C. Overhead tank was filled up with stored stream water and used in spawning and incubation pools. Fish were administered with ovaprim at the conventional rate in the evening of 8April when water temperature of the spawning pool was at 25°C. Spawning of the grass carps was successful and fertilized eggs were collected early in the morning. The egg fertilization was quantified at coma stage. Total egg production was 45 litres with fertilization rate of 80 %. Fertilized eggs were released in incubation pools for hatching. Over 2.5 lakh spawn could be recovered and stocked in nursery pond for fry rearing on 12 April 2011.

Farmer exhibiting mature grass carp

Ambekar E. Eknath
Central Institute of Freshwater Aquaculture
Bhubaneshwar (Odisha)751 002
e-mail: cifa@ori.nic.in

Published by Dr T.P. Trivedi, Project Director, Directorate of Knowledge Management in Agriculture, Indian Council of Agricultural Research, New Delhi 110 012. *Phone:* 011-25842787; *Fax:* 011-25843285, *e-mail:* tptrivedi@icar.org.in. Lasertypeset by M/s Print-O-World, Shadipur, New Delhi 110 008, and printed in India at M/s Royal Offset Printers, A-89/1, Naraina Industrial Area, Phase I, New Delhi 110 028.

Editing **: Dr R.P. Sharma and Shashi A. Verma** ***Design & Production*** **: Dr V.K. Bharti and Punit Bhasin**

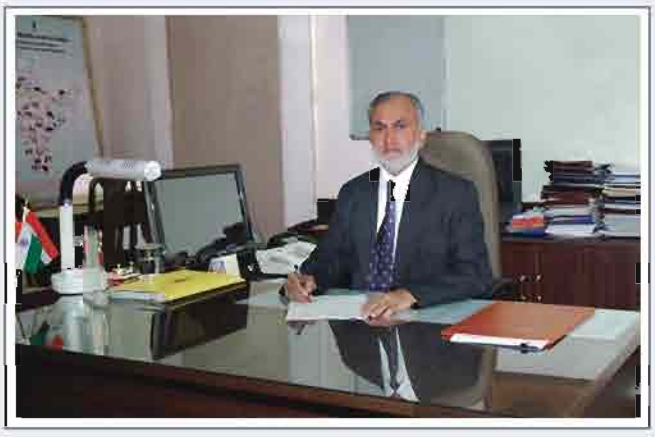
WAY FORWARD

NATURAL fibres are "those renewable fibres from plant or animal sources that can be easily transformed into yarns for textiles". These fibres are totally bio-degradable, comfortable and skin-friendly, and are renewed by nature and through human ingenuity since 7000 BC. They can be grown in different agro-ecological zones, and are known to recycle carbon dioxide (CO_2). A FAO-sponsored research elsewhere has shown that in producing one tonne of polypropylene, more than 3 tonnes of carbon dioxide is emitted into the atmosphere – the main greenhouse gas responsible for global warming. And in cultivating jute, 2.5-3.0 tonnes of carbon is absorbed per tonne of dry fibres ; one tonne of jute-growing requires only 1/10th of the energy that is consumed for producing a tonne of synthetic fibres. Some of the bast fibres could be grown and could be applied also for extracting heavy metals such as cadmium, lead, copper and zinc from contaminated soils.

Globally, around 35 million tonnes of natural fibres are produced from a wide range of plants, mainly cotton, abaca, sisal, coconut, jute, hemp, flax and ramie, and also from animals, mostly sheep, rabbits, goats, camels and alpacas. In the world, natural fibres contribute around 48% to fibres' basket – 38% from cotton, 8% from bast and allied fibres and 2% from wool and silk fibres. In India, cotton alone contributes about 58% of the total natural fibres. With the expansion of global population and consumers' preference for environment-friendly natural products, natural fibres production may touch about 40 million tonnes per annum; and cotton may contribute around 30 million tonnes by the middle of this century. In 2010-11, India produced highest ever 34 million bales of cotton and more than 10 million bales of jute and mesta; cotton requirement is expected to be doubled. With cultivable land remaining almost stagnant and pressure for food crops on agricultural land mounting; to almost double the productivity alone would be the only way to meet the needs of the natural fibres of the growing population.

With the widespread use of synthetic fibres during the last five decades, many traditional markets for natural fibres have either eroded or disappeared. The natural fibres as a whole thus face challenge of developing and maintaining markets where they can compete effectively with synthetics. The year 2009 was declared as the International Year of Natural Fibres by the United Nations General Assembly that sought to focus world attention on the importance of natural fibres to producers, industry, consumers for poverty alleviation and for environment protection.

Apart from cotton, silk and wool, many more green fibres can be used in textiles for healthy and comfortable clothing. Fibres from flax, jute, hemp, kenaf, sisal, ramie, abaca, coconut, pineapple and bamboo could be extracted, processed, modified and used in textiles, reinforcements in composites, in pulp and paper, in agro-fine chemicals and also as the source of energy.



Dr S. Ayyappan, Secretary (DARE) and Director General (ICAR)

It is worth noting at this juncture, the potential of genetically modified fibrous plants also for not only providing high-quality major products such as fibrous cellulose, carbohydrates but also for combating environmental stress such as salinity and drought. The novel fibrous plant containing nano-fibres is also a distinct scientific possibility. Technology for permanent integration of functional additives in cellulose-based fibre matrix that remain effective throughout the life cycle of the material is also being looked into.

The ICAR institutes on Cotton Research at Nagpur, Cotton Technology at Mumbai, and Jute and Allied Fibres Research and Jute and Allied Fibres Technology at Kolkata are engaged in improving productivity, quality, and diversification of natural fibres use, and have generated many appropriate technologies.

Natural fibres are generally regarded environment-friendly; however, there is a need to look into the use of chemicals in natural fibres' production to ensure their eco-friendliness. Agrochemicals use on fibre crops and water contamination as a result of retting are specific instances where alternate eco-friendly routes/ materials need to be identified. It is necessary to emphasize on the environmental advantages of natural fibres while seeking at the same time to promote greater realization of their clean potential. Above all, there is a need to promote technology development and policy framework for change to a bio-based economy by substituting common petrochemical-based raw materials or mineral sources with the products developed from renewable plant and animal sources.

(S. Ayyappan)
e-mail: dg.icar@nic.in