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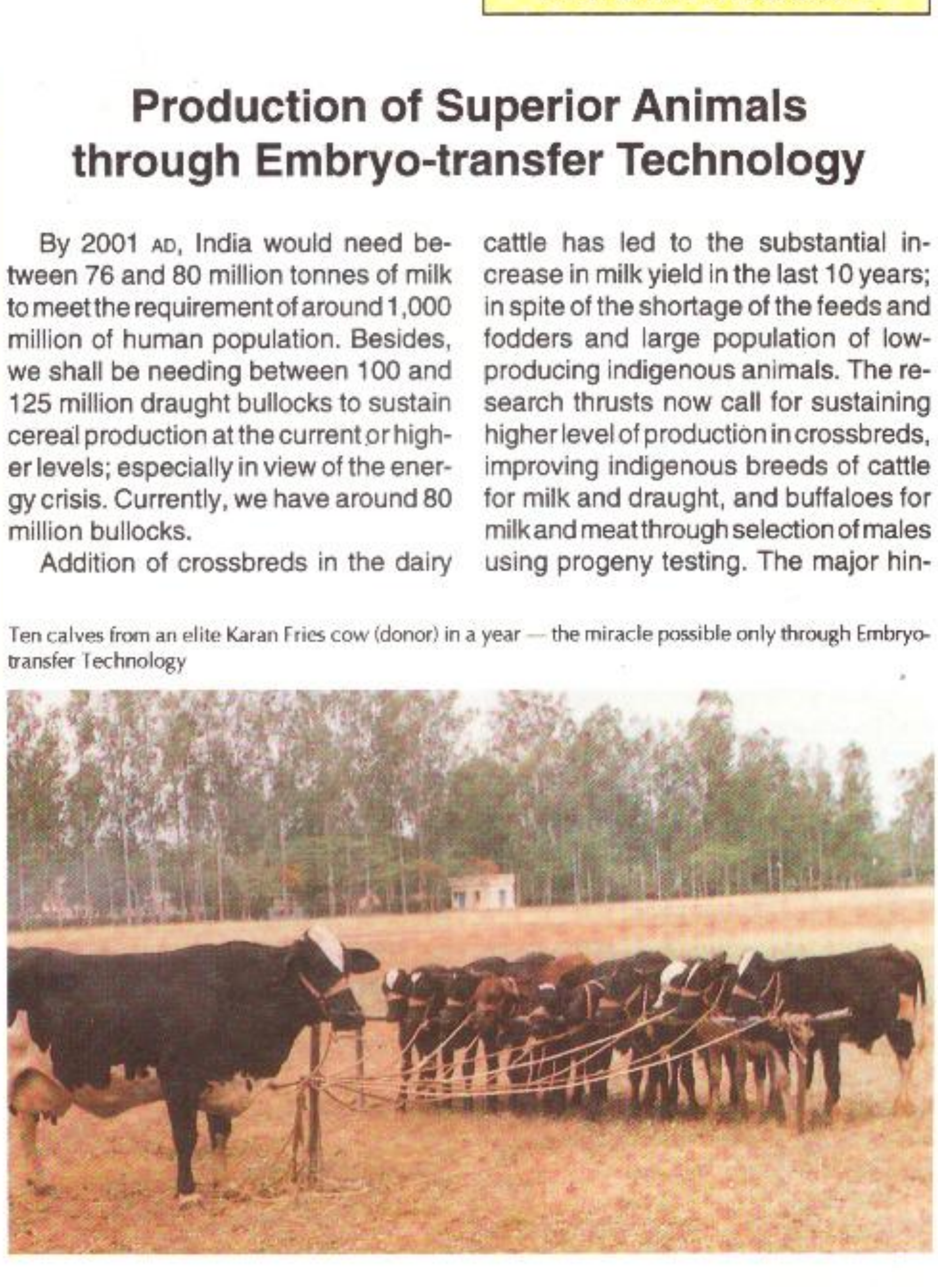
BREAKTHROUGH

Production of Superior Animals through Embryo-transfer Technology

By 2001 AD, India would need between 76 and 80 million tonnes of milk to meet the requirement of around 1,000 million of human population. Besides, we shall be needing between 100 and 125 million draught bullocks to sustain cereal production at the current or higher levels; especially in view of the energy crisis. Currently, we have around 80 million bullocks.

Addition of crossbreds in the dairy cattle has led to the substantial increase in milk yield in the last 10 years; in spite of the shortage of the feeds and fodders and large population of low-producing indigenous animals. The research thrusts now call for sustaining higher level of production in crossbreds, improving indigenous breeds of cattle for milk and draught, and buffaloes for milk and meat through selection of males using progeny testing. The major hin-

Ten calves from an elite Karan Fries cow (donor) in a year — the miracle possible only through Embryo-transfer Technology



Indian Agricultural Research Institute

The Indian Agricultural Research Institute (IARI), popularly known as 'Pusa Institute', was originally established in 1905 at Pusa (Bihar) to initiate agricultural research in India. The Institute was shifted to the present site in New Delhi following a major earthquake at Pusa, and formally inaugurated on 7 November 1936 by the then Viceroy of India, Marquis of Linlithgo. In 1958, the Institute was conferred the status of a 'deemed' university by the University Grants Commission.

Organizational Set-up

In 1975, the ICAR appointed a Board of Management for the Institute with the Director, IARI, as its Chairman. The Board is served and serviced by 4 Councils, namely, Research Council, Academic Council, Extension Council and Executive Council.

The Institute is headed by the Director who is the overall incharge of all the activities concerning research, education, extension and administration. He is assisted by a Joint Director (Research), a Dean and Joint Director (Education), a Joint Director (Extension) and a Joint Director (Administration). The Joint Director (Research), the Dean and Joint Director (Education) and the Joint Director (Extension) are responsible for central co-ordination of research, education and extension activities of the Institute. The day-to-day administrative affairs are handled by the Joint Director (Administration).

The Chief Finance and Accounts Officer has the overall charge of Audit and Accounts.

The Institute's research and educational activities are carried out under the direct supervision of the Project Directors and Heads of the divisions/ regional stations.

The Institute also serves as the headquarters of several all-India co-ordinated projects.

Infrastructure

The research, education and extension activities of the Institute are carried out through a network of 18 divisions (Agricultural Chemicals, Agricultural Economics, Agricultural Engineering, Agricultural Extension, Agricultural Physics, Agronomy, Biochemistry, Entomology, Floriculture and Landscaping, Fruits and Horticultural Technology, Genetics, Microbiology, Nematology, Plant Pathology, Plant Physiology, Seed Science and Technology, Soil Science and Agricultural Chemistry, and Vegetable Crops), 5 multidisciplinary centres (Centre for Environmental Sciences, National Facility for Blue-green Algal Collections, National Research Centre for Plant Biotechnology, Nuclear Research Laboratory, and Water Technology Centre), 9 regional stations—Amartara Cottage, Shimla, Himachal Pradesh (horticultural technology); Indore, Madhya Pradesh (wheat breeding); Kalimpong, West Bengal (virus research); Karnal, Haryana (seed research and production); Katrain, Himachal Pradesh (vegetable research and production); Pune, Maharashtra (virus research); Pusa, Bihar (wheat, pulses and fruits research); Tutikandi, Shimla, Himachal Pradesh (wheat and barley breeding) and Wellington, Tamil Nadu (wheat breeding and 2 off-season nurseries—Aduthurai, Tamil Nadu (rice) and Dharwad, Karnataka (pulses) located in different agroclimatic regions of the country.

National Facilities

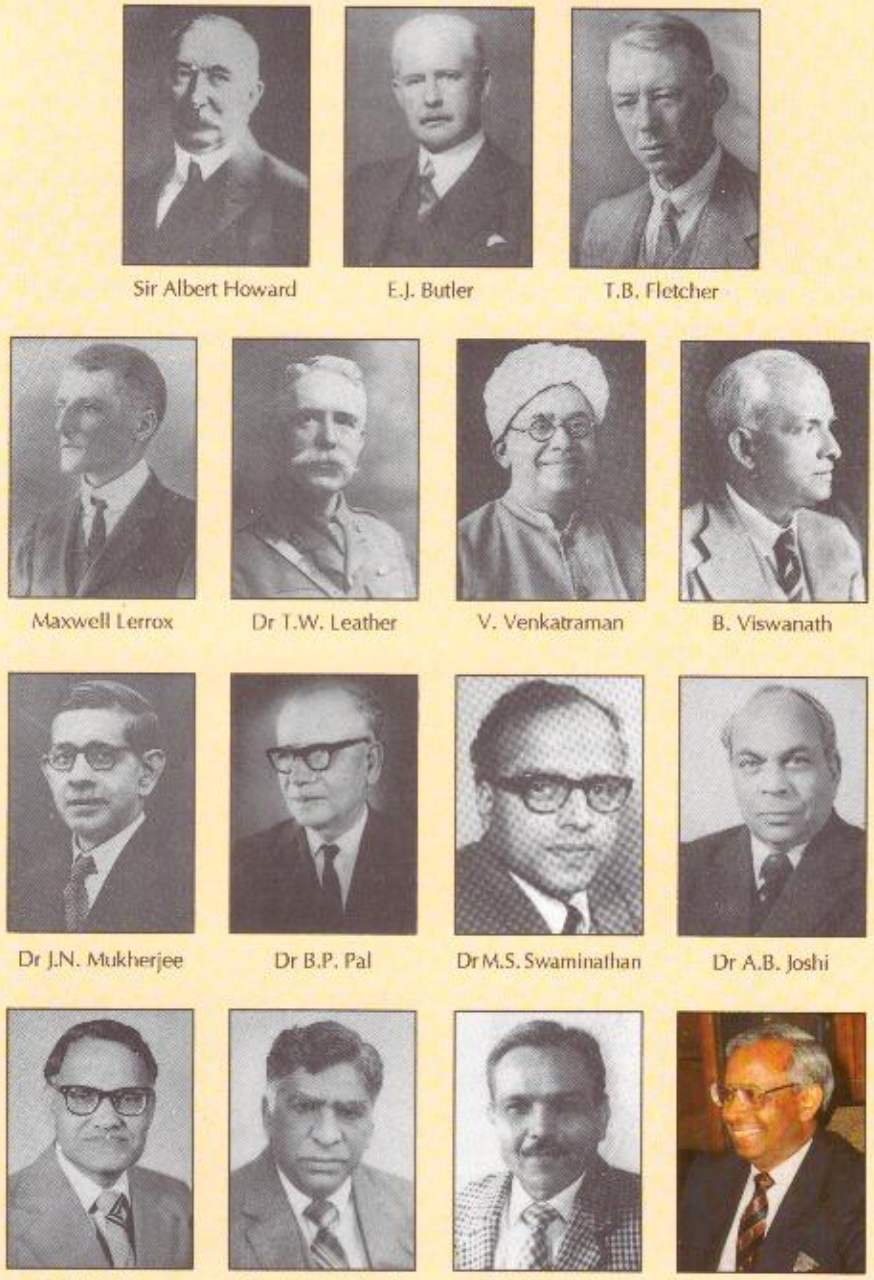
The Institute can boast of having

Lal Bahadur Shastri Centre for Advanced Research in Biotechnology and Plant Protection

unique agrobiological repositories in the country, which comprise a national facility for blue-green algae, a large collection of type-specimens of insects, fungi and nematodes, and, germplasm of agriculturally useful microbes.

Another unique facility available at the IARI is its library, considered to be the largest in Asia in the field of agriculture. At present, the library has over 600,000 publications; over 10,500 files of periodical and serial titles, besides a comprehensive collection of 750 secondary-source journals, 1,500 titles from 80 countries, cover-to-cover translated titles, newsletters, bulletins, etc., spread over 12 kilometres of shelving. It maintains a retrospective bibliography on Indian Agriculture from 1944 and offers reprography facilities in the form of photocopy, microfilm and xerox copies. The library is also a depository for publications of the World Bank, FAO, IDRC and CGIAR. The ICAR has recently decided to upgrade it to the status of the National Agricultural Library.

The Institute also houses the Bioinformatics Centre which caters to the application of information technology to life sciences. It acts as a computerized information base and has on-line access to international databases through global network and electronic mail. It is equipped with a powerful MICROVAX II computer to handle various databases available in the World.



The IARI Directors–Past and Present

Research Achievements

The IARI occupies a pride of place in the field of agricultural research in the country and continues to provide scientific leadership to many ICAR institutes and state agricultural universities.

The Institute achieved success in developing high-yield technology in many crops. Its role in the late sixties to develop production technology for dwarf wheat is well known. In recognition of the contributions of the Institute towards Green Revolution, the Prime Minister of India in 1968 released a Postage Stamp. Similarly, high-yield technology programmes in maize, sorghum, pearl millet and other crops have resulted in the release of several hybrids and composites.

Wheat improvement programme at this Institute remains the most intensive of its kind. Wheat varieties such as Sonalika, Kalyansona, Hira, Moti, Shera, Arjun and several others of the HD series developed at the Institute, are the household names among farmers throughout the country. Two varieties HD 2329 and HD 2285 have occupied more than 70% of the wheat-cultivated area in Punjab, Haryana and Uttar Pradesh.

A breakthrough has recently been achieved in triticale research with the development of a high-yielding amber-grained triticale DT 46 for the first time in the world.

In rice research , the emphasis in recent years has shifted to the development of high-yielding, semi-dwarf, fine grain, aromatic basmati rices, specially suited to the north-west Indian conditions— the traditional belt of basmati cultivars.

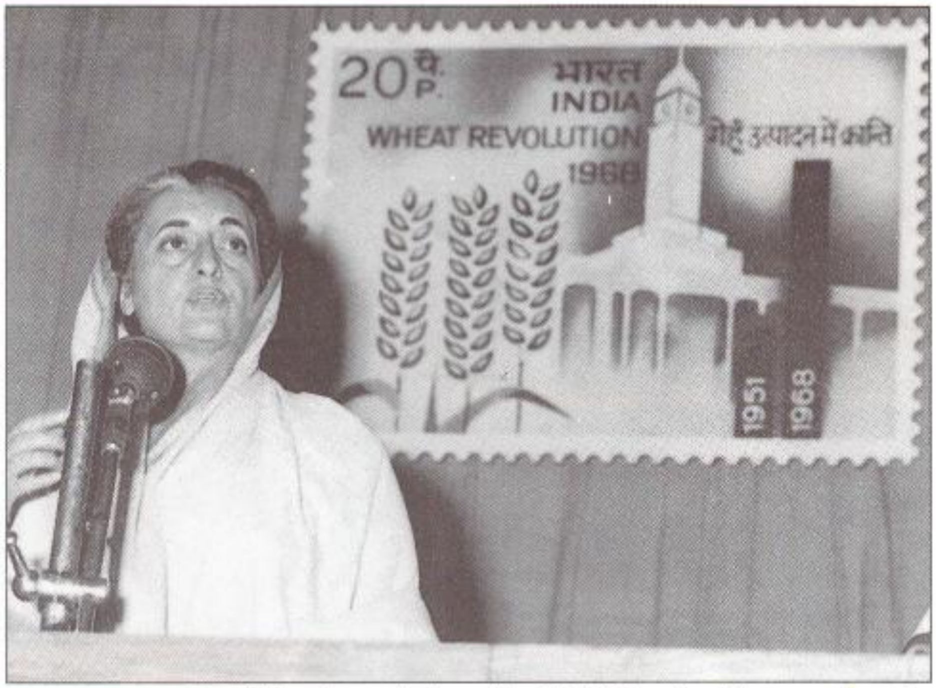
In vegetable improvement, the emphasis has been on accelerating productivity through exploitation of hybrid vigour and breeding for high-yielding, disease-resistant varieties.

Development of high-yielding, disease-resistant varieties, particularly in mango, papaya, grape and strawberry, has been one of the major concerns in fruit crops research.

The flower crops developed by the Institute, particularly in rose, gladiolus and bougainvillea are extremely popular with the gardeners. The Institute is at present working on the technology of the cut-flower for export.

More recently, the Institute has sought to strengthen the genetic enhancement programme through emphasis in researches involving biotechnology and molecular biology.

In agronomy, major emphasis is on evolving efficient cropping systems under irrigated as well as dryland conditions, efficient management of inputs, particularly fertilizers and water, and development of effective weed control measures in food, fibre, fodder, spices and vegetables crops. Some of the other major achievements include: development of the new concepts in multiple cropping for increasing yield per unit time, enabling the raising of 4 crops a year, development of the new cropping systems involving short-duration pigeonpea/wheat rotation to meet the country's ever-increasing need for pulses, use of neem-cake for minimizing applied nitrogen losses and incorporation of legume residues for nitrogen economy.



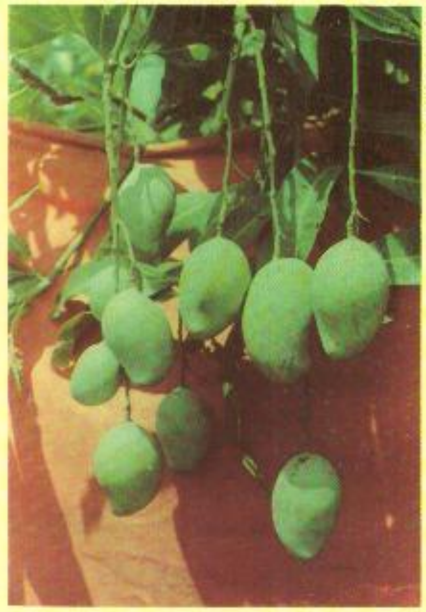
A postage stamp, acknowledging the contributions of the IARI's Wheat Revolution, was released in 1968 by the then Prime Minister, Mrs Indira Gandhi

The Institute appreciates the importance of soil as a major resource in sustainable development and attaches much importance in maintaining its fertility and productivity. The major contributions in this area have been the preparation of the first soil map of India, and soil-fertility maps of India for nitrogen, phosphorus and potassium generated from sampling of several millions of soil samples covering the country. Remote sensing has been put to a good use in detecting moisture stress and nutrient deficiency and for making yield prediction. Remote-sensing studies on water management and land degradation particularly at the Indira Gandhi Canal Command, Rajasthan, and diara lands of Bihar are worth mentioning.

The Institute is giving adequate attention for designing and developing manually-operated, animal-drawn and power-driven implements, equipments and machinery for crop production with emphasis on small- and medium-sized holdings; design and development of equipment/processes for processing of cereals, pulses and oilseeds; post-harvest technology with particular emphasis on storage engineering; and utilization of renewable source of energy such as solar energy and biomass. Techniques have been perfected for use of plastics in agriculture, particularly in green-house cultivation.

Good success has been achieved in isolating efficient strains of rhizobia, HD 2329 wheat

Amrapali: A high-yielding annual-bearing mango suitable for high-density orchards



Mrinalini: A popular rose

Some popular varieties released by the IARI

Pusa Basmati 1: The first non-lodging, semi-dwarf rice variety, yielding 4.5–6.5 tonnes/ha

Pusa Gaurav: A promising tomato suitable for processing and long-distance transportation

cellulose- and lignin-decomposing micro-organisms, phosphate-solubilizing bacteria, *Azospirillum* and *Azatobacter* and standardizing technique for their mass culture. The Institute houses national facilities for *Rhizobium* culture collection and blue-green algae.

In 1905, the Institute established Herbarium Cryptogamae Orientals, which has a collection of more than 41,000 specimens. Later, the Indian Culture Collection was also established. It has more than 3,000 live-cultures.

Education

The Institute has been doing a commendable job in imparting education for a select band of young men and women from different parts of the country. It is helping many SAU's and third world countries to train and upgrade their faculties under specified schemes.

Besides M.Sc. and Ph.D. programmes, the Institute offers training in specified areas such as mushroom cultivation.

At present the Institute is awarding M.Sc. degree in 11 disciplines and Ph.D. degree in 17 disciplines. Several IARI students get the Jawaharlal Nehru Award of the ICAR each year for the best Ph.D. work.

Foreign students from 38 countries have obtained M.Sc. (130) and Ph.D. (68) degrees till 1994.

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UP 2338 wheat

UP 2338, the latest wheat variety from Pantnagar

UP 2338 wheat has been released for cultivation for the north-western plains zone comprising western Uttar Pradesh, Haryana, Delhi, Punjab, Rajasthan and Jammu and Kashmir.

UP 2338 gives better yield (8-10%) than HD 2329 under timely-sowing and HD 2285 under late-sowing. Besides yield, this variety possesses high degree of resistance to leaf rust, yellow rust and Karnal bunt. The grains are bold, sherbati and make good chapaties. The variety has wide adaptation and can be planted from November first week till December; thus ideally suited for various cropping systems.

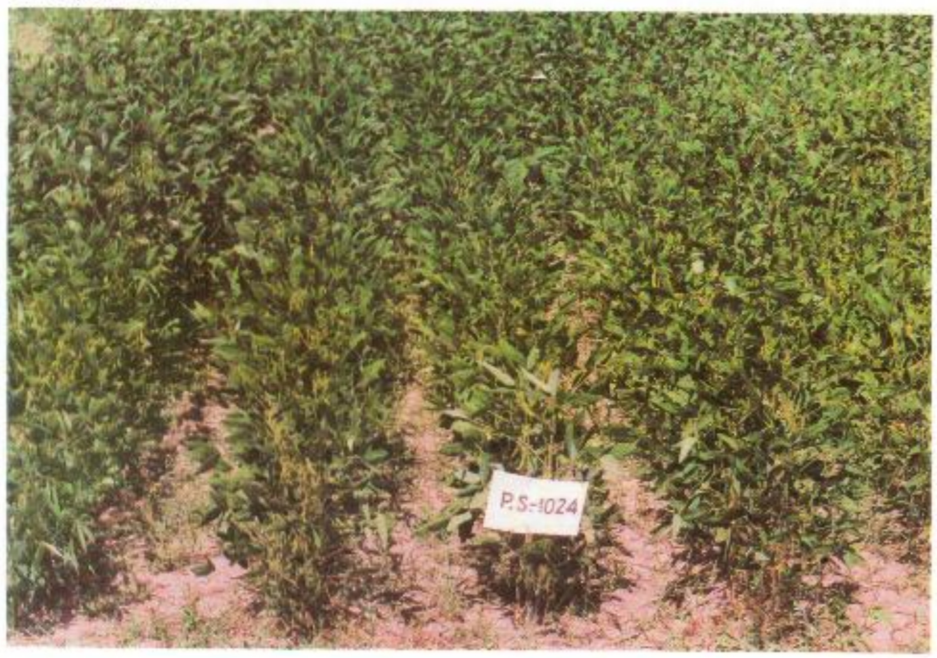
More protein through wonder wheat Raj 3077

Raj 3077 wheat is the first multipurpose and multifaceted, high-yielding variety released by the Rajasthan Agricultural University (RAU) for the north-western zone of the country. This dwarf, rust-resistant variety is tolerant to alkaline as well as saline areas, and is suitable for both normal- and late-sown situations. This bold-grained variety has good chapati-making quality and has 12.5% more protein than other wheat cultivars presently in vogue. It is popular not only in Rajasthan, but also in neighbouring Haryana, Punjab and Uttar Pradesh.

Yellow-mosaic resistant soybean—Pant Soybean 1024

Susceptibility to yellow mosaic and poor seed longevity are the 2 major constraints limiting production of soybean in the northern plains. Soybean breeding programme of the Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, has had a mission-oriented goal of developing yellow-mosaic-resistant varieties with good seed germinability. The programme has achieved the objective of combining resistance to yellow mosaic and bacterial pustules by releasing soybean varieties like PK 416, PS 564; and recently Pant Soybean 1024 (PS 1024) to which a distinct phenotypic genetic marker has been added in the form of narrow leaflet.

Pant Soybean 1024



Pant Soybean 1024, the best and latest variety of soybean, has been released for commercial cultivation in the plains and tarai region of Uttar Pradesh, though this variety has been found suitable for other northern states also— Haryana, Punjab and Delhi.

The variety is resistant to yellow mosaic which is a major problem in soybean cultivation. It has narrow and lanceolate leaflets with dark-green colour as a major mark of identification from other varieties. The specific plant type is very much suited for plant-protection measures and high photosynthesis. The yield potential of the variety is 40.81 q/ha on the basis of the co-ordinated agronomic trials with an average yield potential of 30-40 q/ha, 39.45% protein and 21.50% oil content. The variety is very much suited for intercropping with sorghum and maize as it is free from lodging and shattering.

CO 3—A new sunflower variety

Attempts were made at the Tamil Nadu Agricultural University, Coimbatore, to evolve varieties better than CO 2 and Morden through mutation breeding, and a new CO 3 variety of sunflower has been released as a Pongal gift in January in Tamil Nadu.

The variety was tested as TNAU SUF 10 in research stations and farmers' holdings in different districts of Tamil Nadu. In rainfed areas it gave an average yield of 1,251 kg/ha, which was 24% and 27% higher than CO 2 (local check) and Morden (national check).

In irrigated areas in *rabi*, the variety recorded an average yield of 1,390 kg/ha, which was 21% and 40% higher than CO 2 and Morden. It has potential to yield 2,625 kg/ha. It has greater head diameter (16 cm). Seed contains 38.3% oil; hence, the oil out-turn per hectare is also more. The variety is moderately resistant to pests such as jassid, ash-weevil and head borer and diseases such as *Alternaria* and rust.

The manurial schedule of 40:20:20 NPK/ha and other practices followed for open-pollinated varieties can be adopted for this. It is suited to Periyar, Coimbatore, Salem, Tiruneveli and Kattabomman districts for *kharif* (rainfed) and *rabi*.

Bio-control for quick wilt in pepper

The National Research Centre for Spices (NRCS) at Calicut in Kerala has found a biological control for the quick-wilt disease that has been devastating the black-pepper crop of the country. The *Trichoderma* and *Gliocladium* varieties of fungus are found useful in controlling the root-decaying disease.

A extract of garlic and mustard has also been perfected for effectively checking growth of the disease-causing agents in affected gardens.

The cost of biological control at Rs 13 per peppervine is economical compared to chemical methods that cost 4 times more.

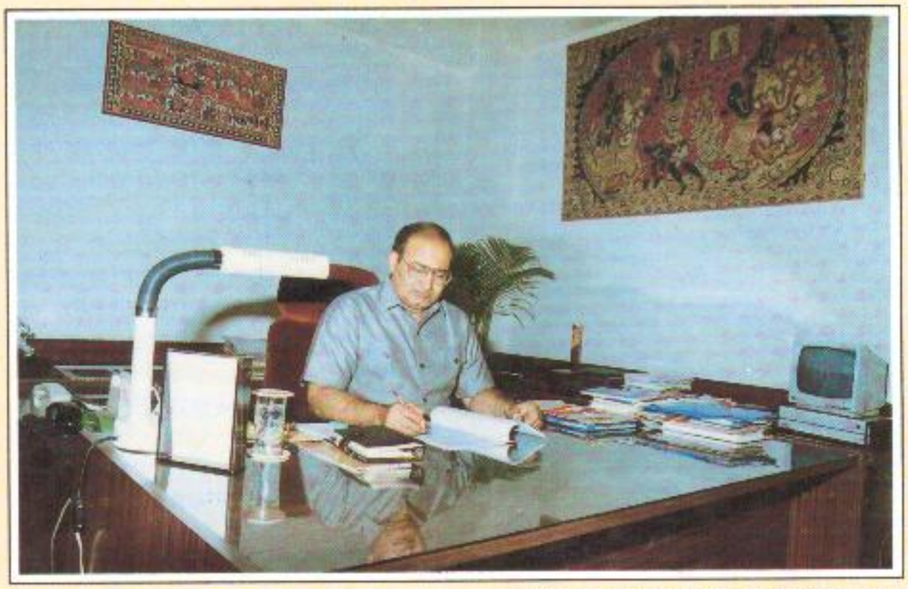
To make mango peeling easier and cheaper— Use mango peeler

Peeling of mangoes for pickles, chutney and powder production is mostly done manually which is labour-intensive and tedious.

The food technologists at the Indian Institute of Horticultural Research, Bangalore, have developed a continuous peeler of raw mangoes.

The peeler consists of a concave wheel, guide drum, casing, a frame and power transmission. In the present model, 3 concave wheels with different sizes of cavities can be provided for big, medium and small fruits. The inlet and outlet for the unpeeled and peeler mangoes are provided in the casing. The concave wheel with sharp

Dr Balram Jakhar dedicating a raw-mango peeler developed at the Indian Institute of Horticultural Research to the industry



DR R.S. PARODA, DIRECTOR-GENERAL, ICAR

On agricultural front, India has successfully moved from food scarcity to food surplus in the last 3 decades. This could be possible mainly due to the cutting edge of the science coupled with fast adoption of technology by the farmers supported ably by the developmental agencies. Indian experience of 'Green Revolution' is often cited worldwide as a success story dispelling all earlier predictions of the "Prophets of Doom". During 1994-95, India not only excelled in meeting food targets, by achieving 189 million tonnes, for the first time but has also attained an all-time record buffer stock of 35 million tonnes. Successes of similar kind have been noticed in oilseeds, fruits, vegetables including potato and milk.

The secret of these successes lies in the fact that the Nation had created the required research and development infrastructure, agricultural human-resource and programmes aiming at self-reliance in food front. Today, our National Agricultural Research System (NARS) is one of the largest R&D institutions in the developing countries with a network of over 49 Research Institutes, 30 National Research Centres, 10 Project Directorates, 27 State Agricultural Universities and 1 Central Agricultural University, and a large number of All-India Co-ordinated Research Programmes involving more than 30,000 researchers and teachers.

Our focus now is to ensure similar successes in future as well, especially when we are entering into the 21st century. We must have our 'Perspective Plan' for the next quarter of the century (up to 2020) and take appropriate steps to strengthen as well as re-orient our efforts to meet future challenges, which would be more demand-driven and would require a matrix-mode approach as well as a shift from the commodity-/project-based to systems-/programme-based approach. There is obviously no room for complacency at this stage. A definite "change" is needed at this junctufe in our governance, functional efficiency, information-management system, programme orientation, inter-disciplinary/inter-institutional linkages, human-resource development, and above all effective linkages between technology-generation and technology-transfer, involving scientists, farmers, non-governmental organizations and the private sector.

Diversification, value addition and concerns for sustainable agriculture, environmental protection and globalization of agriculture would require necessary adjustments in our research prioritization and planning. Time is ripe to move fast to re-orient our efforts in order to meet future challenges successfully. This eventually would ensure a bright future for our younger generation. This is by no means a small task, and we must move, and rather move fast. The key to the future success would largely depend on the 'Renewal of our NARS' — a goal towards which we all must aim as 'partners' in order to effect the much-needed change — obviously a change for the better.

(R.S. PARODA)