munity, farmers and indigenous people on biodiversity and advocated the equivalent share of benefits to them, arising from the commercial use. S. Sopory (New Delhi) elucidated that the plants sense abiotic stresses via various signal transduction pathways. In salinity the calcium sensor activates the kinase (Ca-binding protein) and sodium is thrown out of the cell.

The deliberations and discussion resolved (i) to collate the pertinent information on the endangered taxa for public attention and scientific record, (ii) to encourage floristic and taxonomic study, especially in the hot spots and identification of sensitive and tolerant species through molecular markers, (iii) capacity building, and (iv) utilization of biomass, exploitation of indicator species, pollution monitoring, analysis of the potential chemicals and study of bryophyte-associated animals and microorganisms.

During a field excursion to Nainital, the delegates caught glimpses of bryo-vegetation of various habitats, mineral-enriched substrates, indicator value and role of mosses in building of mineral rocks. They marked various growth forms in relation to the habitat and micro-climatic condition. The conference was immensely successful and well organized.

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MEETING REPORT

Learning to change*

The crucial and varied needs for, as well as some possible processes of change in agricultural R&D, were analysed by experts and policy makers in a workshop on 'Agricultural Policy: Redesigning R&D to Achieve the Objectives'. The workshop brought together several actors and agencies concerned about the future of agricultural knowledge systems in India.

A crucial expectation from the workshop was to gain insights into the relationship between agricultural science and policy in the Indian context. While the recent National Agricultural Policy document of Government of India provided an immediate focus, the larger question was concerned with the capacity of R&D to identify and respond to the critical and durable elements of agricultural policy.

The opening session on 'The context for change', proclaimed that change in R&D was imminent. The session began with a clear statement of the workshop objective, viz. 'To deliberate and arrive at some crucial suggestions and an agenda for action to guide this change'.

As the main sponsor and organizer, the National Academy of Agricultural Sciences (NAAS) made an explicit demand for shifting from perceptional guidance in R&D to well-debated and analysed measures for change. The Academy (President V. L. Chopra) desired that these debates and suggestions be: (a) scientific and analytical, (b) honest and uninhibited. Presenting the ICAR perspective, the DG, ICAR, demanded that the workshop should provide a picture of how to go about changing R&D organizations. The keynote address by A. Vaidyanathan (MIDS, Chennai) made a candid assessment of the changing context of agriculture, and urged that innovation in the public sector agricultural R&D be conversant with these dynamics. The past decade has witnessed significant changes in growth rates and trends in agricultural production/productivity, resource use – in irrigated and rainfed agriculture, and has given us evidences of ecological degradation. Agricultural R&D continues to appease itself with claims of success (limited often to varietal release), while there is evidence of declining productivity of disciplinary commodity-based knowledge in the face of these agro-ecological problems. Other changes in context include increasing presence of private sector and profit motives in agricultural R&D, an erosion of public sector commitment to basic and poverty-oriented knowledge, and the potential of emerging biotechnology and information technology regimes. The demands of 'sustainability' and poverty reduction, the need for introspection and the role of evaluation in R&D, and the dialectical relationship between data generation and utilization in R&D (as one of the most important inputs for reflection and changes in the direction of research), were also presented as critical changes in context. The four papers presented in this session, the discussant's response and inputs from the floor, highlighted the important milestones of success in green revolution technology achieved thus far. This success, however, must not perpetuate a 'business as usual' approach to the generation and utilization of knowledge and technologies in the agriculture sector. The innovation system must now look for ways forward to the next stages of excellence in science and success, agro-ecological and socio-economic goals.

The session on 'Organization and management of research for sustainable agriculture' highlighted the need for an analytical framework that can guide the transition of research organizations from their productivity goals to sustainability goals. The papers and interventions questioned the capability of the existing research system to engage effectively with the institutional landscapes and dialectical processes of agricultural innovation. In the session on 'Technology development, diffusion and linkages', these organizational issues were analysed further. It was argued that the linear model of technology generation, diffusion and adoption in spatially and functionally dif-

*A report on the workshop on 'Agricultural Policy: Redesigning R&D to Achieve the Objectives' held at the Indian National Science Academy premises, New Delhi between 10 and 11 April 2002, sponsored by the National Academy of Agricultural Sciences, and organized jointly by the Centre for Advancement of Sustainable Agriculture, National Institute of Science, Technology and Development Studies and National Centre for Agricultural Economics and Policy Research.

ferentiated organizations, must give way to a nonlinear model of continuous participatory learning within the larger agricultural innovation system. The latter, the innovation systems approach, based on iterative learning and building partnerships with the relevant actors/ agencies in the agricultural innovation system, demands institutional and organizational changes. There is a felt need to strengthen social science research in agricultural innovation systems, to enhance the social and ecological learning capacity of R&D organizations. Finally, the papers in the session on 'Addressing sustainability goals' were concerned with two crucial aspects of long-term sustainability in agricultural innovation systems: (a) the agricultural education system to produce dynamic manpower, and (b) the natural resources research sub-system to ensure sustainable use of and conservation of natural resources. Both the groups of papers addressed institutional and organizational issues that impede the goals of sustainability in Indian agricultural R&D.

Some of the important issues and suggestions that emerged from the technical sessions were discussed further in the last session. The main recommendations of the workshop are:

- The policy regimes of the past, which put a huge public R&D system in place, have changed. The current economy and policy will not support this R&D system whose performance has definitely declined.
- Since the productivity of crop and disciplinary subject-matter research has reached a plateau, an interdisciplinary issue-based research approach is necessary.
- Success of the green revolution should not lead to complacency in this era with pressures from WTO, emerging technologies like biotechnology, and declining international (CG system) support for agricultural R&D. New methods of funding R&D and partnerships in R&D must be sought.
- Personnel policies in the system need to undergo a change to promote innovation, with due reward to merit.
- Major changes in the conduct of R&D are needed, most crucial being an analytical framework to orient agricultural research to meet sustainability goals and specific poverty-reduction goals.
- Indian agricultural R&D must seek the processes and structures for an internal thinking mechanisms at all levels.
- While decentralization and accountability down the line to the Principal Investigators have been recommended time and again, it has always been translated to mean financial decentralization. A progressive and dynamic R&D system that caters to policy demand for agro-ecological, diversified strategies for agriculture demands decentralization of ideas and approaches in the conduct of research.
- Increasing stakeholder involvement in research decision-making and better research partnerships in technology generation and utilization demand institutional learning and organizational changes that enable these learning processes.
- Better social science research capabilities to analyse and develop R&D strategies for specific agro-ecological regions or farming systems perspectives. This will, therefore, call for greater interaction between natural sciences and social sciences.
- There is a need for emphasis within ICAR and SAUs (in the public sector) on an innovation systems approach to agricultural policy, science, and development.

It was concluded that professionals in the innovation system, policy-makers and other stakeholders have to define the socio-economic and sustainability goals in an ecoregional perspective and work towards reorienting location-specific R&D needs to meet these goals.

This workshop was a small beginning; yet, a significant one in which the need for change in R&D was discussed and analysed, openly and honestly.

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NEWS FOCUS

Science in Thiruvananthapuram

Kerala. Viewed from the skies is lush green, white surf lapping the coastline and aptly described as 'God's own country'. 'Keralam' is 'land of coconut trees'. But, can this remain so? Kerala is beset with problems; those requiring intervention of scientists. A 570 km coastline, several rivers and estuaries need scientific monitoring. A high population density means more erosion and more landslides. Improved land use, alternate building materials, pollution checks, water budgeting, watershed development, terrain analysis, soil studies, materials development and biodiversity protection need attention. Geoscientific studies of minerals, seismology and understanding natural radioactivity occurring on the Kerala coast are necessary for Kerala's continued health. Thiruvananthapuram, Kerala's capital city has several institutions involved in scientific and medical research. Kerala is the first state in the country to have a State Committee on Science and Technology, which now includes Environment also, and is known as STEC (Box 1).

Centre for Earth Science Studies

The Centre for Earth Science Studies (CESS) celebrates its silver jubilee in 2002–2003. For the development of