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BREAKTHROUGH

CONTENTS

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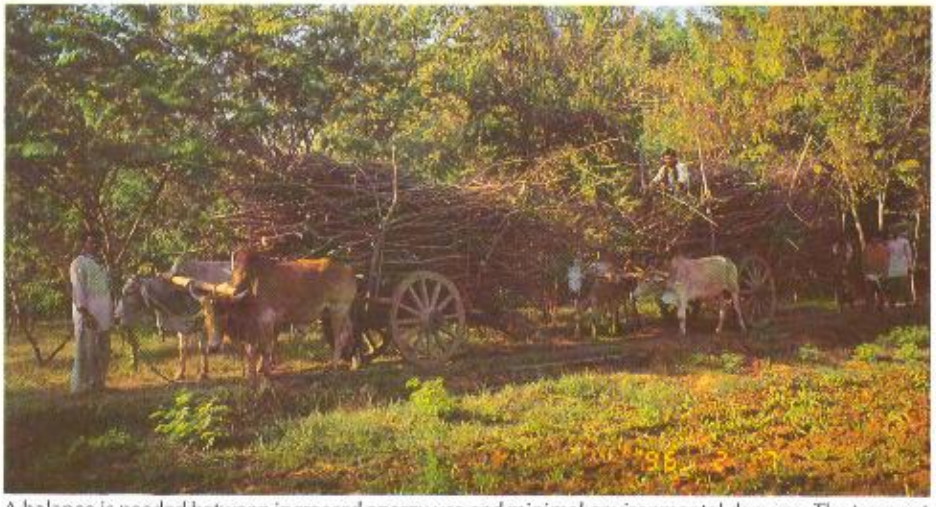
Protecting Environment: An Emergent Issue

"The future of agriculture will depend upon our ability to promote sustainable land-and-water use systems. The beautiful, kind and silent `mother earth' is telling us that all our economic accomplishments must be based on corresponding ecological obligations. Ignoring this precept will lead to widespread ecological fire", said Dr Swaminathan (1990).



A balance is needed between increased energy use and minimal environmental damage. The trees cut for fuel, fodder and timber should be replaced by fast-growing trees to keep the balance of the Nature.

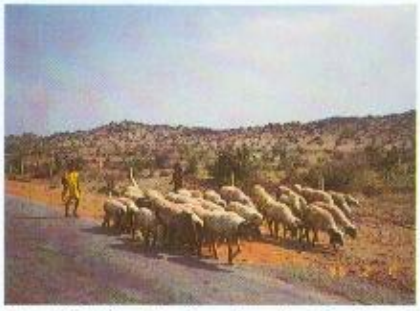
Today, in the late 20th century, we are facing serious depletion of our resources, which are indispensable for our social and economic development. Soil is impoverished, water and air are polluted, and there is an increase in the intensity of genetic erosion in plants and animals, and perhaps even the climate is getting irreversibly altered due to global warming and greenhouse effect.

The fundamental challenges in the 21st century are to find ways for sustainable development that are environmentally sound, equitable, and allow respect for individual and social rights. Poorly planned developments are often environmentally destructive.

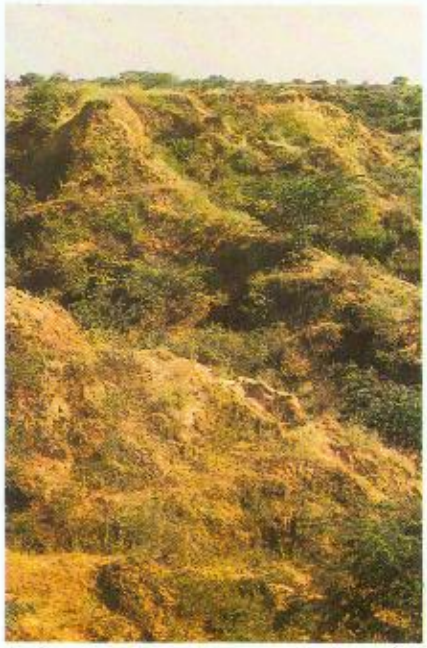
Over-exploitation of Natural Resources Leads to Environmental Hazards

River-bed farming–Although it as an age-old farming system gives seasonal employment but has become risky due to use of huge amounts of organic manures (many times sewage manure is used), chemical fertilizers and pesticides, which not only pose serious threat to human health but also pollute river.

Shifting sand-dunes–They are the result of loss of permanent vegetal cover in the arid region.



Desertification–It arises from the fragility of the dryland ecosystems, which under excessive pressure of human use, overgrazing, felling of trees, lose productivity and ability to recover.



Ravines–Loss of vegetal cover and gully erosion along the rivers result in massive ravines (about 2.02 million hectares are under ravines in India)

Mine-Overburdens–Represents a site of dust pollution.

Future Thrusts

1. Develop farming systems based on optimum yield potential and minimum environmental damage.
2. Agriculture need to be based on judicious use of renewable resources of energy. New technologies of crop production are needed to reduce gradually the use of chemical fertilizers, pesticides and heavy farm machines without affecting crop productivity. Emphasis on biofertilizers, biopesticides, conservation farming and integrated watershed management, etc. are precepts that assure sustainable food supplies.
3. Arrest land degradation and water pollution.
4. Greening of India through agroforestry systems.
5. Motivating people to conserve biodiversity through participation in genetic resources evaluation in collaboration with plant breeders' and to practice 'conservation farming systems'.
6. Improve 'restoration management' of fragile areas.
7. Linking of environmental protection with economic development.
8. Increase sustainable food production systems on problem soil areas.
9. Reduce wastage and recycle biomass. Burning of biomass must be stopped.
10. Agroforestry-based farming systems should be encouraged. They will not only assist in the utilization of excess water through tree plantation right from the beginning but will also create new resources for fuelwood, fodder and timber, besides improving microenvironment.

Degraded Mined Watershed in Mussoorie Hills Becomes Green

Mining for limestone and phosphorite in Mussoorie hills of Doon Valley has caused serious environmental problems. A limestone mined watershed (64 hectares) at Sahastradhara was taken up by the Central Soil and Water Conservation Research and Training Institute (CSWCRTI), Dehra Dun, for rehabilitation studies in 1984. Steep slopes and high rainfall (3,000 mm/annum) used to result in heavy flow (550 tonnes/ha/annum) of debris from this mined area, causing disruption of vehicular traffic on road, landslides, land degradation, drying of water sources, pollution of water and air; and it was a constant threat to habitants.

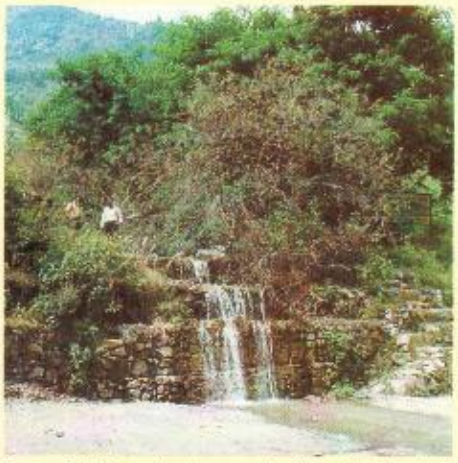
The watershed was treated with a package of integrated soil and water conservation (WSC) measures. Gabion spurs, toe/retaining and side walls were provided for stream-lining of flow and bank protection. Quick-growing trees *Acacia catechu, Cedrela toona, Leucaena leucocephala, Lannea coromandelica* syn. *L. grandis* and *Salix*, bushes *Ipomoea carnea, Vitex negundo, Arundo donax* and grasses *Chrysopogon fulvus, Napier, Eulaliopsis binata, Saccharum spontaneus* were planted. Contour trenches were made for quick establishment of vegetation by conserving moisture. Geojute technique was used to stabilize highly degraded mine-spoils. The overall cost of reclamation came to Rs 15,000 per hectare.

As the result of rehabilitation, the soil erosion has been checked, clear water springs have regenerated, and useful species of vegetation have been established in the area.

Besides, the rehabilitation measures applied have effected a saving of more than rupees one lakh per year, which the State PWD used to spend on removing huge amount of debris from the Sahastradhara road.

Dr J.S. Samra
Director
Central Soil and Water Conservation Research and Training Institute
218, Kaulagarh Road
Dehra Dun (Uttar Pradesh) 248 195

The abandoned mined watershed before treatment (1984)



Perennial flow of clean water from the treated watershed

The Indian Council of Agricultural Research is conscious of the above facts and is continuing its emphasis towards conservation and upgradation of natural resources for assuring sustainable productivity in harmony with healthy environment for the posterity.

The ICAR in this pursuit

Soil erosion is a serious threat. The ICAR Institutes working in different regions have evolved technologies to arrest as high as 95% water run-off and soil loss. The Indian Grassland and Fodder Research Institute at Jhansi has demonstrated that through land-use systems on the rainfed degraded lands, it was possible to decrease run-off and soil loss by more than 90%. The agroforestry systems not only prevent soil erosion but have the capacity to increase carbon sequestering. The planting of the suitable trees and grasses in 35 million hectares of the Indian wastelands has shown the potential of sequestering 0.84 and 1.06 Pg (1 Pg = 10^{15}g) of carbon in vegetation and soil organic matter, totalling to 1.9 Pg, in 7 years, as against CO_2 emissions of 2.27 Pg in the same period. Thus global warming can be slowed down, which has serious implications for agriculture and environment. Shifting cultivation and the practice of growing potato on bunds and pineapple along the hill-slopes, and large-scale deforestration have caused various land-use problems in the hills of the Eastern Himalayan Region. The ICAR Research Complex for the NEH Region has worked on lines with tribal wisdom and many technologies for proper utilization of these lands–zabo system, bench terracing, micro-watershed management–have been evolved which have high potential for checking soil

and nutrient loss. All these farming systems on micro-watersheds were able to retain 90-95% rain water and reduce soil erosion.

Bioamelioration of alkali soils through *Prosopis chilensis* syn. *P. juliflora* and *Daplachne fusca*-based agroforestry systems has been found to not only optimize land productivity but has also reclaimed soil in 5 years (pH brought down from 10 to 7.5) as demonstrated by the researches at the CSSRI, Karnal. The reclamation of canal-water inundated soils through grasses and trees has also been standardized. This process of bioamelioration not only saves adjoining fertile lands but increases production of much needed fodder, firewood and timber.

The ravinous areas (2.02 m ha) pose yet another environmental and socio-economic problem. The pace of soil erosion is accelerated by faulty land-management practices. Researches of the CSWCRTI, Dehra Dun, and its stations at 3 places have succeeded in checking the march of ravines and have devised land-use plans to conserve these lands for human settlements along with assured optimum productivity.

Desertification and shifting sand-dunes are severe in western Rajasthan. The Central Arid Zone Research Institute, Jodhpur, has developed technology for combating desertification. Revegetation of sand-dunes with *Acacia tortilis*, *Prosopis chilensis* and *Ziziphus* spp. is being adopted under the desert development programme.

Ecoprotection can also be achieved through safe bioalternatives such as biopesticides, biofertilizers, etc. Several strains of micro-organisms have been selected and promoted as biofertilizers. Besides, the prospects of developing new cultivars with desirable traits through transgenics is also an exciting and promising hope for future.

Dr M. Velayutham and
Dr P.S. Pathak
ICAR, Krishi Bhavan
New Delhi 110 001

The CIFRI launches "Ganga Fisheries and Environment" Mission Programme

The Ganga basin, representing more than a quarter of the total geographic area of the country, is characterized by its rich biodiversity. It is the original abode of the most prized Indian major carps, viz. Catla catla, Labeo rohita, Cirrhinus mrigala. The river also sustains large catfishes, featherbacks, mahseers, hilsa and several major carps. It also partly meets carp-seed requirement of aquaculture sector.

For the past few decades, the river system has witnessed tremendous development in terms of urbanization, agricultural activities and industrialization, which has resulted in adverse impacts on the riverine habitat, and some disturbing trends are already discernible in its biodiversity and water quality. Apart from steady decline in fish yield, there has been a shift in fish population of major carps in favour of catfishes and carp minnows. Over-exploitation of stocks and influences of environmental stresses are largely held responsible for this qualitative and quantitative shift in riverine ecology. To monitor stretches and to develop guidelines for conservation, management and development of fisheries in the river, the CIFRI has launched a mission programme encompassing whole riverine stretch from its origin in Himalayas to its end point at the Bay of Bengal.

A team of fishery-biologists, botanists and ecologists are on job for collecting valuable information for formulation of aquatic biodiversity, conservation policies, fisheries conservation and management programmes of the Ganga.

Dr V.R.P. Sinha
Director
Central Inland Capture
Fisheries Research Institute
Barrackpore (West Bengal) 743 101

Network on Promotion of Hybrid Research in Vegetables

India is the second largest producer of vegetables after China, with estimated annual production of around 72 million tonnes from 6.2 million hectares. The vegetable requirement of the country is estimated at 90 million tonnes by the-turn-of the century, and it will be 225 million tonnes by 2020 AD. Development of a large number of varieties including F_1 hybrids with tremendous yield potential, standardization of production technologies under varied agroclimates, short-yielding period, infrastructural support, adequate market potential including export of vegetables, suitability for processing, open seed policy, lesser price fluctuations and increasing demand for improved varieties have ushered in a revolution in vegetable production. This is reflected by the adequate availability of vegetables throughout the year. As a result, per caput consumption has also increased from 80 g to 135 g per day. The future strategy is to increase their production further to ensure supply of 285 g of vegetables/person/day for a balanced diet.

India can take the credit for the first record in the world in the manifestation of hybrid vigour in chillies in 1933 at the IARI and in okra at Coimbatore. Thereafter, a series of hybrids have been developed. By now, more than 27 F_1 hybrids of 10 crops have been released by different public-sector institutions. A momentum in growing of F_1 hybrid vegetables was witnessed in late eighties and early nineties. Spectacular progress has also been achieved in developing hybrids of tomato, cabbage, capsicum, okra, brinjal, onion and melon. It is estimated that 40,000 hectares is covered by F_1 hybrids, especially of tomato and cabbage in southern states.

The credit for popularizing hybrid vegetables largely goes to the private sector. Majority of the private seed companies have strong research and development programmes coupled with excellent marketing network to ensure regular supply of consistently good quality seeds to farmers in time and at a reasonable price.

Intensive research and entry of many corporate firms in seed business have contributed to the growth of Indian Vegetable Industry.

Many joint ventures with other countries for the production and distribution of vegetable seeds have recently come up as a result of the liberalized seed policy, leading to global recognition of the Indian Seed Industry. Our country has not only achieved self-sufficiency in seed production of temperate vegetables, but has also started their export. In 1991-92, vegetable seed valued at Rs 126.0 million was exported. Seed production has jumped from 1.8 million tonnes to almost 7 million tonnes in 1991-92.

In order to provide healthy competition amongst public and private sector institutions in the country, the ICAR has formally launched a special project on *Promotion of Hybrid Research in Vegetable Crops* on 15 November `1995.

The Project has been steered with triple purpose of increasing productivity of major vegetable crops, incorporating biotic stress resistance in hybrids and strengthening facilities for production of hybrid seed. Initially, an outlay of Rs 33.8 million has been earmarked for 3 years, up to March 1998. Fifteen research centres of the All-India Coordinated Vegetable Improvement Project have been selected for developing hybrids in 9 vegetable crops–tomato, brinjal, capsicum, chillies, onion, okra, cucumber, bittergourd and cabbage. The project is in operation at the 4 ICAR Institutes and 11 State Agricultural Universities. It has been launched on a mission-mode approach at different centres, and is being effectively monitored directly from the ICAR Headquarters, New Delhi.

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Assistant Director-General
(Vegetable Crops)
ICAR, Krishi Bhavan
New Delhi 110 001

Impact of some of the pesticide residues on human health

- BHC has been found more hazardous than DDT in causing liver tumours.
- An increase in cholesterol synthesis in people over 45 years has also been linked to organochlorine insecticides such as DDT, Aldrin, Lindane etc. Degradation of thyroid hormones in the presence of organochlorine insecticides seemingly leads to hyperactivity of thyroid glands.
- Aldrin causes hepatic tumours.
- Carbaryl results in systemic poisoning and skin irritation.

Dr (Mrs) Tej Verma
ADG (Home Science)
ICAR, Pusa, New Delhi 110 012

India Released the Second Half of the Contribution to the CGIAR

India has contributed an amount of 1 million US dollars to the CGIAR as the emergency contribution to support the CGIAR renewal programme. Half of this amount was paid in the financial year 1994-95, and the second half has been paid in 1995-96.

Conservation of Dwarf Vechur Cattle of Kerala

Among cattle, Vechur was considered the pride of Kerala. The animals have derived their name from the place of origin, Vechur–a small place near Vaikom. The small size, adaptability to area and low-feed requirement are some of the good qualities of the cows. But the farmers' preference to these animals was also due to their relatively higher milk production compared to other local types. The cows are capable of producing 2-3 kg of high-fat milk daily.

But lately, the cattle has fallen to the brink of extinction, due to extensive grading with Red Sindhi breed since 1950's, and more recently, due to cross-breeding with Jersey and Swiss Brown.

A humble beginning to save Vechur cattle from extinction and to preserve the breed was made at the Kerala Agricultural University, Mannuthy, Thrissur, on 26 July 1989 with 8 animals, i.e. 4 cows, 1 heifer, 1 bull and 2 bull-calves. Subsequently, some more animals were added, and through breeding the stock was multiplied to over 100.

Since 1993, the project is financially supported by the Indian Council of Agricultural Research, New Delhi. The main objectives of the project are evaluation, characterization and conservation of breed.

Vechur cow– It attains height of 81-91 cm and body weight of 95-150 kg.

MOET for Conserving Vechur

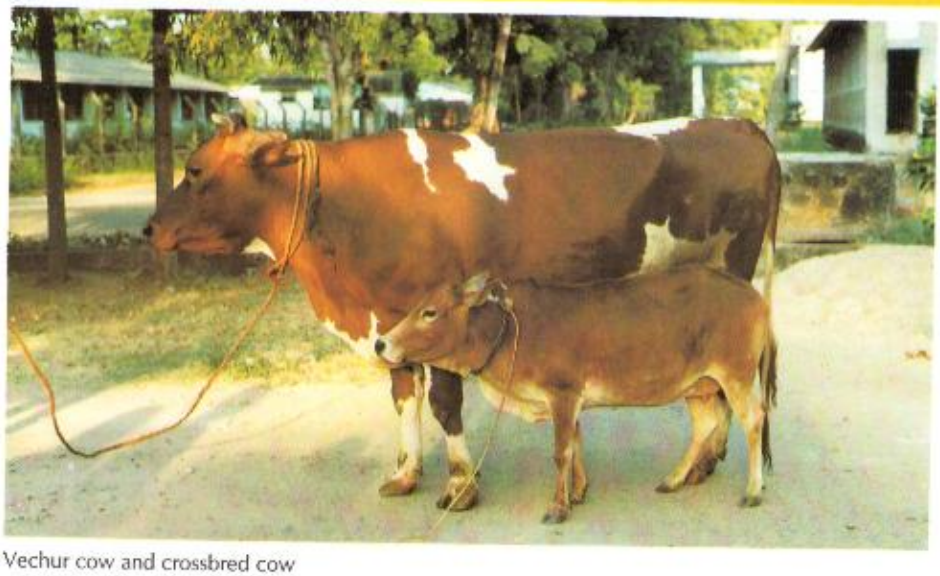
Vechur donor (*centre*) and the recipients on either side

Scientists have succeeded in utilizing Multiple Ovulation and Embryo Transfer (MOET) technique for conservation of an almost extinct breed of Vechur cattle.

At the Centre for Advanced Studies (CAS) in Animal Genetics and Breeding, a pure-bred Vechur cow 'Nandini' was subjected to multiple ovulation and insemination with semen of 'Ganesh', a Vechur bull. Five embryos were recovered and deposited into the uterus of 2 recipient cows; which resulted in 2 pregnancies. One of the recepients was 'Anupama', a crossbred Vechur cow, and the other was a Holstein x Friesian (HF) cross. The HF crossbred cow was also subjected to artificial insemination in her natural heat period by using frozen semen from a Holstein x Friesian crossbred bull.

'Anupama' calved a female-calf and the HF cross gave birth to 2 male-calves. One of the male-calf had all typical features of HF cross. The other male-calf and the female-calf from Anupama, had all typical Vechur characteristics. Parentage of the calves was confirmed by blood typing. The female-calf from Anupama weighed 8 kg. The male-calf of Vechur type of HF cross weighed 13 kg. The HF crossbred calf weighed about 23 kg at birth. The female-calf was named 'Anjali' and male-calves were named 'Lavan' and 'Kusan'.

Twin calves (one Vechur type and the other crossbred type) from a HF cross cow; one out of the artificial insemination using frozen semen from HF cross bull and the other from Vechur embryo transferred on the 7th day after insemination.



Vechur cow and crossbred cow

Vechur cattle vs crossbred cattle

Vechur calves mortality rate is lower than crossbred calves. The resistance against foot-and-mouth disease has also been observed to be higher in Vechur cattle compared to crossbreds.

The size of the milk fat globules in Vechur cattle is smaller compared to crossbred cattle of Kerala and Murrah buffalo, but is larger than that of goats.

Embryo transfer in Vechur cattle has also been introduced with the collaboration of the Kerala Milk Marketing Federation (MILMA). The technique has been standardized and calves are already born. It is proposed to freeze and store requisite number of doses of semen of 15-20 bulls of the breed for the purpose of conservation.

Prof. Sosamma Iype
CAS in Animal Genetics and Breeding
Kerala Agricultural University
Mannuthy, Thrissur (Kerala) 680 654

Future Conferences

Title	:	**Fifth International Mango Symposium**
Venue	:	The Dan Panorama Hotel and Convention Center, Tel Aviv, Israel
Period	:	1-6 September 1996
Contact	:	5th International Mango Symposium P.O. Box 29041, Tel Aviv 61290, Israel
Telephone	:	+972-3-5175150
Fax	:	+972-3-5175155
Title	:	**Third Asia-Pacific Conference on Agricultural Biotechnology**
Venue	:	Melia' Hua Hin Hotel Hua Hin, Prachuab, Thailand
Period	:	10-16 November 1996
Contact	:	Dr Sutat Sriwatanapongse National Center for Genetic Engineering and Biotechnology National Science and Technology Development Agency Ministry of Science, Technology and Environment Building Rama VI Road, Bangkok 10400, Thailand
Telephone	:	(66-2) 245-7374, 245-7185-6
Fax	:	(66-2) 246-4850
E-Mail	:	sutatsr@nwg.nectec.or.th
Title	:	**Third International Symposium on Hybrid Rice**
Venue	:	Hotel Holiday Inn Krishna, Hyderabad, India
Period	:	14-16 November 1996
Contact	:	Dr M. Ilyas Ahmed Hybrid Rice Programme, Directorate of Rice Research, Hyderabad (Andhra Pradesh) 500 030, India
Telephone	:	040-245036
Telex	:	0425-6739
Fax	:	040-245308

Central Potato Research Institute, Shimla

Although, potatoes were introduced into India as far back as the 17th century, no serious attention was paid to improve this crop through scientific research until the Indian Council of Agricultural Research, 3 years after its coming into being in 1929, financed a scheme for investigation on physiology and genetics of the crop at the Nilgiris in Madras. This scheme was soon replaced in 1935 by a potato breeding scheme for north India at Shimla. In 1943, a potato research station at Bhowali (UP) was set up to supplement to work at Shimla, and a potato certification scheme was also initiated at Kufri, in higher hills. However, there remained many problems which could be successfully tackled only by an integrated and comprehensive research on the all-India basis. Realizing the importance of a long-range research for increasing production of this valuable crop, the ICAR in 1945 recommended to the Government of India that a Central Potato Research Institute should be set up under its aegis. Accordingly, the Central Potato Research Institute was set up in 1949 at Patna (Bihar). Later on, in 1956, the Institute Headquarters were shifted to Shimla, so that the advantage of profuse flowering of this crop, which occurs in hills, could be availed of for breeding better varieties.

Main building of the CPRI, Shimla

A view of the Kufri Farm

Organizational Set-up

The Institute has a Management Committee of 13 members–4 scientists of the Institute; 3 representatives of the State Agricultural Universities and State Agricultural/Horticultural Departments; 2 farmers; 1 representative of the ICAR; 1 from the Finance/Accounts Department; the Director as Chairman; and the Senior Administrative Officer as Member-Secretary.

The Institute is headed by the Director, who is the overall incharge of the activities related to education, research, extension and administration. The Director is assisted by the heads of 8 divisions and 9 regional stations.

The 9 regional stations are located at major potato-growing zones. Stations at Modipuram (Uttar Pradesh), Jalandhar (Punjab), Gwalior (Madhya Pradesh), Patna (Bihar) and Kufri (Himachal Pradesh) are the main producers of breeder seed, besides their carrying-out of researches on area-specific problems.

The CPRI has the following 8 divisions at Shimla — Genetics and Plant Breeding, Plant Pathology, Agronomy and Soil Science, Crop Physiology and Biochemistry, Entomology and Nematology, Seed Production, Social Sciences and Post-harvest Technology.

The responsibilities pertaining to administration are handled by the Senior Administrative Officer, and the charge of the Audit and Accounts lies with the Senior Finance and Accounts Officer. There also exists a Staff Welfare Association, headed by one of the scientists. Recommendations relating to academic and professional improvements of the staff are made by a special PG Committee. The research activities of the Institute are guided by a Staff Research Council. The other Committees in the Institute are–(i). Joint Staff Council, consisting of representatives of the staff and management, (ii) Grievance Cell and (iii) Publication Committee.

Infrastructure

The Institute has about 500 hectares of farm-land which is used for seed production and carrying-out field experiments.

Electron microscope

Tissue-culture laboratory

CPRI library

The Institute Library is the largest in the whole of Asia, Africa and Latin America, having readily available information on potato. It is not only equipped with vast collection of books and data on potato, but also has the sophisticated computer facilities like CDROM and CAS (Current Awareness Service) through CAB ACCESS and CCOD of UK and USA, which provide bibliographical citations and author abstracts of about 1,000 core and most-cited journals in agricultural science. It has 25,405 books and documents and subscribes to 340 periodicals.

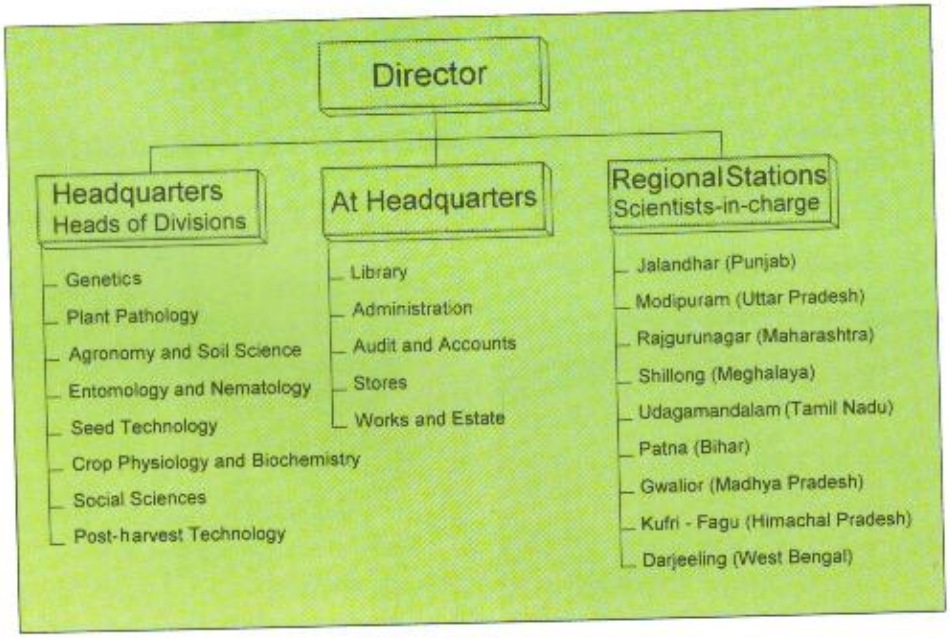
Facilities like tissue-culture laboratory, radio-isotope laboratory, electron microscope, growth chambers and cold stores are available; supported by strong network of computers.

The Institute's annual budget for 1994-95 was Rs 73.9 million. This is less than 0.2% of Rs 36,000 million, which is the annual contribution by potato to the national economy.

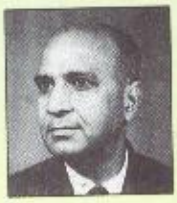
Liaison and Linkages

It has linkages with the State Agricultural Universities through the All-India Co-ordinated Potato Improvement Project (AICPIP).

The Institute also has a collaborative programme with the International Potato Centre (CIP), Lima, Peru, for exchange of potato genetic material, training of potato-workers, advanced training of senior and mid-career scientists at the CIP, and joint research



Dr S. Ramanujam
(1949-51; 1952-56)



Dr Pushkarnath
(1956-69)

Dr Mukhtar Singh
(1969-75)

Dr B.B. Nagaich
(1975-82)

Dr N.M. Nayar
(1983-89)

Dr J.S. Grewal
(1989-94)

Dr G.S. Shekhawat
Present Director

Directors' of the CPRI

projects on immuno-detection of potato viruses, potato storage and true-potato-seed (TPS)-based potato production.

Transfer of Technology

The Institute has a separate division of Social Sciences, comprising units of Extension, Economics, Statistics and Information and Publicity. The Extension Wing has been operating Lab-to-Land Programme, since 1979, in various clusters of villages in Shimla, Modipuram and Patna. Operational Research Projects were successfully run in Meghalaya and Bihar, and the Tribal Area Development Programme was implemented in Lahaul and Spiti in Himachal Pradesh and Waghai in Gujarat. At present, the Lab-to-Land Programme is being run in villages Panesh and Moolbari (Shimla) and in Meerut. The ICAR has selected the Institute as one of the Centres to operate the Technology Assessment and Refinement through Institution-Village Linkage Programme. For this, Theog Panchayat in Shimla and villages in Patna are selected and preliminary surveys have been conducted. The Institute has a strong back-up of Publications and Publicity. Research findings and recommendations are published as technical bulletins and extension bulletins from time to time. The Division is also actively engaged in organizing training for field-functionaries on different aspects almost every year. Besides, farmers' training camps, field days, kisan melas are the regular features. All-India Co-ordinated Potato Improvement Project started in 1971 by the ICAR with headquarters at the CPRI, Shimla, is also the main body for assessment and transfer of technology. All technologies developed by the Institute are tried and evaluated in the AICPIP centres located in different State Agricultural Universities, and finally, the technology is transferred to the actual users by the SAUs and the State Departments.

Farms and Services

The CPRI Farms are used for production of disease-free breeder's seed. About 2,500 tonnes of breeder seed is produced annually. This is supplied to the State Government agencies and the National Seeds Corporation for further multiplication. The CPRI also produces and supplies anti-sera for testing virus infection.

Research Achievements

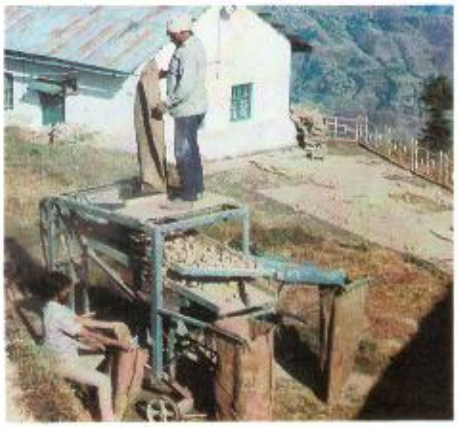
The increase of 365% in area under potato and 1063% in production from 1949 to 1995 has primarily been the result of the research achievements of the CPRI. The yield of crop increased by 150% and the per caput availability by 350% during the same period.

Barley-potato intercropping

Some of the Institute's salient achievements are as follows.

- Released 26 high-yielding cultivars suitable for different agroclimatic regions. Five more varieties are awaiting release by the Central Varietal Release Committee (CVRC), including 2 TPS varieties. Besides, developed varieties that could give economical yields under short days and short-growing season in plains and that showed resistance to late blight, tolerance to viruses, immunity to wart disease and resistance to cyst nematode.
- Developed package of practices for potato and potato-based cropping systems in 8 major potato zones of the country.

Nethouse for conducting physiological studies on the crop



Potato size-grader

Potato planter-cum-ridger

The CPRI generates about 30% of its annual budget from its own resources. The major source of income for the CPRI is the sale of disease-free seed-potatoes produced by the Institute. Another source with great potential is consultancy contracts, particularly with private industry

True Potato Seed for Commercial Scale Production

The potato-crop is conventionally raised from seed-tubers which pose several problems of storage, carry-over diseases, transport and require major investment in procurement of seed for raising crop. Besides, if seed-tuber, which essentially is a food material, can be saved, large quantities of potatoes can become available for human consumption.

Since about two decades, the scientists have been working on developing a new technology of potato production, requiring use of true potato seed (TPS) or botanical seed of potato-plant as the planting material. The crop raised through TPS is almost disease-free, as most of the diseases get filtered out during pollination and fertilization in production of TPS. The recommended seed rate for raising crop from seed-tubers is 2.5 tonnes/ha and the seed rate for the crop raised through TPS technology is only about 120 g/ha. This technology thus, has a capacity to provide disease-free seed at low-cost and without constraints of storage and long-distance transport.

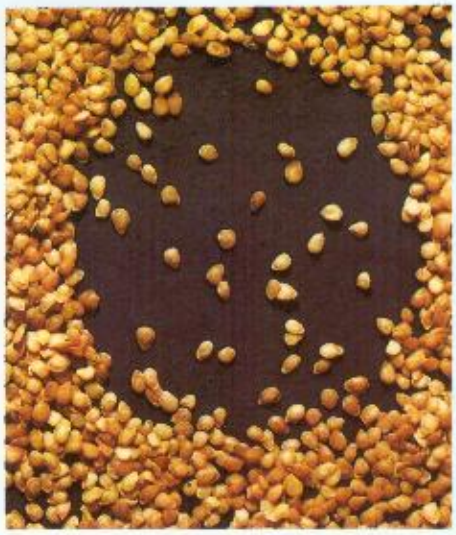
Work on the TPS technology is presently being done at the Central Potato Research Institute (CPRI), Shimla, and the International Potato Centre (CIP), Region South West Asia, New Delhi, is also collaborating. The main thrust of the work has been on developing agronomic practices for commercial crop production from TPS, and identification of TPS progenies with high productivity and low variability for maturity and tuber characters.

The TPS can be produced in high hills during the summer potato-crop (April/May-Aug/Sep.) and in plains during winter crop (Oct/Nov-Feb/March), by providing extra light hours. Recently, a high-yielding TPS hybrid, 92-PT-27, has been developed at the Central Potato Research Station, Patna. Unlike parents of C3 and HPS 1/13, the parents of this hybrid do not require extra-daylength to come to flowering in plains. About 100 kg of TPS can be produced per hectare.

The true potato seed is commercially produced by the Department of Horticulture and Soil Conservation, Government of Tripura, Tripura, the Centre for Technology Development, Bangalore, and several other Government and private agencies.

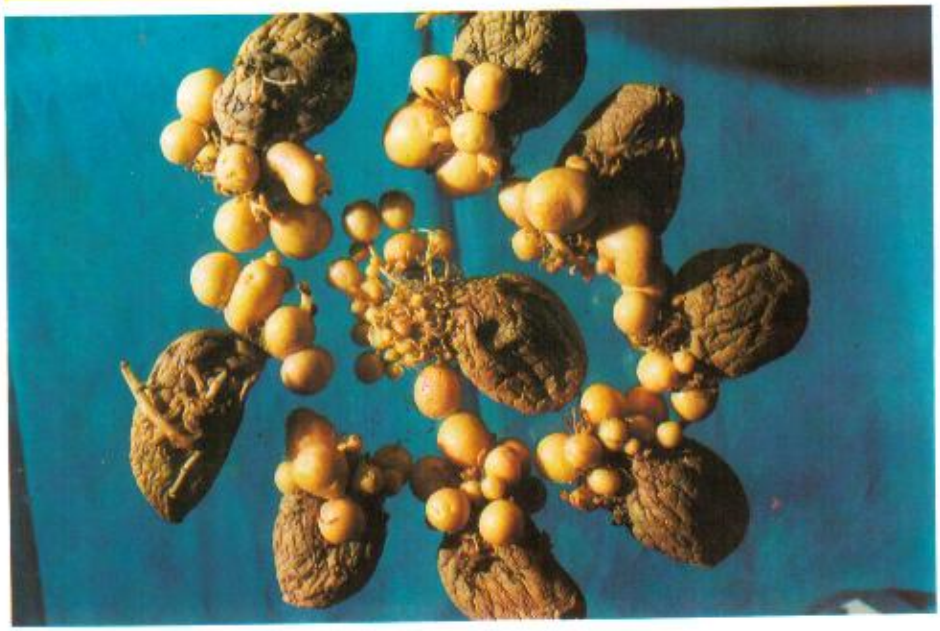
The work done in the country indicates that TPS technology of potato production can make Assam, Bihar, Karnataka, Gujarat and Maharashtra, which regularly import seed from the northern states, self-sufficient in good quality potato-seed. These are also the regions where this technology has its maximum potential for exploitation.

Potato flowers



Potato true seed

Potato berries (fruits)



Mini-seed tubers production on mother-tubers in storage

- Developed 'Seed Plot Technique' to produce seed of high-quality in the northern plains–one of the most important achievements which revolutionized production of potato in India by making available quality seed to farmers at reasonable prices.

The CPRI is the only Institute in India which produces breeder's seed of potato and supplies them to the State Departments, NSC, State Seed Production Agencies for further multiplication and then distribution to farmers.

Consultancy Services

The CPRI offers consultancy services for:

- Evaluation and testing of agrochemicals
- Quarantine of imported planting material and phytosanitary certification for material to be exported
- Rapid multiplication of desired genotypes through tissue culture
- Multiplication of desired genotypes through conventional seed production
- Training in tissue culture and micropropagation techniques
- Training in TPS-based potato production
- Evaluation of processing quality of genotypes

- Developed alternative for conventional cold storage.
- Developed methods of rapid seed multiplication.
- Developed a late-blight forecasting system for hills. Similar methodology is being developed for plains also.
- Developed management schedules for late blight, bacterial wilt, soil- and tuber-borne diseases, viruses, aphids, tuber-moth and cyst-nematode and control measures for other pests and diseases.
- A total of 22 potato-cultivation equipment have been developed for mechanized potato farming.
- True-potato-seed technology has been developed for crop production. The seed cost, the problems of transport and virus infiltration in seed-tubers, leading to degeneration of seed stocks, have led to the utilization of the true-potato-seed (TPS) technology of the crop production. This technology is expected to supplement availability of healthy propagules for crop production and in saving seed-tubers for human consumption.
- The Central Potato Research Institute has also developed a micropropagation technique for large-scale production of disease-free, potato-seed. (Refer ICAR News Vol. 1 No. 4, p. 15).

It may soon be possible to grow seed-potatoes in stores rather than in fields. If potatoes of the right physiological state are stored in dark at about 20°C, they produce on their sprouts as many as 20-40 minitubers per tuber as against 6-8 seed-tubers from one mother-tuber in conventional seed production. Most of these minitubers can be planted directly in field to raise a normal crop.

Dr G.S. Shekhawat
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Central Potato Research Institute
Shimla (Himachal Pradesh) 171 001

A new rice selection for rainfed uplands

A rice culture CR 808-4, selection from the natural cross of Heera (Heera-NX), maturing in 100 days, has been found suitable for rainfed uplands. This culture, with semi-tall plant stature and stiff straw, and long slender grains and heavy panicles, gives yield up to 4 tonnes/ha. It is suitable for transplanted condition also.

Dr K.C. Mathur
Director
Central Rice Research Institute
Cuttack (Orissa) 753 006

Co 86032 sugarcane for commercial cultivation

The Varietal Identification Committee of the All-India Co-ordinated Research Project on Sugarcane, which met in November 1994 at Navasari, has recommended for release by the Central Varietal Release Committee Co 86032, Co 87025 and Co 87044 for Peninsular Zone and Co 87263 and Co 87268 for the North Central Zone. Among these varieties, Co 86032 has picked up well, and is already under commercial cultivation in a few factory zones in Tamil Nadu and Maharashtra. Multilocation trials in Bihar and West Bengal have indicated high production potential of Co 87263 and Co 87268.

Sugarcane Co 86032

Dr K.C. Alexander
Director
Sugarcane Breeding Institute
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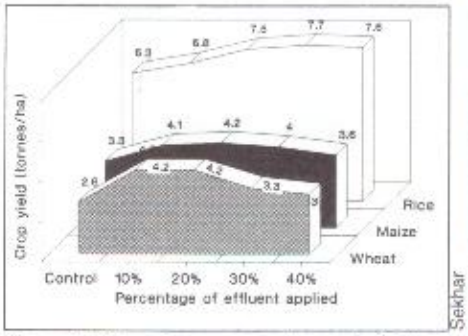
Distillery effluent can be successfully used as manure

Field experiments conducted at Hargaon, Sitapur district and DehraDun (Uttar Pradesh), Rahuri (Maharashtra), Ankapalli (Andhra Pradesh), and at the IARI Farm have shown that post-methanation distillery effluent can be used as a manure for rice, sugarcane, wheat, maize and mustard. The effluent can be used either as a pre-sown application (up to 5,000 ppm biochemical oxygen demand, BOD) or with a post-sown irrigation (up to 1,000 ppm BOD). Continuous application of this effluent for the last 3 years has not shown any deleterious effect on soil properties. When applied through soil, this effluent will not only reduce doses of fertilizer applied but will also save water-bodies from pollution.



Crop yield at various percentages of distillery effluent applied with irrigation water

Dr H.C. Joshi
Senior Scientist
Division of Environmental Sciences
Indian Agricultural Research Institute
Pusa, New Delhi 110 012

GTH1-the first tobacco hybrid in India

Tobacco is an important cash crop of Gujarat, grown in an area of about 100,000 hectares, and yields on an average about 1,700 kg/ha. Among the different types of tobacco grown in the state, bidi tobacco takes the lion's share; being cultivated in Kheda, Baroda and Panchmahal districts. The varietal improvement programme of bidi tobacco has progressed at a projected pace, from 745 kg/ha in 1951-52 to 1,601 kg/

Tobacco GTH1–the first hybrid tobacco of India

Features of GTH 1

Nature of the hybrid : CMS based
Yield : 3,644 kg/ha
Percentage increase over popular variety
- Anand 119 : 48%
- GT 5 : 36%

Specific features :
- Tolerant to root-knot nematode
- Leaf thickness better than GT 5
- Synchronous maturity, hence suitable for whole plant harvest
- Percentage nicotine content is as high (above 8) as GT 5
- Chemical and smoking qualities comparable to GT 5

ha in 1984-85, with the release of GT 5; an noticeable increase of 115 % in the productivity of the bidi tobacco.

In middle Gujarat, banana and mustard, cost-competitive and less labour-intensive crops, are being grown in some of the traditional bidi-tobacco areas. This has resulted for a need to improve tobacco yields for giving more returns, and it is in this direction, the efforts of the Bidi Tobacco Research Station, Gujarat Agricultural University, Anand, have yielded in the release of Bidi Tobacco Hybrid 112 under the name Gujarat Tobacco Hybrid 1 in February 1995. This is the first tobacco hybrid released for cultivation in India.

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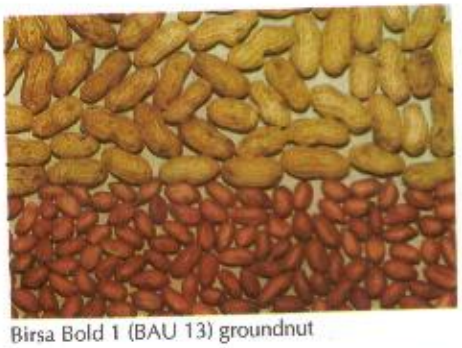
IARI developed an insect-tolerant cabbage hybrid

Insect tolerance is the pre-requisite for summer cultivation of cabbage in the temperate hills of India. Among insect-tolerant sources of cabbage detected at the Katrain Regional Station of the Indian Agricultural Research Institute, IRC 1 has been found superior in insect tolerance; but it is a poor yielder. This cultivar was crossed with popular cultivars, and the resulted hybrids were evaluated against insect-pests in summer and winter. Cabbage hybrid IRCH 5 has been found not only tolerant against insect-pests but gave maximum net yield of 199.96 quintals of cabbage heads per hectare during 2 consecutive years. This hybrid has also shown its suitability for summer cultivation compared to other hybrids, which yielded higher in winter. During summer 1995 also, this hybrid performed better than other hybrids for tolerance against insect-pests, diseases and for horticultural traits.

Dr R.N. Barwal
Senior Scientist
Regional Research Station
Katrain, Kullu (Himachal Pradesh)

Birsa Bold 1 groundnut, a confectionery variety par excellence

BAU 13, a derivative of the cross of BAU 6xM 13, was primarily developed for the farmers of the plateau region of Bihar. But it has proved to be a confectionery variety *par excellence* for the entire groundnut-growing tracts of the country, transcending zonal barriers, because of its extra large attractive red kernels, bunch habit, high productivity (potential yield 3,100 kg/ha), relatively early maturity (125 days) and wide adaptability. It is the boldest seededness variety, ever-tested in the All-India Co-ordinated Trials on Groundnut (100-kernel weight 70-110 g). Bold-seededness is one of the most important quality attributes for hand picked selected



Birsa Bold 1 (BAU 13) groundnut

grade. Its performance over locations throughout the country and seasons for a number of years has been superior to the best national check M 13.

On the basis of 3 years' (1990-92) mean performance, it is concluded that across the locations, over years, the HPS entry BAU 13 has recorded a pod yield as high as 2,193 kg/ha and a kernel yield of 1,421 kg/ha; which is 10.6% and 10.8% higher than the best check M 13. Its 100-kernel weight has been 14-18% higher than M 13 (61 g). Likewise the percentage of sound mature kernel has been 3%. However, the shelling percentage of BAU 13 has been to the tune of 63% which is at a par with M 13, which records 64% shelling. This variety has also been reported to be moderately resistant to seed colonization due to *Aspergillus* group of fungi–an essential attribute for export. BAU 13 has been released as Birsa Bold 1 by the Bihar State Varietal Release Committee in 1992. It has also been notified by the Ministry of Agriculture, Govt of India, in 1994 for the whole country. Its seed is being multiplied for distribution.

Dr M.A. Mohsin
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Birsa Agricultural University
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Released Priyanka cashew with bigger nuts

A new hybrid Priyanka (H 1591), having an yield potential of 16.9 kg/tree with a nut size of over 10g and w 180 grade kernel (2.87 g), developed at the

Priyanka cashew

Madakkathara Centre of the All-India Co-ordinated Research Project on Cashew, was recommended for release for Kerala during the XII Biennial Workshop on the All-India Co-ordinated Research Project on Cashew held at the Central Plantation Crops Research Institute, Kasaragod, on 14–16 October 1995.

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Alley cropping of rice-wheat sequence with *Leucaena leucocephala*

To bridge large gap between the demand and the supply of food, fodder and fuel, integrated food-based-fodder cropping systems are needed. One such system called "Alley Cropping" has been evolved by the Project Directorate of Cropping Systems Research, Modipuram (Uttar Pradesh). In this upland rice was raised in rainy season, followed by wheat in winter in between 2 hedge-rows (5-m apart) of *Leucaena leucocephala* (subabul). The system tested on the alkali soils for 3 years revealed that application of 90 kg N/ha in combination with *Leucaena* loppings added @ 6 tonnes/ha/annum to soil as green-manure before rice and wheat planting was sufficient for maximizing productivity from the system.

Even though association of *Leucaena* reduced grain yield of rice and wheat by 0.4 and 0.2 tonnes/ha, but it provided 6 tonnes of green manure/ha/annum for incorporation into soil, which contributed approximately 80 kg organic N/ha/annum and increased the total productivity of the system equivalent to 30 kg N/ha, applied through chemical fertilizers. Thus, the system saved 25% of the inorganic-fertilizer N. Besides, 6-7 tonnes of green fodder/ha/annum and 4-5 tonnes of fuel-wood/ha/annum were also harvested, resulting in a net saving of about Rs 3,000/ha/annum over only sequence cropping of rice-wheat.

In addition, many beneficial effects were also noticed in the soil. The pH of the soil came down from 8.7 to 8.2 and there was considerable improvement in infiltration rate, bulk density and available NPK status due to continuous green-manuring by *Leucaena* loppings. Thus alley cropping of rice-wheat sequence with *Leucaena leucocephala* (subabul) is not only economical but also beneficial in improving and sustaining crop and soil productivity on a long-term basis .

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Feral goats to solve meat problem of Andamans

Feral goats are found in the barren islands of Andamans. In Andamans, there is always a severe crisis of fresh water in dry season, and the most striking advantage with feral goats is that they can depend on sea water for survival during prolonged dry spells. These goats graze only during dawn and dusk; retiring in shade during peak sunshine. The dew that accumulates on leaves at dawn and the water that gets collected in small rock pockets after rains are licked by goats along with tender tree fodder.

Feral goat

During the last few years, the existence of these feral goats has been endangered by the successive volcanic eruptions. Their number in islands was only 200-250 in 1991. To protect this rare species from extinction, the Central Agricultural Research Institute has brought some feral goats from the islands to Port Blair for scientific studies and preservation of germplasm.

These goats were kept in captivity and their acclimatization to domestication was undertaken after thorough scientific consideration about their diet and behaviour. Specific fodder trees, viz. *Ficus* species, wild musanda, Bakri patti (*Trema tomentosa*) and *Sesbania grandiflora* were identified for goats. Feral goats have been well acclimatized with respect to available feed and fodder resources of Andamans, housing conditions, water requirement, milking behaviour and temperament.

Because of their inherent adaptability with the island environment, feral goats are easy to manage and may prove to be a boon for solving meat problems of the islands.

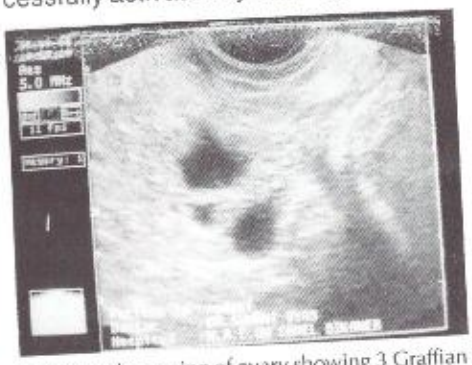
Dr A.K. Bandyopadhyay
Central Agricultural Research Institute for Andaman and Nicobar Group of Islands Port Blair (Andamans)744 101

Folliculogenesis in camels

Camel is a seasonal breeder and induced ovulator. Its breeding season extends from November to March. It has no defined estrous cycle but has a follicular cycle. The ovarian follicular status during breeding season revealed presence of mature Graffian follicles(s) (GF) on the ovaries of about 75% she-camel examined. But, just prior to breeding season, during the first week of November, immature follicles were palpable only in 30% fertile females. They were visible in almost all breedable females by the end of November on both ovaries. December onwards up to March-end, all breedable females had mature GFs. Towards end of March/April, follicle had a tendency to become oversized and thick-walled, and no GF was palpable up to June-end. There was again a surge of ovarian activity noticed in about 80% empty dry she-camels during rains (July/August). However, ovaries became inactive subsequently in September and October.

Detailed studies on folliculogenesis were also conducted using ultrasound scanner in different seasons. The ultrasonography revealed 1–3 follicles in either ovary. One follicle increased in size from the day 4 onwards till it reached maximum size (25-30 mm) by 17-18 day. Thereafter, it started regressing, and completely disappeared by 26-28 day.

It was found that during non-breeding season also, in some healthy breedable females, when kept in the company of virile male-stud, folliculogenesis started to get activated; resulting in even fertilization in sporadic cases. This indicates a strong evidence that in camels reproduction can be successfully activated by altering management practices and adopting other precautionary measures. But, the success rate in non-breeding season is likely to be much less as compared to breeding season.



Ultrasound scanning of ovary showing 3 Graffian follicles

Ultrasound scanning showing a Graffian follicle on the 9th day.

Dr U.K. Bissa
Incharge (Technical Cell)
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Bikaner (Rajasthan) 334 001

Freeze-dried starters in pouches

Steep growth of Dairy Industry and diversification of its activities has consequently resulted in manifold demand of the organisms required for various milk-fermentations. An easy way to store and transport these lactic acid bacterial starter-cultures in bulk is to freeze-dry them and keep them in suitable containers. Glass vials are now being replaced by more resistant, convenient and lighter materials. The NDRI has recently developed laminated aluminium-foil pouches. The survival of the freeze-dried *dahi* and yoghurt cultures, suspended in a newly devised

Methane Emission from Rice Fields

Methane is an important greenhouse gas, accounting for about 20% of the radiating forcing added to atmosphere, causing global climate change. Global warming potential of methane is about 30 times more than that of carbondioxide. Among various sources, flooded rice fields are considered to be one of the important sources of methane on a global scale; contributing an estimated 20-150 Tg (1Tg=10^{12}g) methane annually (IPCC, 1992). More than 92% of the world's rice is produced in tropical countries of Asia. Out of which India and China put together share 60%.

In order to meet food requirement of the growing population, production of rice is required to be increased further. As more biomass produced is also likely to emit more of methane, remedial measures need to be developed and practised. However, recent studies covering various agroclimatic regions of India have shown that **methane emission from Indian rice fields is not more than 4 Tg/year.**

Measuring methane in rice field

Effect of manures

Maximum methane emission (4.86±1.24 mg/m²/hr) took place in FYM + urea application, followed by biogas slurry + urea (4.05±1.08 mg/m²/hr) and urea alone (2.96 ± 0.92 mg/m²/hr). The average total methane emission in the entire growing period of the crop was estimated at 49.44 kg/ha with FYM + urea. This was 4.2 times higher than control (11.76 kg/ha), 2.3 times higher than biogas slurry + urea (22.08 kg/ha) and 2.4 times higher than urea-treated plots. Emission is found more under continuous flooding of field (30-34 kg/ha) than under intermittent flooding (26.27 kg/ha).

Technically rice is grown in India under intermittent irrigation, and the total methane contributed by irrigated rice comes to only 0.432 Tg, which is much lower than the projected estimates. Emission of methane is less with urea as compared to organic manure. But constant use of urea leads to soil pollution and regular use of organic manure causes air pollution; through increased methane emission with organic manure. Thus, a combination of methane inhibitors and organic manures and/or use of microbe-activating technology for faster biodegradation of organic matter need to be assessed. These are being evaluated to increase yield and biomass at a manageable level of methane emission.

Effect of irrigation

Experiments with rice varieties IR 72, Pusa 169 and Pusa Basmati under different agronomic practices have indicated that methane emission is largely affected by water management. Emissions are normally high under continuous flooding. The methane emission is significantly reduced when fields are intermittently irrigated. Total methane flux with IR 72 variety in continuously flooded field was 22.67 kg/ha, whereas intermittent irrigated field without any organic amendment emitted 9.71 kg/ha of methane. The other cultivars, Pusa 169 and Pusa Basmati emitted 12.47 and 13.44 kg/ha methane under intermittent irrigation.

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Effect of flyash incorporation on soil and crop productivity

Flyash is generated during combustion of coal in thermal-power plants. In India, during 1993, about 60 million tonnes of coal-ash was generated. It is likely to cross 90 and 140 million tonnes, during 2001 and 2020 AD. The properties of flyash depend on composition of the coal, conditions during combustion, efficiency of emission-control devices, storage and handling of byproducts and climate.

In India, most of the thermal-power plants use bituminous coal. This contains high amount of ash (up to 40%), sulphur (0.2-0.6%) and elements like Al, Si, K, Ca, V, Cr, Mn, Ni, Cu, Zn, Sr, Pb, As, Rb, B, Cd, Ce, Co, Cs, Cu, Zn, Ga. Trace elements including Hg, Mn, Cu, Zn, Pb, Ni, Fe, Cr and Cd exhibit concentrations which are considerably higher than those present in coal, and concentration of biologically toxic elements B, Mo and Se greatly exceeds to their concentration in soil.

Mounds area of flyash at NCPP, Dadri, Ghaziabad

Deposition of this flyash on crop-canopies may reduce crop yields due to impaired photosynthesis. Besides, flyash deposited on fodder crops makes them unfit for cattle feeding. Water pollution from coal-based thermal-power stations has also acquired significance over years. At present, most of the thermal-power plants used to dispose of flyash and bottom ash in a wet slurry form to a nearby ash-pond; where ash settles at the bottom and clear water overflows from the pond. But in this, heavy metals contained in the ash after degradation, gradually and slowly leach and percolate to water-bodies. Thus water may get contaminated which would in due course may adversely affect human and aquatic life.

Efforts are being made to device strategies for safe disposal of huge amounts of flyash. The ash finds application in road construction, as lime, bricks, flyash-concrete, concrete, cement and landfill and mine-storing activities. Unfortunately, this has not gained popularity due to higher cost: benefit ratio. Moreover, not even 25-30% of the total ash produced is utilized by these activities. The remaining amount of flyash can be stored in ash-mounds. Making permanent structures of ash-mounds by bitumen and water and subsequent compaction and growing vegetation on these structures prevent loss of ash particles due to wind.

As the concentration of all elements except N is higher in flyash than soil, it as an amendment can improve physical and chemical properties of agricultural soils. However, non-judicious use, may lead to deterioration of soil texture and structure, formation of surface crust, addition of toxic elements and alteration in physico-chemical characteristics. Here it becomes imperative to find out the threshold level of flyash application on land which is beneficial for plant and soil environment. Experiments conducted at the IARI showed favourable soil-physical environment as induced by soil amendments with flyash; resulting in higher root growth in maize and wheat.

Flyash can be used as a liming material on acid soils or acid-mine soils. Increase in pH induced by alkaline flyash is a desirable property and can be used for detoxifying elements like Cd, Al and Mn. Similarly, acidic flyash can be successfully used for reclaiming alkali soils. A joint IARI/NCPP study is presently going on to evaluate problems associated with flyash in air, water and soil system and its affects on crop productivity. Field experiments with maize and rice in *kharif* 1995 in Muthiani and Gulawathi villages of Ghaziabad district of Uttar Pradesh were conducted to evaluate crop growth and yield response with/without flyash incorporation in soil. Flyash incorporation of 10 tonnes/ha in the soil was decided on the basis of the previous studies carried out by the NCPP, Dadri Unit, regarding dust-fall samples collected from various villages, which were around 5–12 tonnes/ha, that added into the soil over a year. There were non-significant differences in grain yield in flyash-treated plots compared to control. Field experiment with maize was also undertaken at the IARI Farm, New Delhi, under different levels of flyash. The treatments included no flyash addition, flyash applied to soil and foliage spray at 5, 10, 15, 20 and 50 tonnes/ha. Increase in yield was noticed up to 10 tonnes/ha. Dusting of ash on crop-canopies decreased yield. The experiments still need to be conducted over a number of years for in-depth investigation of flyash effects.

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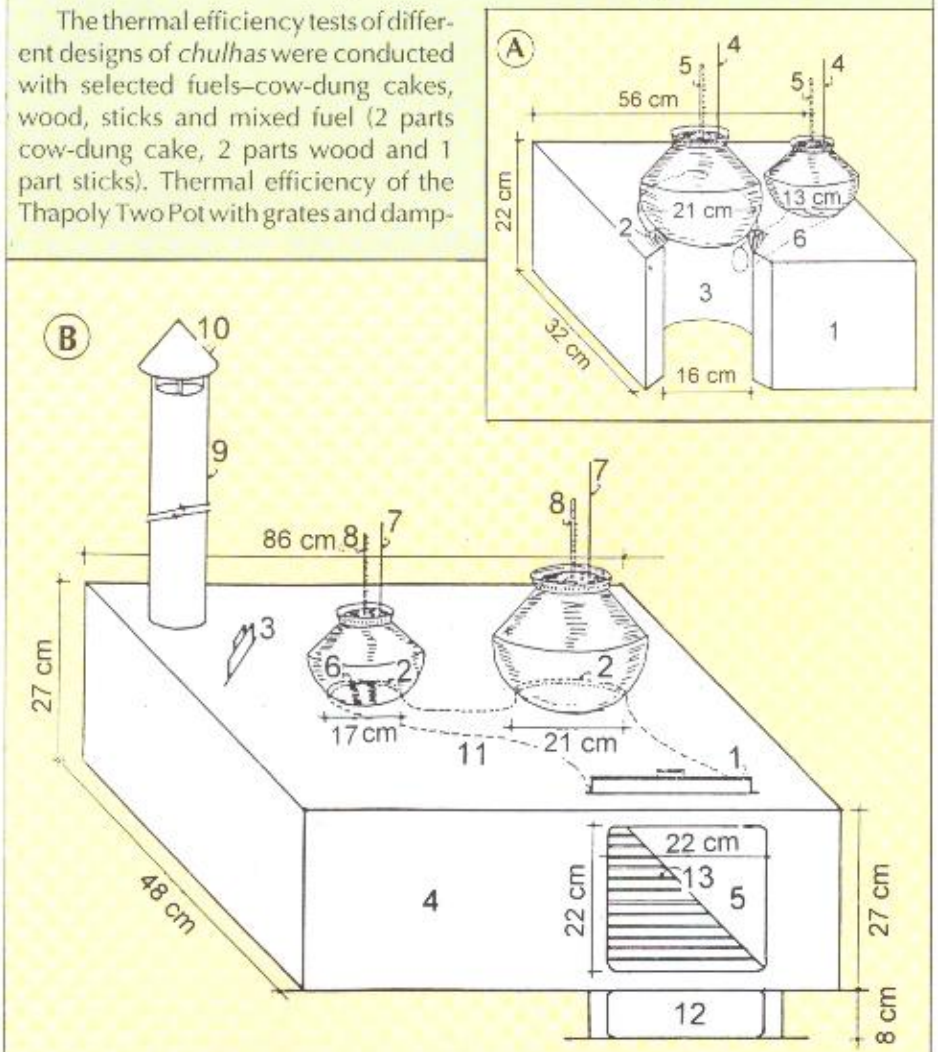
Dadri, Ghaziabad (Uttar Pradesh)

Thermal efficiency of selected designs of *chulhas*

The thermal efficiency tests of different designs of *chulhas* were conducted with selected fuels–cow-dung cakes, wood, sticks and mixed fuel (2 parts cow-dung cake, 2 parts wood and 1 part sticks). Thermal efficiency of the Thapoly Two Pot with grates and damper was maximum (15.61) with mixed fuel, followed by Thapoly Two Pot without grates and damper, i.e. 14.53. Heat utilization by Thapoly One Pot with grates and damper was maximum (13.54) with wood. Efficiency of Traditional Two Pot was lowest with almost all selected fuels, followed by Traditional One Pot. However, the thermal efficiency of all the *chulhas* was maximum with mixed fuel.



A. Traditional Two Pot *chulha* (1, main body; 2, pot holders; 3, fire box; 4, stirrer; 5, thermometer; 6, connecting tunnel); B. Thapoly Two Pot *chulha* with grate (1, front damper; 2, pot hole; 3, chimney damper; 4, main body; 5, fire box; 6, baffle; 7, stirrer; 8, thermometer; 9, chimney; 10, cowl; 11, connecting tunnel; 12, ash pit; 13, grate)

Dr (Mrs) Krishna Oberoi
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Punjab Agricultural University
Ludhiana (Punjab) 141 004

cryoprotective agent consisting of buffalo milk, gelatin, sucrose and 1.0 M monosodium glutamate, has been found maximum at–20°C. The cultures contain 1.2-1.4% residual moisture and are packed in 25g quantities in 12 μ polyethylene + 12 μ aluminium foil + 150 gauge polypropylene pouches and are sealed under vacuum. Sealing in air and storing at 40°C has been found deleterious.

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Director
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Making ghee through microwave heating

Ghee is a fat-rich Indian dairy product, extensively consumed in the country. The traditional method of preparing ghee is highly energy-and time-consuming and is also a labour-intensive process. Research was, therefore, carried out to study the effect of microwave heating for preparation of ghee. It is found that microwave technology could be successfully applied for manufacture of ghee from high-fat cream/butter. The chemical nature and flavour, colour and textural characteristics of the microwave-processed ghee were similar to those of the traditionally prepared ghee. This processed ghee conformed to the legal specifications with no loss in nutritional quality of ghee.

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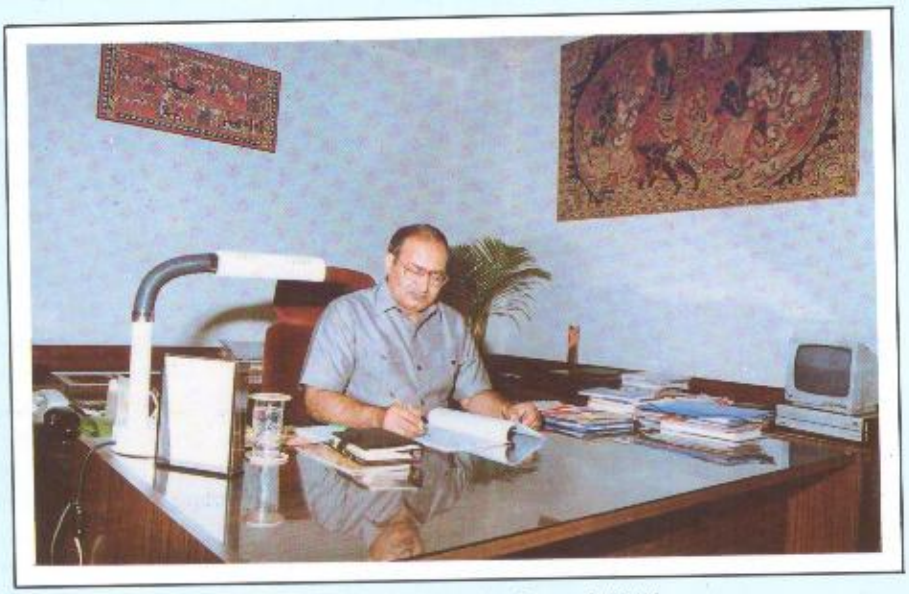
As a process of evolution, tremendous genetic variability, both in flora and fauna got generated worldwide. India is one of the 8 mega-centres of biodiversity, representing considerable variations in plants, animals, fishes and micro-organisms. As civilization developed, the interference of man with the Nature also grew, resulting in indiscriminate use as well as over-exploitation of available natural resources, thus stripping land of its beauty, and leaving ecological ruins for the future. This process is still continuing in various parts of the world, resulting in depletion and devastation of genetic legacy–not inherited from our parents but borrowed from our children– and this process could be equated with "Spreading Slaughter".



Dr R.S. Paroda, Director-General, ICAR

It is estimated that before man appeared on earth, probably one species died every four years. Today, some 30,000 species slip into near-extinction yearly, out of the estimated 10.5 million in existence. Of these, only 15% have so far been given scientific names, whereas 85% are yet unknown. Many of these species are "keystones" in interlocking ecological structures. Obviously, destroying "keystone" triggers off a deadly "domino effect", thus crumbling the entire ecosystem.

Attention to these issues was drawn during the "Earth Summit" held in Rio de Janeiro in June 1992, where 154 countries signed the "International Convention on Biological Diversity" and expressed solidarity and commitment to protect biological diversity worldwide. As a follow-up, various nations started addressing the issue of protecting their valuable genetic resources for sustainable development as well as for better future for the younger generation. The "Earth Summit" also recognized the "Sovereign Rights" of the nations relating to their biodiversity and gave a call for initiating national and global plans of action both for *"in-situ"* and *"ex-situ"* conservation involving Governmental Institutions, Non-Governmental Organizations (NGOs) and farmers. The underlying principle that no international effort would succeed unless the national programmes are strengthened, various nations have geared up their efforts in this direction.

In India also, appropriate steps have already been initiated by the concerned public institutions to protect rich biodiversity. Especially, in relation to agrobiodiversity, effective programmes at the national level have been initiated by the Indian Council of Agricultural Research (ICAR) through the establishment of 3 Bureaux–the National Bureau of Plant Genetic Resources (NBPGR), New Delhi, established in August 1976, the National Bureau of Animal Genetic Resources (NBAGR), Karnal, established in September 1984, and the National Bureau of Fish Genetic Resources (NBFGR), established in December 1983 in Allahabad, and subsequently shifted to Lucknow in May 1994. Considerable stress is being given during the VIII Plan to strengthen network for conserving agrobiodiversity with greater emphasis on conservation of wild and weedy species and landraces of plants, local breeds of animals and various fish species. Today, the National Gene Bank at the NBPGR is holding more than 170,000 accessions of various crop-species, and a new Gene Bank, likely to be completed by November 1996, would be one of the largest Gene Banks in the world with a capacity to store more than 1 million seed-samples. Also, steps have been taken during this Plan to establish a National Centre on DNA Fingerprinting. Besides, a National Centre for Agricultural Micro-organisms is planned to be established during the IX Plan. It is, therefore, satisfying to mention that the Indian National Agricultural System is alive to the need for having a strong system for conservation of our agrobiodiversity. In future, efforts would also be directed towards *"in-situ"* conservation through effective partnership with farmers and NGOs; so that we are able to conserve our genetic resources for posterity.

Let me re-emphasize that it is still not too late! However, we have to act fast to protect our biological diversity before some more species get extinct. History would not happen behind our backs, if only we utilized all the power of information and infrastructure at our disposal with required wisdom to take corrective measures in this regard. I firmly believe that with our commitment to the cause, we would be the masters of our destiny and the shapers of the future of our younger generation!

(R.S. PARODA)