Volume 15 No. 2 April-June 2009

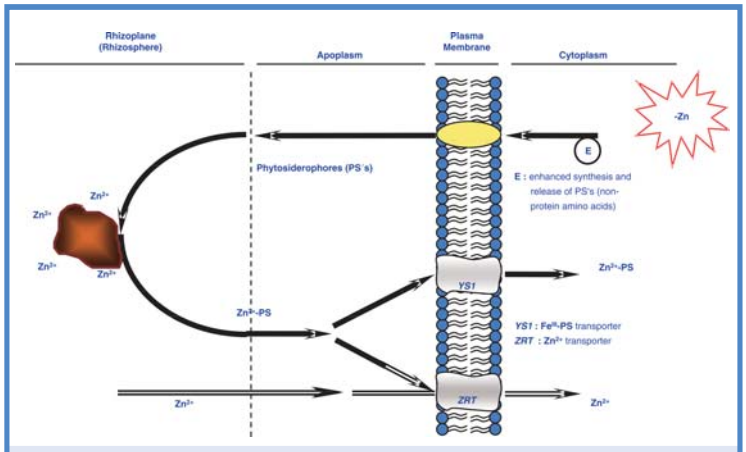
ICAR
A SCIENCE AND TECHNOLOGY NEWSLETTER
ICAR NEWS

RESEARCH UPDATE

PROMISING TECHNOLOGIES

Phytosiderophores improve zinc efficiency of cereals

One of the widest ranging abiotic stresses in the world agriculture arises from the low zinc (Zn) availability in the calcareous soils. It is one of the most prevalent nutritional constraints in the crop-plants, especially cereals. Among cereals, wheat and rice, in particular, suffer from Zn deficiency. In India, up to 50% of the agricultural land, particularly the whole of the Indo-Gangetic belt, is reeling under zinc deficiency. This has serious consequences as plants grown on zinc-deficient soils have reduced grain yield (80%). Correction of soil Zn deficiency through Zn fertilizers is neither economical nor environmental-friendly, as 20% of the applied Zn only is available for the plant uptake.



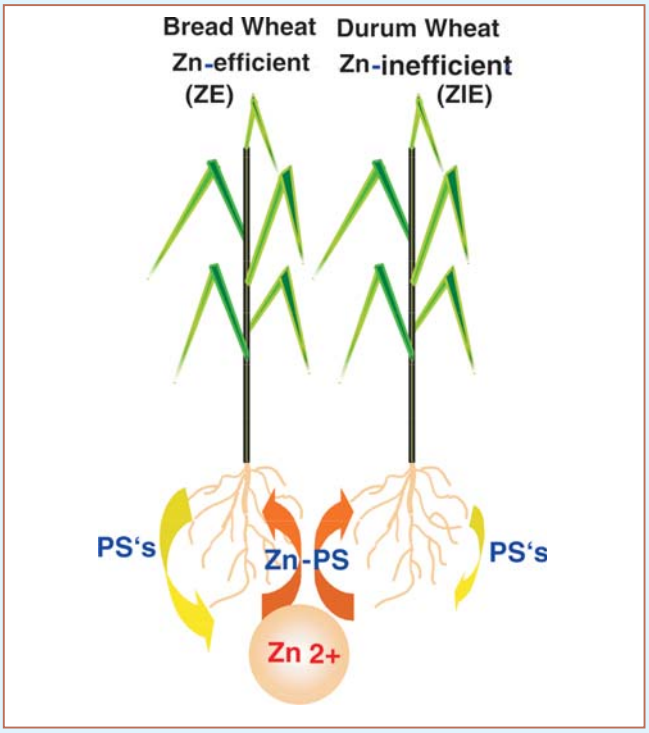
Phytosiderophores release is causally related to zinc efficiency

Indian Council of Agricultural Research
Krishi Bhawan, New Delhi 110 001, India
www.icar.org.in

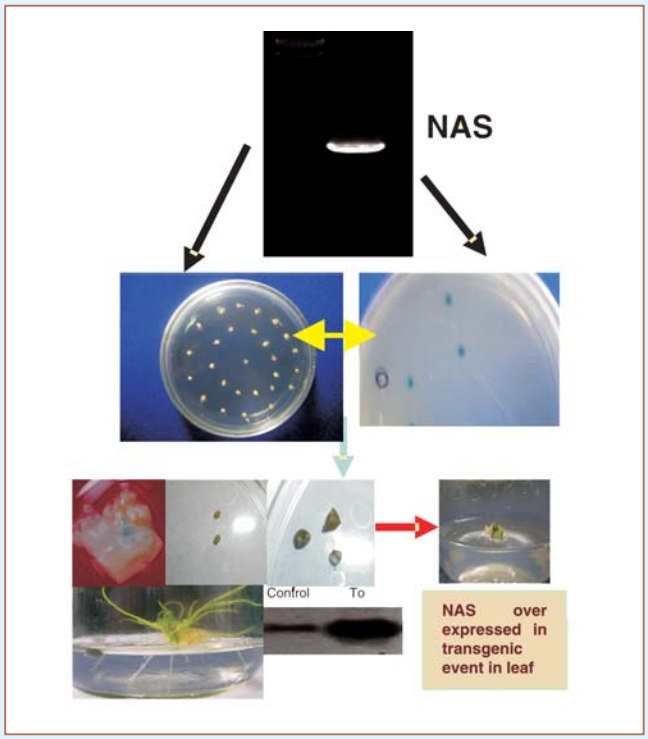
PROMISING TECHNOLOGIES

Lately, considerable progress has been made towards identification of adaptive mechanisms for efficient uptake of nutrients from soils low in nutritional quality. One novel mechanism that has been found in graminaceous species under Fe deficiency was the release of certain amino acids that were not used for protein synthesis but were highly effective in mobilizing Fe from less available forms of Fe compounds such as Fe (III) hydroxides and oxides from the rhizosphere. These chelating compounds referred to as phytosiderophores (PS; phytometalophores), are also released under Zn deficiency, and may play a significient role in zinc efficiency of cereals.

Plant roots can absorb not only ionic Zn but also chelated form, Zn-phytosiderophores. Experiments have shown that Zn deficiency increased root exudation of amino acids, sugars and phenolics, but the exudates from the Zn-deficient dicotyledonous species were not able to mobilize Zn from synthetic resins. In contrast, graminaceous species root exudates from Zn-deficient



Zinc inefficient (ZIE) durum wheat benefits from high phytosiderphores availability when grown in mixed culture with zinc efficient (ZE) bread wheat



Manipulating production of PS through over-expression of NAS gene–a transgenic approach

Recently, a Japanese research group has successfully transformed rice with phytosiderophore synthesising genes, nicotianamine synthase (NAS) and nicotianamine amino transferase (NAAT) from barley to achieve a larger release of phytosiderophores in the transformed rice plants. The transformed plants were found more tolerant to low iron availability and had 4 times higher yields than non-transformant ones on Fe-deficient soils. It is quite plausible that zinc deficiency tolerance of graminaceous species can also be achieved through a molecular manipulation of phytosiderophores biosynthesis. Such genetically engineered plants possessing capacity for enhanced production and secretion of phytosiderophores would be tolerant to low Zn availability on the calcareous soils and may help in boosting grain-productivity and grain-nutritional quality, which are highly desirable to cope up the challenges of declining productivity, deteriorating quality of cultivable land, abiotic stresses and hidden-hunger in growing population.

plants increased mobilization of both Zn and Fe from various sources. Phytosiderophores are found not only to enhance Zn mobility in rhizosphere and uptake but also translocation of Zn from root to shoot. A 18-20 fold higher rate of phytosiderophores release has been reported in wild grasses raised under Zn deficiency as compared to Zn-sufficient conditions. Our studies have revealed that differences in Zn uptake capacity in wheat are related to differential release of phytosiderophores (PS) from roots, and also that Zn uptake efficiency of low PS releasing and Zn inefficient durum wheat improved when it was grown in mixed culture condition with high PS releasing and Zn efficient bread wheat. Durum wheat benefits from high PS availability in its rhizosphere under mixed culture. This indicates that molecule manipulation of PS biosynthesis and release by inefficient plants can help in improving their efficiency. Attempts were made to clone nicotianamine synthase (NAS) from barley and over-express the same in wheat.

It is opined that phytosiderophores may be causally involved in affecting zinc uptake efficiency of graminaceous species under zinc deficiency.

Bhupinder Singh
Nuclear Research Laboratory, IARI, New Delhi
e-mail: bhupindersinghiari@yahoo.com

New Pseudomonas strain for sorghumstalk-rot management

Pseudomonas chlororaphis strain SRB127 produces strong antifungal and antisporulent metabolites, which inhibit growth of soil-borne pathogens, *Macrophomina* and *Fusarium*.

Sorghum CSV 8R, M 35-1 seeds were treated with talc-based formulation of the bacterium (2×10^7cfu/g) and were sown in stalk-rot sick plots in replicated trials. Data on disease incidence, lodging and grain mass were recorded and analysed. The bioagent SRB127 suppressed stalk-rot, reduced disease incidence by 40%, crop-lodging by 20%, and increased grain mass. In the absence of adequate genetic resistance, especially in the high-yielding sorghum cultivars, SRB127 holds potential in managing stalk-rot and related losses in grains and stover quality, and thus increasing yield of *rabi* sorghum.

The bacteria profusely colonize on sorghum roots and form micro-colony like cell-aggregates, which help them to survive in sorghum rhizosphere without significant reduction in population till grain-filling. Cell-free culture filtrates of the strain reduce formation and germination of pathogen-sclerotia (>80%).

Further testing of the strain for efficacy in multiple locations involving different soil types and sorghum genotypes is in progress.

I.K. Das and **N. Seetharama**
National Research Centre for Sorghum
Hyderabad 500 030 (Andhra Pradesh)
e-mail: nrcshyd@ap.nic.in.

New oyster mushroom, Pleurotus cystidiosus, with excellent shelf-life

A new *Pleurotus* species was collected from Singapore Cherry-tree in 2006. Based on its morphocultural

Pleurotus cystidiosus in Nature

characters, it was identified as *Pleurotus cystidiosus*. Further work was carried out for its domestication on the sawdust-and paddy-straw-based substrates.Its cultivation technology on sterilized paddy-straw, which can give a biological efficiency of 60-80%, has been successfully developed.

This mushroom produces characteristic black coremia (asexual spores) in culture medium as well as during spawn-running. Coremia formation is temperature-dependent, and they are not formed below 15°C. The optimum spawn-running temperature for the species is 25-30°C, and optimum cropping conditions include temperature between 25 and 30°C and relative humidity between 70 and 85%. Fruit bodies (sporophores) are large, thick, fleshy, initially dark-grey; becoming light-brown on maturity. The major diameter of sporophores varies from 98.25 to 100.48 mm, and minor ranges from 70.18 to 77.12 mm, and the thickness at the pileus stipe junction is 14.24 mm. Stipe is tough, measuring 70-74 mm in length and 18-20 mm in thickness. Gills are thick, white, producing white-spore print. Basidiospores are oblong. This species has an excellent shelf-life of 3-4 days at 28-32°C, 20-22 days at 15°C and 30-35 days at 4°C, as compared to the shelf-life of 1-1.5 days, 4-5 days and 8-10 days of *Pleurotus florida* commercial species under similar conditions.

This species may be an excellent addition to the Indian mushroom industry due to its large, fleshy sporophores and excellent shelf-life.

Meenakshi Srinivas
Indian Institute of Horticultural Research
Hessaraghatta, Bengaluru 560 089 (Karnataka)
e-mail: director @ iihr. ernet. in

Hand-guided cloning technique for buffalo reproduction

This technique is simpler, and is an advanced modification of the Conventional Cloning Technique, which was used for production of cloned sheep Dolly.

In this technique, oocytes isolated from the abattoir ovaries were matured in *in vitro,* denuded, treated with an enzyme to digest zona to obtain zona-free ova. The ova were further enucleated with hand-held fine blade. And somatic cell from an ear of the donor buffalo was propagated to be used as donor-nuclei. Enucleated oocytes and donor-nuclei were electro-fused, cultured in the laboratory and resultant embryos were transferred to recipient buffaloes for calf production. One of the biggest advantage of this technique is that calf of the desired sex can be obtained.

World's first buffalo calf through the technique was born on 6 February 2009 at the NDRI, Karnal. And the second cloned buffalo calf *Garima* is born on 6 June 2009 through *advanced hand-guided cloning technique*; this technique is different from the earlier, as in this the donor cell used was from the foetus, instead of ear.

Garmia, born on 6 June 2009

The technology of the hand-guided cloning can help increase number of outstanding bulls, as it has the potential to supply elite bulls in the shortest possible time.

S.K. Singla, R.S. Manrik. M.S. Chauhan, P. Palta, R.A. Shah and **A. George**
NDRI, Karnal 132 001 (Haryana)
e-mail: dir@ ndri.res. in

Breaking seasonal barrier in scampi farming

In northern India, the freshwater prawn, scampi (*Macrobrachium rosenbergii*) is normally cultured during June to December, depending on the water temperature (18-34°C with an optimum range of 27° to 31°C). And so the fresh prawn-crop is not available to consumers after December. In Bihar, *Macrobrachium* has been successfully cultured during post-monsoon winter season for the first time.

The scientists of the Complex at Patna could succeed in farming scampi by providing suitable shelters in ponds and trenches at its Walmi Farm, from August to February. This adaptive research work has paved way for scampi farming beyond December.

The farmers and entrepreneurs will be highly benefited from the new approach of scampi farming in the seasonally waterlogged areas of Bihar.

D.K. Kaushal, P.M. Sheery and **M.A. Khan**
ICAR Research Complex for Eastern Region, Patna
e-mail: dkkaushal@rediffmail.com

Decision support system for soil-and-water analysis

In India, flue-cured virginia tobacco is cultivated in 2 lakh hectares, producing annually 27 million tonnes of cured leaf.

Soil, water and climatic factors play a predominant role on tobacco yield and quality. Soil-and-water testing laboratories for tobacco are at the Central Tobacco Research Institute, Rajahmundry, Ongole in Andhra Pradesh and Periyapatna in Mysore district of Karnataka. In these laboratories, a large number of soil-and-water samples are analyzed regularly and test reports along with fertilizer recommendations are prepared manually that consume a lot of time, and also there is a possibility of an error.

Efforts were made to develop a decision support system for the crop which would help in preparation of soil-and-water testing reports along with the fertilizer recommendations. The software has been developed with visual basic as front-end and MS-access as back-end for accurate and quick processing of soil-and-water test data. The database structure for storing and retrieval of information has been designed using Microsoft-access environment with 35 parameters as attributes. The parameters, farmer's name, soil type, source of water, soil *p*H, EC, N, P, K, chlorides and water *p*H, EC and chlorides, which are important for tobacco-crop, were selected for inclusion in the package.

In this system, when once the analytical reading either from an instrument or from a titration regarding a parameter is fed, the final value of the parameter will be computed and compared to the standard value stored in the memory, categorized into low, medium or high. Ultimately this decision support system gives output regarding suitability of either soil or water for cultivation of tobacco, and recommended fertilizer dose for a particular soil is also suggested. The system can also be extended to other crops.

H. Ravisankar, C. Chandrasekhararao and **V. Krishnamurthy**
Central Tobacco Research Institute
Rajahmundry 533 105 (Andhra Pradesh)
e-mail: hravisankar@india.com

NARS institutions under High Speed Network

Based on the recommendation of the National Knowledge Commission, 9 ICAR institutes and 5 state agricultural universities have been included under the High Speed Network (100 Mbps) that is for universities, libraries, laboratories, hospitals and agricultural institutions across the country.
This would enable enhanced communication, online collaboration, and creation and sharing of knowledge resources within the country. Work for networking of these NARS institutions has already started.
Other ICAR institutes and SAUs have also been prioritized to be subsequently connected with the network in three phases.

A bioreactor for multiplication of beneficial microorganisms — Earthworm-gut

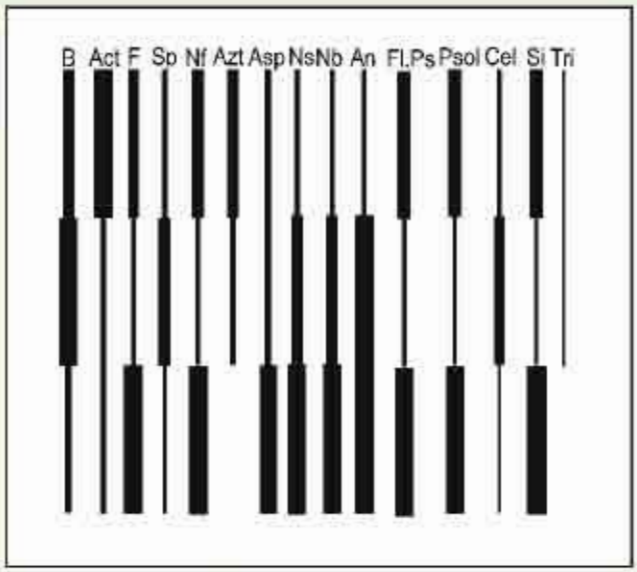
An indigenous strain of earthworm, *Eudrilus* sp., with a unique capacity to digest high-lignin containing coconut leaves has been isolated from the CPCRI farm.

Indigenous earthworm *Eudrilus* sp. degrading coconut leaves and producing dark-brown granular vermicompost

Simple technologies to mass-multiply earthworms and use them for converting coconut leaf-biomass wastes (6-8 tonnes from 1 hectare of coconut-garden-annually) into vermicompost were standardized during 1998.

The vermicompost produced from coconut leaf+cow-dung substrate (10:1 w/w) is dark-brown, granular organic material having C:N ratio of 9.95, organic carbon content 17.8%, humic acid 10-13%, nitrogen 1.8%, phosphorus 0.21% and potash 0.16%.

Coconut-leaf vermicompost (CLV) when applied to humid tropical soils has shown significant improvement in the health and fertility of the soil. One of the key reasons for this improvement, besides addition of major and micronutrients and plant growth-promoting hormones, is the addition of the large populations of plant beneficial microbial communities.



Qualitative bar-coding microbial dynamics during production of coconut-leaf vermicompost (CLV) from substrate (coconut leaf+cow-dung) to *Eudrilus*-gut contents to final vermicompost production stage. (*B*-bacteria, *Act*-actinomycetes, *F*-fungi, *Sp*-spore formers, *Nf*-free living N-fixers, *Azt-Azotobacter, Asp-Azospirillum, Ns-Nitrosomonas, Nb-Nitrobacter, An* - ammonifiers, *Fl Ps*-fluorescent pseudomonads, *Psol* - phosphate solubilizers, *Cel*-cellulose degraders, *Si*-silicate solubilizers, *Tri-Trichoderma*)

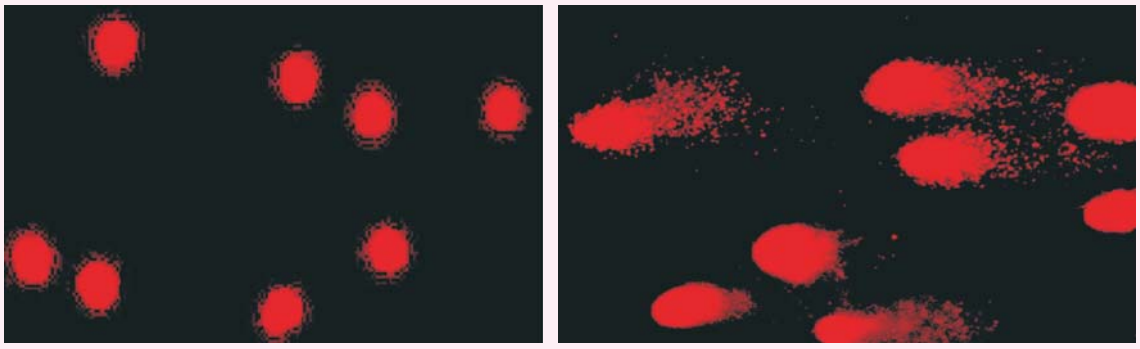
Vermicompost enrichment with plant beneficial microorganisms takes place during digestion and passage of substrate through earthworm-gut. Fifteen microbial communities, including general and function specific, were in the earthworm feed substrate (coconut leaf : cow-dung:: 10:1, w/w) in the gut contents of the worm, when reared on the above substrate, and in the vermicompost produced from it. It was observed that populations of 9 out of 15 microbial communities increased significantly after they were digested and excreted by the earthworm as vermicompost. Among the 9, populations of asymbiotic nitrogen fixers (114% increase), phosphate solubilizers (235% increase), fluorescent pseudomonads (70% increase) and silicate solubilizers (60% increase) were enriched in the vermicompost to a large extent; after its passage through earthworm-gut. This clearly indicates that a

suitable and favourable micro-environment prevails in the earthworm-gut for enriching vermicompost with plant beneficial microorganisms. Application of coconut-leaf vermicompost to soil resulted in increased microbial biomass and activity, and modification of microbial community composition of soil leading to efficient nutrient mineralization.

Murali Gopal, Alka Gupta and **George V. Thomas**
Central Plantation Crops Research Institute
Kasaragod 671 124, (Kerala)
e-mail: mgcpcri@yahoo.co.in

Genotoxicity in fishes

Natural water resources,rivers, lakes, sea, harbouring fish fauna are being polluted with domestic sewage, industrial discharges, radioactive wastes, oil, chlorinated hydrocarbons and run-off from agricultural fields, containing chemical fertilizers, pesticides and herbicides. A majority of the pollutants are not only toxic but also have carcinogenic and mutagenic effects on fishes, eventually leading to various disease conditions, tumour formation and overall reduction in fitness.



Blood cells of *Channa punctatus* showing intact nuclear DNA in control group (*left*) and damaged DNA in the exposed group (*right*), detected by comet assay

Development of bio-markers for *in-vivo* and *in-vitro* test systems has become essential for providing scientific basis for comparing risks of pollutants on the natural biota. Acute toxicity, bio-assay and behavioural studies are being conducted to test toxicity levels of the pollutants. Various genotoxicity assays with different end points viz. chromosomal aberrations, sister chromatids exchange, micronucleus assay and comet assay have been tested and validated to assess changes in the genetic material of the organisms. Comet assay under alkaline conditions (*p*H > 13) is able to detect DNA damage, i.e. single strand breakage or other lesions such as alkali-labile sites, DNA cross-links and incomplete excision repair events. This assay is widely used in genetic toxicology and environmental bio-monitoring including aquatic organisms for measuring relationship between the DNA damage and exposure to the genotoxic pollutants.The lethal concentrations (LC_{50}) and safe levels of various pesticides, malathion, endosulfan, prophenophos, chlorpyriphos, glyphosate, carbosulfan, atrazine, and heavy metals like mercury chloride, arsenic trioxide, chromium nitrate, cadmium chloride, and piscicides like *mahua* oilcake, quillja saponin and rotenone have also been estimated. The studies have indicated that the above pollutants are mutagenic and genotoxic to test species, *Channa punctatus*. And *in-situ* bio-monitoring studies of fishes from the Ganga, Yamuna and Gomati have indicated genotoxic nature of the pollutants to wild fish fauna. Such investigations will help in developing suitable strategies for conservation of aquatic genetic resources of the country.

Ram Sakal Chaurasia
National Bureau of Fish Genetic Resources
Lucknow 226 002 (Uttar Pradesh)
e-mail: nbfgr@sancharnet.in

National Bureau of Agriculturally Important Microorganisms

The Bureau is one of its kinds not only in India but also in South East Asia as it focuses on the conservation and preservation of microbial diversity

Characterization of microbes is of paramount importance, not only from the point of view of conserving them and protecting their gene-pool resources but also for enhancing crop productivity. The Bureau aims to excel in isolation and utilization of genes for conventional and unforeseen products of high economics and value in environment and agriculture. Such efforts will greatly strengthen national capabilities in quarantine and other regulatory matters.

The National Bureau of Agriculturally Important Microorganisms (NBAIM) was established in the IXth Plan in 2001. It was shifted from old NBPGR Building, New Delhi, on 1 June 2004 to the vacant premises of the National Institute of Sugarcane and Sugar Technology (NISST) at Kusmaur, Mau Nath Bhanjan, Uttar Pradesh.

MANDATE

To act as the nodal centre at the national level for acquisition and management of indigenous and exotic microbial genetic resources for food and agriculture, and to carry out related research and human resource development for sustainable growth of agriculture

INFRASTRUCTURE

The NBAIM has well-equipped research laboratories, Central instrumentation facility, separate Fungal and Bacterial labs, Molecular Biology lab, Genomics unit with ultramodern instrumentation, Lyophilization unit, Culture collection facility, including cyanobacterial culture unit, newly developed Microbial Genome Resource Repository (MGRR), administration block,

Microbial Genomic Resource Repository

This resource repository is in the process of establishment at the NBAIM, and it would carry out following:

- Collection of DNA materials from microorganisms and other relevant organisms, which result from various molecular genetics and genomics research programmes
- Acquisition of gene constructs from various sources
- Value-addition to genomic resources
- Characterization, validation and conservation of microbial genomic resources
- Production/multiplication and quality control for distribution
- Exchange of genomic resources under a material transfer agreement (MTA)
- Development of a user friendly web-based information system for microbial genomic resources

scientists' lobby, library, Conference hall and mini-conference rooms with state-of-the-art audio-visual equipments and Agricultural Research Information Service (ARIS) cell.

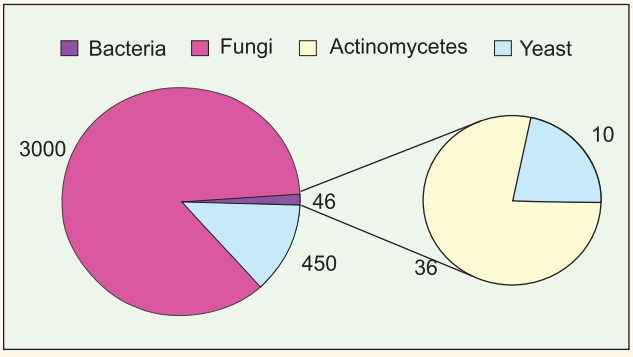
Looking at the prospects of the most modern research trends including microbial ecology, genomics, bioprospecting, gene-mining and bio-product development, the Bureau has taken a lead in research and development in these areas, and has acquired genome sequencing units, DNA fingerprinting unit, Shotgun Cloning Lab, Sequencing Laboratory and Genoinformatics centre, Confocal and SEM microscopy,

Lyophilization of microbial cultures in the NAIMCC

HPLC and GC units and a separate unit for computerized documentation. A Local Area Network and Website of NBAIM have been created, and all the units of the NBAIM are linked with various ICAR institutes and research organizations all over the country.

National Agriculturally Important Microbial Culture Collection (NAIMCC)

- Biodiversity Authority of India recognizes the NBAIM culture collection as the National Repository. The bureau follows strict quality control and biosafety standards in the culture collection as well as in laboratories. Various types of microorganism including filamentous fungi, bacteria, actinomycetes and yeasts are maintained under the long-term preservation. Each culture is preserved by two methods according to the type of microorganism. Fungi are preserved under mineral oil and by freeze-drying/ lyophilization. The bacteria, actinomycetes and yeast are preserved by freeze-drying/ lyophilization and in glycerol at –80° C. For short-term storage, the cultures are maintained on the slants in appropriate medium at 4°C.
- The culture collection, preserves and conserves microbial diversity of the country. The collection has wide diversity of fungi, including more than 700 species belonging to 250 genera. Likewise the bacterial collection has more than 100 species belonging to 35 genera.
- The NAIMCC has developed state-of-the art short-term conservation of AIMs based on culture and mineral oil techniques. Using these techniques, AIMs can be conserved for 5-10 years.
- The NAIMCC has high capacity lyophilizers for long-term preservation of AIMs (20-25 years) under vacuum at–60 °C.



NBAIM culture collection

The NBAIM is developing databases of all the AIMs in the electronic passport data management system. The software is named as MicroNBAIM

- The NAIMCC exchanges cultures on MOU basis with different National Institutes/Organizations.
- The NAIMCC has conserved bacterial isolates reported from extreme environments for the first time in India such as *Bacillus humi, B. drentensis, B. asahii, B. cohnii, B. pumilus, B. niacini, B. djibeloresis, B. fumarioli, B. senequalensis, B. oleronius* and *B. sporothermodurans, Halomonas* sp., *Marinobacter alkaliphilus*, *M. hydrocarbonoelasticus, Halomonas variabilis, Alteromonadales bacterium, Nitrinicola lacisaponensis, Bacillus thuringiensis, Chromohalobacter salexigens, Marinobacter aquaeolei*.

DNA Fingerprinting Unit

The NBAIM has fully operational DNA fingerprinting unit; well equipped with highly advanced instruments routinely used for DNA profiling and fingerprinting. Unit contains rooms for Electrophoresis, Gel Documentation, PCR (Amplicon room), and DNA sequencing section. It contains Pyro DNA Sequencer (454 Technology), DNA sequencer (ABI) and Real Time PCR.

The bureau is also using metabolic genes and toxin genes to develop diagnostic DNA probes for some AIMs.

SIGNIFICANT ACHIEVEMENTS

A software developed by the bureau lists out characteristics of AIMs in terms of origin, ecology, morphology, physiology and biochemical parameters, pathogenic/nonpathogenic nature, detailed available information about specific properties and molecular tools used for the characterization of AIMs.

The NBAIM has collected thousands of Agriculturally Important Microorganisms (AIMs) (pathogenic and saprophytic) from local crop plants/survey of Indo-Gangetic plains/other extreme environments. Surveys at following have been completed so far: Western Himalayas, warm subhumid and cold arid-eco-region; Western plains- Kachchh and part of Kathiawar peninsula, hot arid eco-region; Karnataka plateau (Rayalaseema), hot arid region with deep loamy and clayey mixed red and black soils (low to medium awc and lgp); Northern plains (and central highlands) including Aravallis, hot semi-arid eco-region; Central highlands (Malwa, Bundelkhand), Gujarat plain and Kathiawar peninsuala, semi-arid eco-region; Deccan plateau, Eastern Ghats with hot semi-arid eco-region; Tamil Nadu uplands- hot semi-arid eco-region; Northern plain- hot sub-humid (dry) eco-region; Moderately to gently sloping Chhattisgarh/Mahanadi basin, hot moist/dry sub-humid transitional with deep loamy to clayey red and yellow soils (medium awc lgp); Eastern plateau (Chhottanagpur) and Eastern plain, hot subhumid (moist) eco-region; Assam and Bengal plain, hot subhumid to humid (inclusion of perhumid) eco-region; Eastern coastal plains- hot subhumid to semi-arid eco-region; Western coastal plains- hot humid eco-region Islands of Andaman-Nicobar and Lakshadweep, hot humid to per humid island eco-region.

The bureau has developed several protocols based on morphological/physiological and molecular tools for identification and characterization of *Trichoderma, Fusarium, Bacillus, Pseudomonas, Azotobacter, Azospirllium, Streptomyces, Alternaria* and *Macrophomina*.

Greenhouse trials for some PGPR and biocontrol agents such as *Pseudomonas fluorescens* and *Trichoderma harzianum* are being performed.

Application of Microorganisms in Agriculture and Allied Sectors

This project has 7 components: *(i)* Microbial diversity and identification; *(ii)* Nutrient management, PGPR and Biocontrol; *(iii)* Microbial management of agrowaste, bioremediation and microbes in post-harvest and processing *(iv)* Microbial management of abiotic stress; *(v)* Microbial genomics; *(vi)* Microbial Genomic Resource Repository; *(vii)* Human resource development

Microbial diversity and identification

- A total of 4,810 bacteria, 124 cyanobacteria, 310 actinomycetes, 348 fungi and 261 mushrooms have been isolated from India.

Useful AIMs

The Bureau has a good collection of very useful microbes with fascinating properties of agricultural and industrial importance. Among these species of *Trichoderma, Arthrobotrys, Dactylaria, Rhizoctonia, Fusarium, Helminthosporium, Phytophthora, Cercospora, Colletotrichum, Pythium, Penicillium, Pestalotia, Phomopsis, Cryptococcus, Saccharomyces, Candida, Macrophomina, Peronospora, Aspergillus, Erysiphe, Sclerotium, Venturia, Curvularia,* Mycorrhizal fungi (*Glomus*), *Agaricus, Alternaria, Gliocladium, Verticillium, Claviceps, Uromyces, Melapsora, Albugo, Rhizobium, Azotobacter, Pseudomonas;* phosphate-solubilizing bacteria and fungi- *Catenaria anguillulae, Arthrobotrys oligospora, Rhizoctonia solani, Bacillus* spp.; cellulose-degrading bacteria– *Fibrobacteria succinogenes, Ruminococcus flavefaciens, R. albus, Clostridium lochhreadii, Eubacteria cellulosolvens*; hemicellulose-degrading bacteria–*E. xylanophillium, Coprococcus eutactus, Treponema bryantii*; starch-degrading bacteria–*Streptococcus bovis, Ruminobacteria amylophilus, R. ruminicola, Succinimonas amylolytica*; sugar-utilizing bacteria–*Lactobacillus ruminis, L. vitulinus*; acid-utilizing bacteria–*Megasphaera elsedenii* (lactate), *Veillonella parvulala* (lactate), *Oxalobacter formigenes* (oxalate); protein-degrading bacteria –*Bacteroides amylophilus, Butyrivibrio fibrisolvens, Steptococcus bovis*; urea-degrading bacteria–*Bacteroides, Ruminococcus, Micrococcus, Streptococcus, Butyrivibrio;* nitrogen-fixing bacteria–*Clostridium pasteurianum, Bacillus macerans, Citrobacter freundi*; lipid-degrading bacteria–*Anaerovibro lipolytica;* methanogenic bacteria–*Methanobrevibacter ruminantium, Methanosarcina barkeri;* tannin-degrading bacteria–*S. caprinus* etc. are of paramount importance, and are being conserved and preserved

- Two value-added cyanobacterial products *Spiro papad* and *Spirogel* have been prepared and launched in the markets, and are in high demand in local community of Imphal.
- Some of the rare bacterial species identified are *Chromobacterium violacearum, Exiguobacterium* sp., *Arthrobacter* sp., *Bacillus fumarioli, Pseudomonas chlororaphis, Microbacterium, Pantoea, Cronobacter, Brevibacillus laterosporus, Serratia marsecens and Beijerinkia.*
- A total of 100 rDNA sequences have been submitted to NCBI GenBank.
- Identified *Brevibacillus laterosporus* (BPM3), a potential biocontrol bacterium, from *Garam Pani* (a natural hot spring) of Golaghat District, Assam.
- Using partial sequencing of 16s rDNA, identified a novel *Bacillus* sp. with insecticidal property. The bacterium belong to *B. fumarioli* cluster with swollen sporangia.
- In total 573 wild mushroom specimens were collected from Himachal Pradesh, Uttarakhand and Rajasthan and 434 have been identified up to the genus level. Tissue cultures from 191 specimens were raised and conserved in the Gene Bank of the NRCM, Solan. Two new *Lignicolous volvariella* spp., a new species of *Flammulina*, were isolated and identified using 5.8S rDNA sequencing.
- From different geographic environments of brackishwater ecosystem, intertidal zones of Mumbai, freshwater ecosystems of Orissa, 370 bacteria, 66 actinomycetes, 55 fungi, 21 yeast isolates and 7 Archaebacteria have been isolated.
- Two sets of new ISR-based primers have been developed for rapid and sensitive screening of *Flavobacterium* species from aquatic environment.
- A simple diagnostic approach for identification of *Bacillus* spp. per se, and to classify them into different species have been developed.

Nutrient management, plant growth promoting Rhizobacteria and biocontrol

- Cold tolerant strains of *Pseudomonas fragi* and *Pseudomonas lurida* showing phosphate-solubilizing ability at 4 °C have been reported for the first time.
- Promising isolates of entomogenous fungi have been identified against sucking pests like *Aphis craccivora, Scirtothrips dorsalis, Bemisia tabaci* and *Myzus persicae* based on laboratory bioassay studies.

Management of agrowaste, bioremediation and microbes in post-harvest and processing

- A novel species of *Sterptomyces* with unique and uncommon growth and pigmentation pattern has been isolated that has tremendous potential in reclaiming contaminated soils.
- *Serratia marcescens* is reported for the first time to reclaim soils contaminated with poly-aromatic hydrocarbons.

- Potential HCH degrading sphingomonad and non-sphingomonads strains have been isolated, which can effectively reclaim HCH contaminated soils.
- An economically viable and rapid method for compost production has been developed for mushroom production using fungi (?). *thermophilum*
- Two novel p-nitrophenol degrading *Bacillus* spp. and one o-nitrophenol degrading *Bacillus* sp. have been isolated from flooded rice soils retreated with respective isomers of nitrophenol.

Microbial management of abiotic stress

- A bacterial isolate identified as *Bacillus pumilus* has been found to increase grain yield of wheat by 21% under saline soils.
- Seed bacterization with stress-tolerant strains of *Pseudomonas* facilitated sorghum and pearl millet seedlings to survive at 50 °C up to 21 days. Seed inoculation also induced synthesis of a novel high molecular weight protein.

Microbial genomics

Genome Sequencing Project: **The NBAIM is a Nodal Centre for complete genome sequencing of an agriculturally important bacterium *Mesorhizobium ciceri* Ca181.**

It will be the first microorganism to be sequenced in the country. *Mesorhizobium ciceri* is highly specific and promising bacterial strain for chickpea with multiple plant growth promoting activities.

Genomic DNA library of *Mesorhizobium ciceri* has been prepared in pUC 19. A total of 2,000 clones have been sequenced and blast searched. Several genes have been identified that can be further used in different studies.

INTERNATIONAL LINKAGES

The NBAIM is an affiliated member of the World Federation of the Culture Collection (WFCC).

The Bureau has linkages with International microbial resource centres covered under the umbrella of the WFCC and OCDE.

Under the World Bank-aided National Agricultural Technology Project, ICAR approved projects under the Bioscience Component with the ICAR-CABI Bioscience, UK, in 2003.

The NBAIM is a consortium partner in the NAIP Mega Project on "Bioprospecting of genes and allele mining for abiotic stress tolerance".

NBAIM is a consortium leader of the NAIP Project on "Diversity analysis of *Bacillus* and other predominant genera in extreme environments and their utilization in agriculture".

THRUST AREAS OF XI PLAN

- Characterization of AIMs and development of molecular diagnostic tools.
- Database of the collection on electronic format and short and long term conservation of AIMs
- Identification of AIMs for utilization as bio- fertilizers, bio-pesticides, growth promoting microorganisms, bio-indicators and for biodegradation, bio-remediation, bio-composting.
- To conserve and characterize variable AIMs for their optimum utilization by the future generations. A better understanding of microbial diversity promises to provide array of new products and processes as well as a better awareness of microbial biosphere; the earth's life support system.
- Biosystematics of microbial isolates of Indian origin is urgently needed. The NBAIM is the only National body which can take lead in this matter and scientists and researchers from all over the country could get "identification and diagnostics" of AIMs.
- Development of The National Culture Collection Centre as per Budapest Treaty with the state-of-the-art facilities for identification and taxonomic studies of agriculturally important microorganisms. The NBAIM may act as a nodal centre for developing a "National Facility for the Identification of AIMs".
- The NBAIM will act as a nodal agency responsible for taking appropriate measures for the system-wide management of AIMs.
- Enhancing productivity of crop plants
- Deciphering functional diversity of bacteria with respect to abiotic stresses (soil salinity, drought, temperature) for use in agriculture.

D.K. Arora
National Bureau of Agriculturally Important Microorganisms
Kusmaur, Post Box No. 6
Mau Nath Bhanjan 275 101 (Uttar Pradesh)
e-mail: nbaimicar@gmail.com

Varietal Releases

CHCL 105 (Neelachal Prabha) chilli

CHCL 105, a mass selection from large population of chillies, has upright growth, heavy fruiting potential, dark-green fruits at immature stage and crimson-red at ripening. It has been identified as a good performer with respect to yield and quality in terms of pungency

and colour. The average plant height is 100 cm and plant spread is 70cm x 60 cm. The plant bears about 110 dark-green highly pungent fruits/plant when harvested at the green stage. Each fruit measures 9.5 cm in length and 0.7 cm in width, which turns red after ripening. The green fruit yield of the variety is 13.2 tonnes/ha, and red dry fruit yield is 3.6 tonnes/ha. The fresh to dry recovery of fruits is 27% having smooth dry surface of the fruit. Neelachal Prabha can be grown for green and dry red chillies, but it fetches high price as a green fruit. The variety is best suited for *rabi* under eastern Indian conditions.

CHCL 127 (Neelachal Agni) chilli

Keeping in view the preference of the consumers and to meet needs of the growers, research on varietal development of chilli was initiated. Out of approximately 300 germplasms, CHCL 127 (Neelachal Agni) has been selected as a dual-purpose variety in respect to yield and quality. Its average plant height is 60 cm with plant spread of 100cm x 100 cm; flowering initiates within 50 days after transplanting. The plant bears light-green fruits of 8.5 cm length and 0.6 cm width, and yields 250-300 fruits / plant in the first crop, and similarly in the second crop, if green fruits are harvested for culinary purposes. If the fruits are allowed on plant, they turn red after ripening with high pungency. Green fruit yield is around 26 tonnes/ha and dry fruit yield is around 6 tonnes/ha. The fresh to red dry recovery of fruits is 26% having wrinkled fruit surface. The variety showed mild resistance to thrips and aphids. Neelachal Agni can be used both as a green as well as a red chilli. The variety is best suited for *rabi* under eastern Indian conditions.

G. Naik, Vishal Nath, H.S Singh and **Sudhamoy Mandal**
Central Horticultural Experiment Station
Aiginia, Bhubaneshwar 751 019 (Orissa)

VL Bean 2 Frenchbean

This bushy-type, early-maturing Frenchbean (vegetable type) variety has been notified for Uttarakhand hills. It was developed by the hybridization of VL Bauni Bean 1 × Contender through pedigree method. Its pods are light-

green, round, stringless, smooth and pulpy. First picking of fruits can be taken at 40-50 days after sowing. The variety is resistant to root-rot disease. In hills, it yields 10-11 tonnes/ha, and is suitable for cultivation under organic and inorganic conditions.

N.K. Hedau, Shri Dhar, V. Mahajan and **H S. Gupta**
VPKAS, Almora 263 601 (Uttarakhand)
email: hsgupta@lycos.com

Varieties released by State Seed Subcommittee of Jammu and Kashmir

The meeting of the State Seed Subcommittee was held at the SKUAST-K on 23 March 2009. After thorough deliberations, the varieties/hybrids considered for release at the state level, and recommended for the notification by the Central Committee on Crop Standards, Release and Notification of varieties include the following.

Crop	Year of release	Variety	Chief characteristics
Field Crops			
Maize	2009	Shalimar Maize Composite 3	Yellow grains, average grain yield 4.8 tonnes/ ha in high altitudes, matures in 135-145 days, moderately resistant to *Turcicum* blight and is tolerant to cold stress at higher elevations
	2009	Shalimar Maize Composite 4	Flint-type orange yellow grains, average grain yield 6.3 tonnes/ ha in lower altitudes, matures in 100-105 days, resistant to stem borer, aphid and *Turcicum* leaf blight
	2009	Shalimar Maize Hybrid 1	The first hybrid maize developed by the University with average grain yield potential of 7 tonnes/ha under irrigated conditions, suitable for higher altitudes, *chapattis* have capacity of retaining moisture for longer periods
Oats	2009	Shalimar Fodder Oat 1	Average fodder yield potential is 38 tonnes/ha, average plant height is 1.6 metres, is resistant to loose smut, leaf spot, aphid and army worm, and is suitable for the whole valley
Vegetable Crops			
Tomato	2009	Shalimar Tomato Hybrid 1	Single-cross hybrid, average fresh fruit yield potential is more than 70 tonnes/ha, fruit wall is thick, suitable for transportation to longer distances, first picking after 70-75 days, fairly good vitamin C content (22 mg/100 g). The hybrid shows tolerance to early blight, leaf spot and buck-eye rot
		Shalimar Tomato Hybrid 2	Single-cross hybrid, average fresh fruit yield potential is 65 tonnes/ha, flesh is medium thick, pulpy with good amount of vitamin C (25 mg/100 g). The fruit matures in 67-75 days and hybrid is tolerant to early blight, leaf spot and fruit rot
Brinjal	2009	Shalimar Brinjal Hybrid 1	The hybrid with light pink fruit has average fresh fruit yield potential of 87.5 tonnes/ha, is early maturing (55-60 days),with long-fruit bearing period, fruit is of superior quality, has excellent keeping quality and has tolerance to wilt, blight and fruit rot
	2009	Shalimar Brinjal Hybrid 2	The hybrid with purple fruits has average fresh fruit yield potential of 65 tonnes/ha,is harvestable in 55-57 days, has longer fruiting period, is tolerant to wilt, blight and fruit rot. The hybrid is recommended for summer season
Capsicum	2009	Shalimar Capsicum Hybrid 1	The hybrid is characterized by large-sized dark-green fruits, attains yellow colour at ripeness, yield potential is 45 tonnes/ ha, maturity ranges from 55 to 60 days, has longer fruiting period, is tolerant to wilt, blight and fruit rot. Average fruit

Crop	Year of release	Variety	Chief characteristics
			weight is 68.5 g with high vitamin C (135 mg/100 g)
	2009	Shalimar Capsicum Hybrid 2	The hybrid has large-sized dark-green fruits, average fruit yield is 40 tonnes/ha, maturity is 55-65 days with longer fruiting period. The fruits attain red colour on ripeness and show tolerance to wilt, blight and fruit rot
Cucumber	2009	Shalimar Cucumber Hybrid 1	The hybrid has an average yield potential of 65 tonnes/ha, matures in just 50 days and is tolerant to leaf spot, powdery and down mildew. Fruits are crisp, vigorous, with early growth and absence of placental cavity
		Shalimar Cucumber Hybrid 2	The hybrid has an average yield potential of 61 tonnes/ha, matures in 50 days, is available for fairly longer duration, fruit wall is thick. It is tolerant to angular leaf spot, powdery and downy mildews. Placental cavity is absent
Potato	2009	Shalimar Potato 1	It is white skinned variety with average yield of 30 tonnes/ha, is tolerant to early blight, tuber rot and is moderately tolerant to late blight. Tubers have firm flesh and are suitable for making wafers and finger-chips. The variety is suitable for high altitudes
	2009	Shalimar Potato 2	It is red skinned variety with average yield of 24 tonnes/ha,is tolerant to early blight, tuber rot and is moderately tolerant to late blight; tubers have firm flesh with good taste and are suitable for making chips and French-fries
Fruit Crops			
Apple	2009	Shalimar Apple 1	The variety developed from a cross between Sunhari and Prima shows resistance to scab, yields about 95 kg/tree (23.75 tonnes/ha). The variety belongs to mid-season group and has reddish pink, small to medium-sized, crisp, juicy and sweet fruits
	2009	Shalimar Apple 2	The variety developed from a cross between Red Delicious and Ambri has average fruit yield of 106 kg/tree (26.50 tonnes/ha) at 25 years old seedling rootstock. It is moderately tolerant to scab and *Alternaria* leaf spot; the fruits are roundish, red mottled, juicy, crisp and sweet. The fruit has long shelf-life

Novel phosphate-solubilizing bacterium from Uttarakhand Himalayas

Pseudomonas lurida (MTCC 9245) is a novel cold-tolerant, phosphate-solubilizing bacterium isolated from a high-altitude grass rhizosphere (2,500 m amsl, Pithoragarh district of Uttarakhand) on the nutrient agar at 4°C. The identity of the isolate was determined by the biochemical characterization and the sequencing of 16S rRNA (1,430 bp). The sequence has been found 100% similar with the sequence of *Pseudomonas lurida* available in the public domain. In a medium containing tricalcium phosphate as an insoluble phosphate source, it released 12.65 and 4.84 µgml of P per day at 15° and 4°C, respectively. It released 15 µgml of soluble P from rock phosphate on the 8 day of inoculation when incubated at 4°C.

VPKAS, Almora 263 601 (Uttarakhand)
e-mail: vpkas@nic.in

Cyanobacteria as biocontrol agents

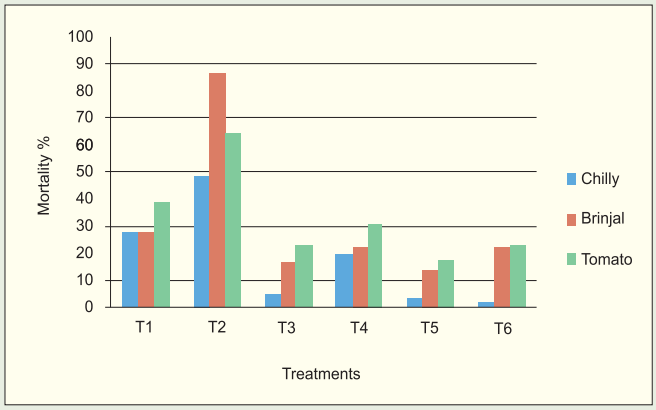
A set of cyanobacterial isolates from diverse agro-ecologies of India exhibited fungicidal potential against phytopathogenic fungi – *Aspergillus candida*, *Fusarium moniliforme, F. solani, Pythium aphanidermatum* and *Alternaria solani* in the laboratory.

Biochemical analyses of the extracellular filtrates of the selected cultures showed activity of the hydrolytic enzymes, chitosanase and xylanase; which is the *first time report* in these photosynthetic prokaryotes.

Significant correlation was observed between the diameter of the zone of the inhibition and enzyme activity, and the microscopic observations revealed disintegration and clearing of the cellular contents of the mycelia.

Sequence homologues of hydrolytic enzymes chitosanase and endoglucanase, identified recently in two *Anabaena* strains, can provide useful information regarding action mode of cyanobacterial metabolites, and their use in biocontrol of agriculturally relevant phytopathogenic fungi.

Biocidal efficacy of the fungicidal compound (s) produced by *Calothrix elenkenii* against damping-off disease caused by *Pythium aphanidermatum* in tomato, chilli and brinjal was evaluated at the National Phytotron Facility along with the commercial chemical control measures (Metalaxyl). Seed treatment with ethyl acetate extracts showed superiority in terms of per cent mortality and plant parameters, besides stimulatory effects on the seedling growth.



Evaluation on chilli, brinjal and tomato in terms of mortality percentage (T_1-Untreated seeds; T_2-Untreated seeds; T_3-Metalaxyl as soil drench + untreated seeds; T_4-Culture filtrate treated seeds; T_5-Ethyl acetate extract treated seeds; T_6-Metalaxyl as seed treatment). All treatments involved application of seeds into potting mix, pre-inoculated with *Pythium aphanidermatum* (except T_1)

Radha Prasanna
Division of Microbiology
IARI , New Delhi 110 012
e-mail: radhapr@gmail.com

Egg parasitoid for control of brinjal shoot-and-fruit borer

Brinjal shoot-and-fruit borer *Leucinodes orbonalis* is a major pest, and causes 20-90% damage to the brinjal- crop. The borer can be controlled effectively using egg parasitoid, *Trichogramma chilonis*.

The egg parasitoid has to be released in large numbers at 40-60 thousand adults/ha/ week from the day the activity of the adults is noticed in the field (based on the pheromone trap). Two to three rows of maize are grown all around the main brinjal-crop. A minimum of 12-15 weekly releases are to be ensured to get promising control of the pest, irrespective of the variety. No insecticides are recommended while releasing parasitoids as most of the insecticides are found toxic.

For control of other pests, need-based spot application of insecticides is suggested. Using above technology at farmer's field, borer damage was brought down to 2.28% (ranging from 1.16% to 3.42%) as against 25-27% in the control field.

Meenakshi Srinivas
Indian Institute of Horticultural Research
Hessaraghatta, Bengaluru 560 089 (Karnataka)
e-mail: director@iihr. ernet.in

Groundwater recharge through surface-water harvesting structures

With high filtration rate in Shivalik region, there is a good possibility of recharging groundwater through surface-water harvesting structures. A significant zone of recharge influence has been observed in down-stream side of the water-harvesting structures up to 200 m (Mandhala watershed, Distt Solan, Himachal Pradesh). Groundwater recharge has been estimated by water-table fluctuations. This varied from 8,101 to 13,420 m^3 for waters-harvesting structures during 2004 to 2008. The study clearly indicates importance of water-harvesting structures, which are primarily meant for irrigation and other multipurpose uses, in effectively recharging groundwater.

V.N. Sharda
Central Soil and Water Conservation Research and Training Institute
Dehra Dun 248 195 (Uttarakhand)
e-mail: vnsharda1@rediffmail.com

Kinnow-fruit coating with lac-based formulation

Waxing is normally recommended in citrus and apples fruits to improve their cosmetic features (shine and colour).

Kinnow is grown in all districts of Punjab, but Hoshiarpur is the main kinnow-growing district, followed by Ferozepur, Faridkot and Amritsar. Now Abohar and Fazilka Tehsils of Ferozepur district are known as densely kinnow-growing areas. There are 17 kinnow waxing and grading plants at Abohar. Commercial formulations such as NU coat Flo, Citrashine, Stay fresh 451 and Stayfresh high shine are being used for coating kinnow-fruits. Chemical fungicide is added in commercial wax emulsion to control post-harvest diseases in stored kinnow-fruits. During operation of the waxing plants, fungicide present in the formulation comes out as fumes from the unit making uncomfortable to stay near the waxing plants.

Fresh Coat is a lac-based formulation developed at the IINRG, Ranchi. Application of Fresh Coat produced better results in respect of gloss, spread area and firmness to fruits as compared to commercial wax, and was liked and highly appreciated by kinnow traders.

Advantages of lac-based formulation over commercial ones

- Natural, non-toxic and composition of lac-based formulation is well specified
- No fungicide addition is required because lac present in the formulation has got inherent property of being antifungal
- Unlike commercial formulations, lac-based formulation is operator's friendly, which means it doesn't produce any obnoxious smell during operation of waxing plant
- Since it is a water-based emulsion hence can be used in pilot plant; combining washing and wax treatment in one operation

Coated kinnow fruits were packed in available commercial CFB boxes and transported from Abohar and Sri Ganganagar regions to Delhi fruit market. Kinnow traders at Delhi expressed their satisfaction and liked glossy appearance of fruits coated with lac-based formulation.

S. Srivastava, B. Baboo and **S.K.S. Yadav**
Indian Institute of Natural Resins and Gums
Namkum, Ranchi 834 010 (Jharkhand)
e-mail: bbaboo@ilri.ernet.in

Contour staggered trenches in ravines for erosion control

The performance of contour staggered trenching (3m × 0.6m × 0.45m) was evaluated in 4 micro-watersheds ranging from 0.4 ha to 1.4 ha. Three trenching systems were designed to trap 25, 50 and 75% of potential runoff and were compared with a control. The treated area was uniformly planted with aonla on humps, bamboo in ravine beds and *Cenchrus ciliaris* in interspaces. Runoff and soil loss decreased progressively from 20.14 to 4.71% and 12.87 to 2.28 tonnes/ha/yr, with increasing runoff trapping potential of staggered trenches. It was further observed that conserved runoff (31.06 to 81.25%)concomitantly retained sediment (30.11 to 85.32%) with increasing runoff trapping potential of trenches. The survival of planted seedings, the mean annual increment of aonla and yield of *Cenchrus ciliaris* increased (air dry weight 5.8 to 12.84 tonnes/ha) with increased trenching densities.

Runoff and soil loss in four micro-watersheds of Chambal ravine

Particulars	Micro-watershed			
	RW_1	RW_2	RW_3	RW_4
Rainfall (mm)	714.2			
Runoff (% of rainfall)	20.14	14.71	9.24	4.71
Soil loss (tonnes/ha/yr)	12.87	9.37	5.60	2.28
Runoff conserved (%)	Control	31.06	53.40	81.25
Sediment retained (%)	Control	30.11	57.98	85.32

V.N. Sharda
Central Soil and Water Conservation Research and Training Institute
Dehra Dun 248 195 (Uttarakhand)
e-mail: vnsharda1@rediffmail.com

Humane electrical stunner for small animals

Each year millions of animals are slaughtered for consumption purpose. The traditional practice of slaughtering animals is by a swift-cut to animal-throat. The concept of humane slaughter is behind the adoption of the practice of stunning animals before slaughter.

An electrical stunner for stunning small food animals has been developed at the University.

The instrument has been tested on pigs using varied voltages; and 85V and 75V were found optimum for effective stunning. This instrument can be used for stunning other small animals like sheep and goats.

The stunner has been developed to suit the needs of the rural slaughterhouses in the country. The cost of this newly developed stunner is about Rs 10,000; the existing stunners in the global market cost more than one lakh rupees.

J.J. Robinson Abraham, V. Venkataramanujam, K. Dushyanthan, M. Siddarth, S. Ezhilvelan and **R. Narendra Babu**
Tamil Nadu Veterinary and Animal Sciences
Chennai 600 051 (Tamil Nadu)
e-mail: tanuvas@vsnl.com

Mechanized system for planting on plastic-mulched raised beds

A modular design of seed-planter has been designed and developed for planting seeds on the raised beds under the plastic mulch. The planter consists of 4 modular seed-planting units attached to a tractor-mounted frame to work as an independent planter for sowing. The planting unit consists of vertical rotor-type seed-metering units. The seeds from the rotor are dropped in the specially designed cavities on a rotating planting ground wheel. On periphery of the planting wheel, 12 pointed jaw-type punches are provided. The jaw opens by the action of the CAM lever for transferring seeds from seed cavity to furrows. The jaw opens when it is close to ground, and is automatically closed by the spring action after seed has been dropped in the punched hole. Four such modular units can be attached for planting 4 rows on two beds (two rows on each bed) simultaneously. Existing design of the machine has been made suitable for laying plastic sheets of 100 cm width simultaneously on to two beds of 40-50 cm top width.

During the trial of the planter on groundnut, the field capacity and field efficiency were 0.18 ha/hr and 75% respectively, for planting 4 rows of groundnut at 30 cm row-to-row spacing. The field capacity of the mulch laying machine for laying plastic mulch on two raised beds (42-cm top width) simultaneously was 0.22 ha/hr.

The yield of groundnut-crop under conventional method, raised beds without plastic mulch and mulched raised beds were 1,270, 2,290 and 2,940 kg/ha, and the gross returns were Rs 25,400, 45,800 and 58,800 per hectare. The labour-saving for sowing on plastic mulch covered raised beds was 66% over flat method and 49% over raised-bed sowing.

V. V. Singh, B. K. Garg and **R. S. Singh**
Central Institute of Agricultural Engineering
Nabi Bagh, Berasia Road
Bhopal 462 038 (Madhya Pradesh)
e-mail: rsingh@ciae.res.in, kvrr@ciae.res.in

Detecting admixture of soymilk in milk

Two methods, one colour-based test and the other immuno-diffusion based test for detection of presence of soymilk in milk have been developed . The first is based on the inhibition of the activity of exogenously added enzyme by the components of soymilk. After addition of substrate and reagents, the colour intensity of pure milk vis a vis adulterated milk is compared. Pure milk gives pink colour and adulterated milk shows drastic reduction in the intensity of the pink colour, which can be visually distinguished.

The test results can be obtained in 50 min. The sensitivity of the test is 2.5 to 10%, depending on the methods of soymilk preparation. Other adulterants such as urea, starch, glucose, sucrose, hydrogen peroxide and formalin do not interfere in the test. The test does not require any expensive equipment and can be applied at the quality control laboratories.

The second test has the sensitivity to detect the presence of 1% soymilk in milk admixture. The results can be availed overnight. The precipitation (antigen-antibody complex) lines are stained for enhancing visibility. An innovative step in the test has been added to allow flow of milk micellar proteins in agarose gel during diffusion. This test also does not require and expensive equipment, and can be applied at the quality control laboratories.

A.K. Srivastava
National Dairy Research Institute
Karnal 132 001 (Haryana)
e-mail: dir@ndri.res.in

Dietetic chhana podo production

Chhana podo is a very popular milk sweet made from whole milk. It is rich in sugar and fat, and therefore, is a high-calorie product. A need was felt to develop a low-calorie bulky product with original taste to promote consumer acceptability. To reduce calorie content of chhana podo was attempted. Chhana podo prepared by using 2% milk fat was the best among 1.0, 1.5 and 2.0% fat. Optimized fat level was used with different binding agents, maltodextrin, suji and sago at 10% and 15% for podo manufacturing. Podo prepared with maltodextrin and sago showed moist appearance with unbaked body and off flavour. Suji with 10% level was selected and replaced sugar with artficial sweetener. Since aspartame loses its activity on high baking temperature in acidic medium and use of seccharin sodium showed some after taste, podo prepared with sucralose was found most suitable and similar to control. Among 50, 75 and 100% levels of sugar replacement by sucralose, 50% was adjudged to give product similar to control podo.

The moisture content of dietetic chhana podo has been 8-9% higher than control, and sugar and fat is half in dietetic chhana podo. There is not much difference in lactose and protein content. The calorie content of dietetic podo is found 25% lower than control. Shelf-life of dietetic podo is 3-4 days and 7-8 days without and with 0.15% potassium sorbate, respectively at room temperature, when packed in polyethylene pouches. The corresponding shelf-life of control podo is 7-8 days and 11-12 days. Dietetic podo without preservative showed 16-17 days of shelf-life at refrigerated temperature while all others showed shelf-life of more than 3 weeks.

A. K. Srivastava
National Dairy Research Institute
Karnal 132 001 (Haryana)
e-mail: dir@ndri.res.in

Insulated fish bags for hygienic handling of iced-fish

Fish become unfit for human consumption in about 8 to 12 hours after they are taken out of water. The spoilage rate of fish at 5.5°C and 11°C is twice and four times as fast as that at 0°C. Generally icing is done at 1:1 level, and it is usually done in the insulated ice-boxes, which are effective but are not handy for use by fishermen on the small traditional craft, and by fish vendors and consumers.

Insulated bags are made of an outer water-proof covering, a middle insulation foam layer, and an inner plastic lining. Laboratory studies using insulated bags filled with ice showed that ice remained intact for six hours in the insulated bags, and 20% of ice remained still in solid form even after 24 hours.

Four types of fish bags have been designed for the use by traditional fishermen, traders, fish vendors and consumers *viz.*, big, medium and small sized insulated fish bags,

Big size insulated bag for tuna fish caught by traditional fishermen on small boats

Medium size insulated bag for use by fishermen in reservoir and riverine fishing

Convenient insulated bag for use by individual urban fish consumer

Small size insulated bag for marketing by fish vendors and fisher women in towns and urban areas

The temperature of freshly caught fish and shellfish ranged between 26°C and 27°C. At the end of six hours, the temperature of fish in the insulated bag ranged between 2°C and 4°C and the temperature of fish kept at the ambient temperature ranged between 25°C and 27°C. Average time taken for the traditional boat operators to reach shore after catching fish is about six hours. The quality of the fish brought in ice using insulated bags were found good as the total bacterial counts, TVBN and PV values were low, and feacal coliforms were absent.

and consumer bags. The big sized insulated bag (175 cm length x 22 cm breadth x 44 cm height) is meant for traditional sail boat fishermen to preserve quality of tuna. Medium (60cm bottom length, 30cm upper length, 22cm breadth and 45 cm height) and small (48 cm bottom length, 30cm upper length, 18cm breadth and 35 cm height) insulated bags can be used by fish retailers/vendors for preserving quality of fish such as seer fish during transport. The small insulated bags are particularly suitable for retail vendors/ fisherwomen, who purchase fish at the auction centres/ the fish-landing centres and sell them from door-to-door. The consumer bag with 30cm length and 60cm height can be used by consumers for bringing home iced fish/prawn in good quality.

Insulated fish bags are very useful for fishers who fish in reservoirs and rivers on small boats, which cannot carry the ice-boxes. These bags enable fishers, small traders and fish mongers to prevent or minimize post-harvest losses, and to keep the quality of fish at affordable cost.

D. Imam Khashim, B. Madhusudana Rao and
A.K. Chattopadhyay
Visakhapatnam Research Centre
(CIFT)
e-mail: cift@ciftmail.org

Potato processing varieties for Indian industry

Our country had no processing varieties of potato till 1998, and this was the major constraint limiting growth of potato-processing industries in India. A breeding programme for the development of indigenous processing varieties culminated in the release of chipping varieties, Kufri Chipsona 1 and Kufri Chipsona 2 in 1998, an improved processing variety Kufri Chipsona 3 in 2005 for Indian plains, and first chipping variety Kufri Himsona for hills in 2007. And in view of the demand of the French-fry industries, Kufri Frysona, the first Indian fry variety has been released in 2009.

Through these varieties, long pending demand of the industry has been met as these varieties produce >21% dry matter and contain low reducing sugars (<0.1% on fresh wt basis), when grown at different locations in India. Kufri Chipsona 1 due to its oblong tubers is also utilized for making French-fries.

All big processing industries in India, are now using these varieties.

These varieties give higher yield of chips, which absorb 4-6% less oil, and hence reduce cost of production, besides providing low fat and low calorie product to health-conscious people.

The organized and unorganized potato-processing sectors presently consume about 4% of the total potato production, which was <1% in 2003. It is expected that total utilization of potatoes in the processing sector in 2010 will rise to 1,740,000 metric tonnes or about 6% of the total production of the country. The excellent performance of these processing varieties in different agroclimatic zones of the country and during storage at 10-12 °C with CIPC (Isopropyl N-(3-chlorophenyl carbonate) has further enhanced availability of the desired raw material round-the-year and thus has brought a 'crunchy revolution' in India. India has thus made its entry in the proud list of countries like US and a few European countries, which have their own processing potato varieties.

S.K. Pandey
Central Potato Research Institute,
Shimla 171 001 (Himachal Pradesh)
e-mail: dircpri@sancharnet.in

Castor depodder and decorticator

Castor (*Ricinus communis*) has high industrial and medicinal uses. Although the crop has many uses, it is still a neglected crop due to the laborious processing operations involved.

A castor depodding and decorticating machine has been developed at the institute, which separates seeds from pods and dehulls seeds. The unit contains a cleaning-grading assembly also that grades seeds in two sizes. Its depodding and decorticating efficiency has been found 98.5% at 6.22% (w.b.) moisture content of the pods.

Overall dimension of the machine is 1255 mm × 625 mm × 1595 mm. This machine can be operated conveniently by a single person.

The fabrication cost of the machine is Rs 25,000, excluding cost of 2-hp electric motor. The operating cost of the machine is Rs 0.65 per quintal of castor pods for 8 hr per day operation.

Central Institute of Post-Harvest Engineering and Technology, P.O. PAU Campus
Ludhiana 141 004 (Punjab)
e-mail: ramabhau@yahoo.com

VL-WAR – a wild animal repellent

Wild animals, boar, porcupine, jackal, fox, hare cause about 20-30% damage to different crops. Major crops attacked by the wild boar and other wild animals are potato, colocasia, tomato, okra, brinjal Frenchbean, garden-pea, cabbage, cauliflower, groundnut, carrot, strawberry, maize, soybean, gram, wheat etc. and many other agricultural and horticultural crops.

Considering the menace of the wild animals, a equipment has been developed, which repels nocturnal wild animals.

Wild animals get scared from the fire is a well-known phenomenon. The same concept has been utilized in the newly developed equipment VL-WAR (VL-Wild Animal Repellent) for scaring and repelling animals from agricultural fields.

Field testing of the equipment VL-WAR was done in the most severely affected village Bhagatola, Block Dhauladevi, District Almora. The equipment was installed at the strategic locations of the village and operated throughout the night. Under hilly condition, normally it covers about one hectare. In general, entire village can be made free of nocturnal wild animals' damage by installing 10-20 VL WAR at the strategic locations.

S.N. Sushil, K.P. Singh, J. Stanley, J.C. Bhatt and **H.S. Gupta**
VPKAS Almora 263 601 (Uttarakhand)
e-mail: hsgupta@lycos.com

IMPACT OF TECHNOLOGY

Farmers' participatory action research programme: Impact of technologies

Integrated nutrient management (INM) technologies were demonstrated in maize + cowpea intercropping – wheat, maize-wheat + mustard (9:1), paddy-wheat (irrigated) and maize - potato - onion rotation in Dehra Dun (Uttarakhand) and Sirmour (Himachal Pradesh) during *kharif* 2008. Yield increased from 32 to 62% in demonstrated plots and water-use efficiency increased from 40 to 66.7% with different technologies compared with farmers' practices. Net returns from *kharif* crops were Rs 6,984, 5,019, 10,603 and 5,679 from the above mentioned cropping systems. Water saving was higher in system of rice intensification (SRI); to the tune of 64.9%; compared to conventional technology. INM of paddy with SRI system benefited farmers in productivity and net returns marginally, but water saving was recorded at 25% over and above to INM rice technology.

Benefits of technologies at Uttarakhand and Himachal Pradesh

Crop demonstrated	INM technologies (% increase)	Yield benefit (% increase)	WUE benefit (Rs)	Net returns
Maize and cowpea	Maize+cowpea intercropping wheat	62.0	66.7	6,984
Maize	Maize–wheat+mustard (9:1)	39.5	44.8	5,019
Paddy (Paddy,SRI)*	Paddy–wheat (irrigated)	32.2(38.3)*	39.9(64.9)*	10,603 (11,913*)
Maize	Maize–potato–onion rotation	43.6	48.0	5,679

* SRI – System of rice intensification

V. N. Sharda
CSWCR & TI, Dehra Dun 248 195 (Uttarakhand)
e-mail: vnsharda1@rediffmail.com

Face care systems from kinnow-peel

Kinnow, a major citrus-fruit of northern states, is processed into juices by the industry and fruit vendors. This generates processing waste in the form of kinnow-peel. Natural facial care systems from dried kinnow-peel powdered extracts have been developed. CIPHET Face mask/pack and Face toner are a rich blend of major concentration of the powdered extracts and other minor components as preservatives and sticking agents. These products possess very effective deep cleansing properties along with stringent, disinfectant and antiseptic actions to protect facial skin from unwanted blemishes as the peel is a rich source of vitamin C, carotenoids, limonene, antioxidants, micronutrients and antibacterial limonoids a compared to the peels of other citrus-fruits. The Institute is in the process of filing a patent for this technology.

Central Institute of Post-harvest Engineering and Technology, Ludhiana 141 004
e-mail: ramabhau@yahoo. com; ciphet@sify.com

Published by Dr T.P. Trivedi, Project Director, Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi 110 012. 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** ***Production :*** **V.K. Bharti and Punit Bhasin**

THE LAST PAGE

Agriculture continues to be central to India's large and growing population. Between 1980-81 and 2000-01, share of the agriculture in the national income declined from 38.8 to less than 18 per cent. But the workforce engaged in agriculture witnessed only a very small decline from 60 to 52 per cent. Slow growth in agriculture with no significant decline in labour force has created a serious disparity between agriculture and non-agriculture and rural and urban India. A worker in the non-agriculture sector earns more than five times the income of a worker in the agriculture. It is in this context that inclusive growth is being talked here, there and everywhere. Public investment in agriculture has crossed 4 per cent of the GDP agriculture at the current price for the year 2007-08. Now it is time to maintain the tempo of growth in the public investment. There is also a pressing need to improve efficiency and effectiveness of investment.

To increase productivity and quality of farm produce, the farmers all-over the country would need access to quality propagules/seeds/breeds/fingerlings. This, in turn, will rely on higher systematic production of the quality basic material that should reach end-users in the desired form and at affordable cost. In this endeavour, an inter-departmental 'National Quality Seed Mission' should be launched.

For the horizontal spread of improved hybrids/varieties, on-farm quality seed production needs to be strengthened. A mission-mode approach requires to be followed where small seed quantity could be provided to each village /village *panchayat*. This would help in the spread of seeds from farmer-to-farmer in the shortest possible time and in the cost-effective manner. Similarly, livestock and poultry strains/breeds need to be mass-produced and supported by adequate supply of vaccines and diagnostics. Livestock health-care facilities need to be augmented substantially to enhance livestock sustainable productivity.

Lately, several parts of India are facing severe water shortages. By 2020, we would need about 29% more water for agriculture whereas water availability is likely to be reduced by 12%. Therefore, we need to augment, conserve and manage water resources through improved water storage, conveyance, application and crop-water-use efficiency, without detriment to environment and natural resource base. In addition, conservation agriculture, integrated nutrient management, carbon sequestration and amelioration of polluted soil and water should be undertaken on a priority basis. Effective policies for management of range and pasture lands and for grazing need to be developed and implemented.

Dr Mangala Rai, Secretary (DARE) and Director-General (ICAR)

To avail market facilities, farmers have to travel long distances, which increases transaction costs. To provide dynamism and efficiency to marketing system, investments are needed for development of post-harvest and cold-chain infrastructures nearer to farmers' fields.

Investment in agricultural R&D, spreading promising technologies, creating rural infrastructure, and evolving appropriate institutions would certainly lead to an accelerated agricultural growth. Recently launched 'National Food Security Mission and Rashtriya Krishi Vikas Yojana' are welcome steps in this direction. But far more is yet to be done.

To address various challenges, a multi-pronged strategic intervention should focus primarily to: (i) Enhance investment for need-based agricultural infrastructure; (ii) develop human resources and effective knowledge management system; (iii) enhance productivity and competitiveness of farm produce in the production area; (iv) promote farmer-consumer linkages by improving marketing efficiencies; and (v) provide an enabling policy environment so that farmers could access input and output markets, reduce cost and receive remunerative prices.

It would be desirable to plan and manage resources in an integrated manner to advance inclusive benefits to all.

(Mangala Rai)
e-mail: mrai.icar@nic.in