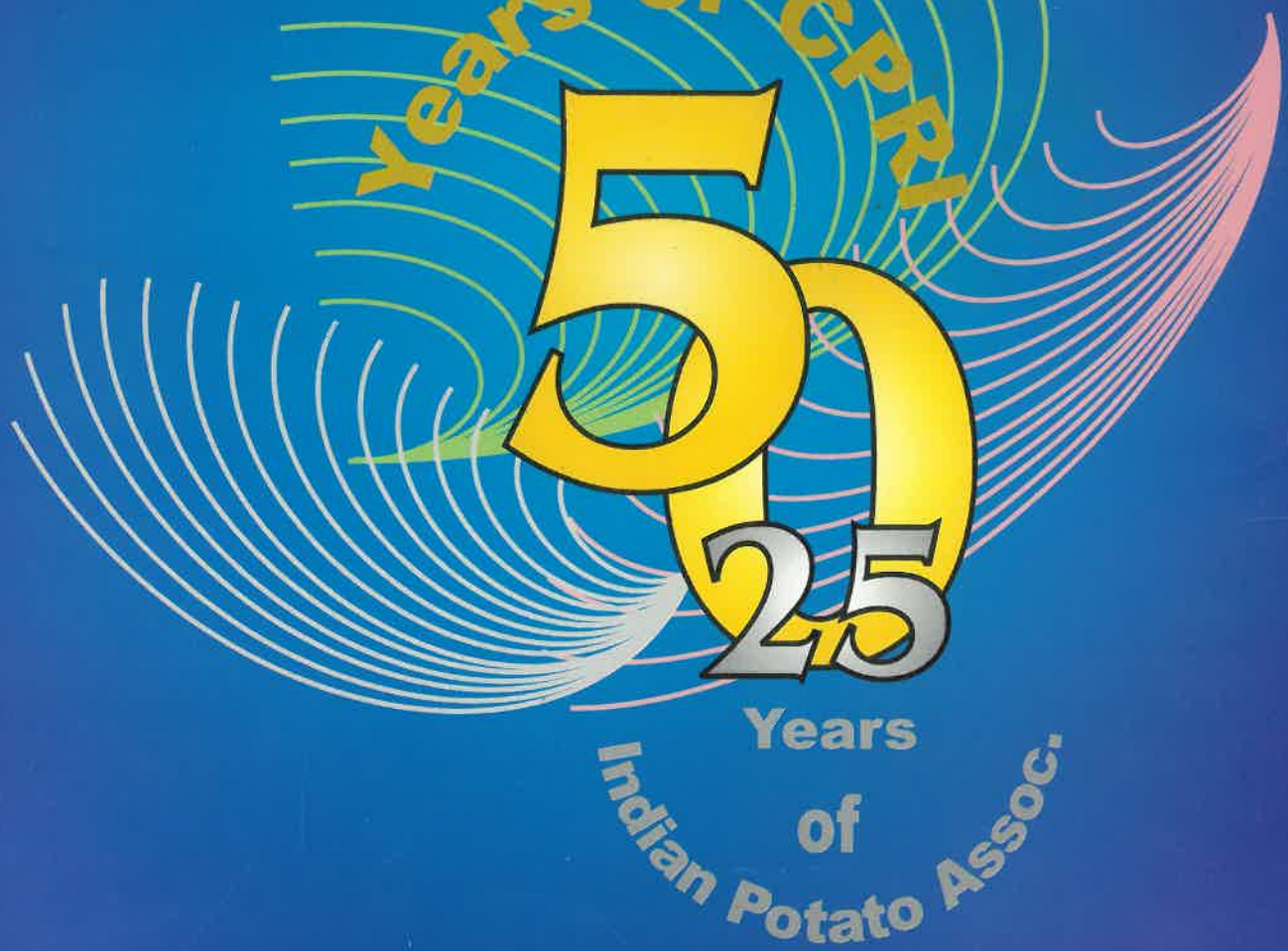
GLOBAL CONFERENCE ON POTATO

December 6-11, 1999, NEW DELHI

Souvenir



Fighting Hunger with Potato

December 6-11, 1999
New Delhi, India

SOUVENIR

INDIAN POTATO ASSOCIATION, SHIMLA
CENTRAL POTATO RESEARCH INSTITUTE, SHIMLA
INDIAN COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI

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GLOBAL CONFERENCE ON POTATO

December 6-11, 1999
New Delhi, India

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Indian Potato Association, Shimla
Central Potato Research Institute, Shimla
Indian Council of Agricultural Research, New Delhi

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GLOBAL CONFERENCE ON POTATO

PROGRAMME AT A GLANCE

December 6 – 11, 1999

Registration December 6 (1030 to 1330 hrs) **Venue: NPL, Auditorium, Pusa Campus, New Delhi**
Inauguration December 6 (1630 hrs) **Venue: Hotel Ashok, 50B, Chanakyapuri, New Delhi-21**

Day/Date	Key Note Address	Session / Symposium		Poster Session	Evening Meeting
Monday, December 6	**Role of potato in global food security** Speaker: MS Swaminathan Time: 1800 hrs Venue: Hotel Ashok	–	–	–	–
Tuesday, December 7	**Retrospect and future prospects of potato research and development in the world** Speaker: Hubert Zandstra Time: 0930 hrs Venue: NPL Auditorium, Pusa Campus	**Crop Production, Cropping System and Crop Modelling** Time: 1100 hrs Venue: NPL Auditorium, Pusa Campus	**Potato Biotechnology** Time: 1100 hrs Venue: ASRB Auditorium, Pusa Campus	Time: 1400-1500 hrs Venue: NPL Auditorium, Pusa Campus	–
Wednesday, December 8	**Potato Research and Development in India** Speaker: RS Paroda Time: 1800 hrs Venue: NPL Auditorium, Pusa Campus	**Genetic Resources and Crop Improvement** Time: 0930 hrs Venue: NPL Auditorium, Pusa Campus	**Disease and Pest Management and Seed Production** Time: 0930 hrs Venue: ASRB Auditorium, Pusa Campus	Time: 1400-1500 hrs Venue: NPL Auditorium, Pusa Campus	–
Thursday, December 9	–	**Potato Late Blight** Time: 0930 hrs Venue: ASRB Auditorium, Pusa Campus	**Potato Storage, Processing and Marketing** Time: 0930 Venue: NPL Auditorium, Pusa Campus	Time: 1400-1500 hrs Venue: NPL Auditorium, Pusa Campus	**GILB-SWA Linkage Group Meeting** Time: 1700 hrs Venue: NCIPM Committee Room, Pusa Campus **Brain Storming Session on Potato Storage and Processing** Time: 1745 hrs Venue: : ASRB Auditorium, Pusa Campus
Friday, December10	–	**TPS and other Non-conventional Methods of Propagation** Time: 0930 hrs Venue: NPL Auditorium, Pusa Campus	**Plenary Session** Time: 1400 - 1500 hrs Venue: NPL Auditorium	Time: 1200-1300 hrs Venue: NPL Auditorium, Pusa Campus	**APIC Group Meeting** Time: 1600 hrs Venue: NCIPM Committee Room, Pusa Campus

Cultural Programme
Kuchipudi Dance Recital
Date: Thursday, December 9
Time: 1900 hrs
Venue: NPL Auditorium, Pusa Campus

Field Visit
Central Potato Research Station, Modipuram and the farmers' fields
Date: Saturday, December 11
Time: 0830 hrs

Village Night Dinner, December 8, 1999 Time: 19.30 hrs;
Venue: Lawns of Genetics Divsion, Pusa Campus

Key Note Address:
Chairperson: RS Paroda
Speaker : **Hubert Zandstra,** CIP, Lima, Peru
Topic : **Retrospect and future prospects of potato research and development in the world**
Venue : NPL Auditorium, Pusa Campus, New Delhi
Date : December 7 (0930 hrs)
Tea Break

INAUGURATION OF EXHIBITION

SESSION 1: Crop Production, Cropping Systems and Crop Modelling

Date : December 7, 1999
Venue : NPL Auditorium, Pusa Campus, New Delhi

Chairperson : **Hubert Zandstra,** International Potato Centre, Lima, Peru
SK Sinha, Indian Agricultural Research Institute, New Delhi, India
Conveners : **Walter Bowen,** International Potato Centre, Lima, Peru
SS Lal, Central Potato Research Institute, Shimla, India

Time	Speaker	Topic
1100 – 1145	**RB Singh**	**Plenary Lecture:** Role of potato in sustainable cropping system
1145 – 1205	JS Grewal & PM Govindakrishnan	Changing scenario of potato production technology in subtropics
1205 – 1225	Patricia Imas & SK Bansal	Integrated nutrient management in potato
1225 – 1245	JP Palta	Water management in potato crop
1245 – 1305	NP Sukumaran	Role of chemicals in potato production, storage and utilisation
Lunch Break	1305 – 1400	
Poster Session	1400 – 1500	
1500 – 1520	AJ Haverkort & PL Kooman	Crop modelling in potato: Current scenario and future strategies
1520 – 1540	Walter Bowen, SS Lal & PM Govindakrishnan	Simulation of potato based cropping system
1540 – 1600	PK Aggarwal	Crop growth modelling in India: Current status and future prospects
Tea Break	1600 – 1610	
1610 – 1630	Noel Govinden	Intercropping of sugarcane with potato
1630 – 1650	Frans Holstein	Mechanization of potato production in developed countries
1650 – 1710	VK Sharma & SR Verma	Mechanization of potato production in developing countries
1710 – 1730	Cobi Shilo & Anil Kaushal	The advantages of overhead micro-irrigation for vegetables
1730 – 1750	Dindo M Campilan	Farmers' participation in potato technology development

SYMPOSIUM 1: Potato Biotechnology

Date : December 7, 1999

Venue : ASRB Auditorium, Pusa Campus, New Delhi

Chairperson : **Manju Sharma,** Department of Biotechnology, Govt. of India

Co-chairperson : **RP Sharma,** NRC on Plant Biotechnology, IARI, New Delhi, India

Conveners : **KC Bansal,** NRC on Plant Biotechnology, IARI, New Delhi, India

PS Naik, Central Potato Research Institute, Shimla, India

Time	Speaker	Topic
1100 – 1145	**E Jacobsen**	**Plenary Lecture:** Potato biotecnology: A global scenario
1145 – 1210	Dilip M Shah,Bradley M Krohn & David M Stark	Genetic improvement of potato through biotecnology: commercial application and constraints
1210 – 1235	A Mattoo	Biotechnology in the management of abiotic stress
1235 – 1300	Subhra Chakraborty, Niranjan Chakraborty & Asis Datta	Increased nutritive value of transgenic potato by expressing a non-allergenic seed albumin gene from *Amaranthus hypochondriatus*
Lunch Break	1300 – 1400	
Poster Session	1400 – 1500	
1500 – 1525	Glenn J Bryan, D Milbourne, R Waugh & WS De Jong	Genome analysis and the potential for molecular breeding in potato
1525 – 1550	Dimitry B Dorokhov	Protein electrophoresis and DNA profiling data as a tool for potato cultivar certification in Russian Federation
1550 – 1615	Ramona Thieme, T Thieme, U Heimbach, T Gavrilenko & U Darsow	Development and use of new sources of resistance for the genetic improvement of the potato
Tea Break	1615 – 1625	
1625 – 1650	RP Singh	Advances in molecular detection methodologies for potato viruses and viroids
1650 – 1715	PS Naik, RK Birhman SK Chakrabarti	Potato biotechnology: Indian perspectives
1715 – 1740	A Datta	Biosafety requirements for carrying out research on recombinant DNA and transgenic plants

SESSION 2: Genetic Resources and Crop Improvement

Date : December 8, 1999

Venue : NPL Auditorium, Pusa Campus, New Delhi

Chairperson : **J Bamberg,** USDA, ARS, US Potato Genebank, Sturgeon Bay, USA

Conveners : **J Gopal and SK Pandey,** Central Potato Research Institute, Shimla, India

Time	Speaker	Topic
0930 – 1015	**Wanda W Collins**	**Plenary Lecture:** International policy implication in potato germplasm exchange
1015 – 1040	A Murthi & U Nuria	The implementation of the global plan of action for the conservation and sustainable utilization of plant genetic resources for food and agriculture
1040– 1105	John Bamberg, A del Rio & Z Huaman	Research on the management of potato genetic diversity
Tea Break	1105 –1120	
1120 – 1145	Z Huaman	Conservation of potato genetic resources at CIP
1145 – 1210	K Schuler	Inter-gene bank cooperation in collecting potato germplasm
1210 –1235	R Hoekstra, Z Huaman & JB Bamberg	History of APIC and the initiative to create comprehensive database
1235 –1300	Stephan Kiru	Germplasm collection, conservation and utilisation in Russia
Lunch Break	1300 – 1400	
Poster Session	1400 – 1500	
1500 – 1530	JE Bradshaw	Conventional breeding in potatoes: Global achievements
1530 – 1600	D Levy	Conventional breeding in potato: Achievements in diverse climates
Tea Break	1600 –1615	
1615 – 1640	NM Nayar	Cytogenetical basis of improvement in potato
1640 – 1705	PC Gaur & SK Pandey	Potato improvement in sub-tropics
1705 – 1730	N Zoteyeva	The Vavilov Institute for Research on wild species potato collection as source of resistance to potato late blight

SESSION 3: Diseases and Pest-Management and Seed Production

Date : December 8, 1999

Venue : ASRB Auditorium, Pusa Campus, New Delhi

Chairperson : **SP Ghosh,** Indian Council of Agricultural Research, New Delhi, India
KV Raman, CEEM, Cornell, USA

Convener : **Oscar Hidalgo,** CIP/SDC, Pakistan

Time	Speaker	Topic
0930 – 1040	**GS Shekhawat, SM Paul Khurana & BP Singh**	**Plenary Lecture:** Important diseases and pests and their management
1040 – 1105	KV Raman	Integrated pest management (IPM) in potato production
Tea Break	1105 – 1120	
1120 – 1145	Kenneth Evans	Management of potato nematodes
1145 – 1210	Hector Lozoya Saldana	Phytosanitation and quarantine considerations in the international exchange and evaluation of potato germplasm
1210 – 1235	Doostmorad Zafari	Biocontrol of soil-borne diseases of potato by Trichoderma spp
1235 – 1300	Ineke Mastenbroek	Potato seed health standards: Need for high quality
Lunch Break	1300 – 1400	
Poster Session	1400 – 1500	
1500 – 1530	J Horvath & G Kazinczi	Potato virus research in Hungary
1530 – 1600	Oscar A Hidalgo	Situations and perspectives of the potato seed systems in six countries of South-west Asia (SWA)
Tea Break	1600 – 1615	
1615 – 1640	LC Sikka	Potato seed production and certification by private sector: Indian vs international experience
1640 – 1705	SM Paul Khurana & KD Verma	Virus vectors and their management
1705 – 1730	T Thieme	NOVARTIS aphids guide: The computer-aided identification key from NOVARTIS

Key Note Address:

Chairperson : Hubert Zandstra

Speaker : **RS Paroda,** Indian Council of Agricultural Research, India

Topic : **Potato research and development in India**

Venue : NPL Auditorium, Pusa Campus, New Delhi

Date : December 8 (1800 hrs)

Dinner

SYMPOSIUM 2: Potato Late Blight

Date : December 9, 1999

Venue : ASRB Auditorium, Pusa Campus, New Delhi

Chairperson : **WE Fry,** Cornell University, Ithaca, USA

Conveners : **BP Singh,** Central Potato Research Institute,Shimla, India

Greg Forbes, International Potato Centre, Quito, Ecuador

Time	Speaker	Topic
0930 – 1015	**Wanda W Collins & Charlotte Lizarraga**	**Plenary Lecture:** Global status and international collaboration in tackling late blight
1015 – 1040	WE Fry	Epidemiology of new late blight with special emphasis on forecasting
1040 – 1105	Greg Forbes	Status of late blight in the highland tropics
Tea Break	1105 – 1115	
1115 – 1140	BP Singh	Status of late blight in the sub-tropics
1140 – 1205	Sophein Kamoun	Virulence and avirulence in *Phytophthora infestans*
1205 – 1230	Stephan Kiru	Genetic sources of resistance to late blight among forms of *Solanum andigenum* Juz *et* Bak
1230 – 1255	N Zoteyeva	Utilization of wild species in potato breeding for resistance to *Phytophthora infestans*
Lunch Break	1255 – 1400	
Poster Session	1400 – 1500	
1500 – 1525	U Darsow	Sources of and breeding for relative late blight resistance of potato
1525 – 1550	E Zimnoch-Guzowska, MT Sieczka, KM Swiezynski & H Zarzycka	Breeding potato cultivars with durable resistance to *Phytophthora infestans*
Tea Break	1550 – 1600	
1600 – 1625	KV Raman	Promoting public and private sector collaboration in potato late blight
1625 – 1650	J Amrein	Role of industry in management of late blight

Evening Meeting

Title : **GILB-SWA Linkage Group Meeting**

Date : December 9

Time : 1700 hrs

Venue : NCIPM Committee Room, Pusa Campus

SYMPOSIUM 3: Potato Storage, Processing and Marketing

Date : 9 December, 1999

Venue : NPL, Auditorium, Pusa Campus, New Delhi

Chairperson : **SS Johl,** Ludhiana, Punjab, India

Keith O Fuglie, International Potato Centre, Bogor, Indonesia

Conveners : **PS Dahiya,** Central Potato Research Institute, Shimla, India

VS Khatana, International Potato Centre, New Delhi, India

Time	Speaker	Topic
0930 - 1015	**SS Johl & PS Dahiya**	**Plenary Lecture:** Potato marketing with special reference to storage and processing in the world
1015 – 1035	ABJ Alberts	The importance of potato storage
1035 – 1055	JP van Maldegem	State of the art techniques for the potato storage
Tea Break	1055 – 1105	
1105 – 1125	Sarath G Ilangantileke	Potato storage systems for small farmers in tropical and sub-tropical regions
1125 – 1145	F Lamber	Development of computer-controlled environment in potato
1145 – 1205	Keith O Fuglie	Economics of potato storage: Case studies
1205 – 1225	P Van Eyek	Potatoes for processing
1225 – 1245	AK Tyagi	Potato storage and processing in India
1245 – 1305	R Ezekiel & GS Shekhawat	Potato processing in developing countries with special reference to India
Lunch Break	1305 – 1340	
Poster Session	1340 – 1430	
1430 - 1450	DB Sabharwal	International trade in processed potato products
1450 – 1510	BB Nagaich	Journey of potato from under ground to under sea
1510 – 1530	Keith O Fuglie	International potato marketing: North American perspective
1530 – 1550	Frans Holstein	Seed potato marketing: Europe
1550 – 1610	M Dattatreyulu	International potato marketing: Experiences of Asia
Tea Break	1610 – 1620	
1620 – 1640	Bharat Ramaswamy	Potato prices in India
1640 – 1700	HP Singh	Approaches to sustain potato production in India through increased utilization

Evening Meeting

Title : **Brain Storming Session on Potato Storage and Processing**

Date : December 9

Time : 1745 hrs

Venue : ASRB Auditorium, Pusa Campus

Cultural Programme

Kuchipudi Dance Recital

Date : December 9

Time : 1900 hrs

Venue : NPL Auditorium, Pusa Campus

SESSION 4: TPS and Other Non-Conventional Methods of Propagation

Date : December 10, 1999

Venue : NPL Auditorium, Pusa Campus, New Delhi

Chairperson : **KL Chadha,** Indian Agricultural Research Institute, New Delhi, India

Co-chairperson : **MD Upadhya,** International Potato Centre, Lima, Peru

Conveners : **Jagpal Singh,** Central Potato Research Station, Modipuram, India

KC Thakur, International Potato Centre, New Delhi, India

Time	Speaker	Topic
0930 - 1015	**MD Upadhya**	**Plenary Lecture:**True Potato Seed (TPS) technology: Present and future research
1015 – 1040	PC Gaur, Sarath G Ilangantileke & KC Thakur	True potato seed: Asian scenario
1040 – 1100	Biswanath Mazumdar, Hans Renia & Peter van Hest	Commercial acceptance of TPS by US home gardeners
Tea Break	1100 – 1110	
1110 – 1135	BS Ahloowalia	Large scale production of seed potato minitubers through an innovative technology
1135 – 1200	Peter Waterhouse	The use and benefits of technitubers seed in Asian potato cultivation
Poster Session	1200 – 1300	
Lunch Break	1300 – 1400	

Plenary Session

Date : December 10

Time : 1400 hrs

Venue : NPL Auditorium, Pusa Campus

Evening Meeting

Title : **APIC Group Meeting**

Date : December 10

Time : 1600 hrs

Venue : NCIPM Committee Room, Pusa Campus

Shri K.R. Narayanan
President of India

Deputy Press Secretary to the President of India

सत्यमेव जयते

राष्ट्रपति सचिवालय
राष्ट्रपति भवन
नई दिल्ली-110004
President's Secretariat
Rashtrapati Bhavan
New Delhi-110004

No.F.2-M/99
16th September, 1999

Dear Shri Shekhawat

The President of India, Shri K.R. Narayanan, is happy to learn that the Central Potato Research Institute and Indian Potato Association are jointly organising a Global Conference on Potato during December 6-10, 1999 at IARI, New Delhi.

The President extends his warm greetings and felicitations to the delegates and the organisers and wishes the deliberations in the Conference every success and usefulness.

Yours sincerely.

(K. Satish Nambudiripad)

Shri Krishan Kant
Vice-President of India

सत्यमेव जयते

उप-राष्ट्रपति सचिवालय
नई दिल्ली-110 001
VICE-PRESIDENT'S SECRETARIAT
NEW DELHI- 110011

November 22, 1999

MESSAGE

The Vice President of India, Shri Krishan Kant, is glad to know that the Indian Potato Association and Central Potato Research Institute are holding a Global Conference on Potato in Delhi from 6th December, 1999.

The Vice President sends his good wishes for success of the Conference.

(Ajay Mandlaus)
Information Officer to
The Vice-President of India

A.B. Vajpayee
Prime Minister of India

सत्यमेव जयते

प्रधान मंत्री
PRIME MINISTER

MESSAGE

I am happy to learn that the Indian Potato Association and the Central Potato Research Institute of ICAR are jointly organising a Global Conference on Potato to celebrate the Golden Jubilee of the Institute as well as the Silver Jubilee of the Association.

I am sure that the Conference will provide participants with useful insight about new farm technologies, storage and marketing techniques.

I wish the Conference all success.

(A.B. Vajpayee)

New Delhi

November 19, 1999

V.S. Rama Devi

RAJ BHAVAN
SHIMLA-171 002
(H.P.)

Dated 12.10.99

MESSAGE

I am indeed happy to learn that a Global Conference on Potato is being organised to mark the Golden Jubilee of Central Potato Research Institute and the Silver Jubilee of Indian Potato Association during December 6-10, 1999. This reminds me that until a few decades ago India was dependent on imported food stocks and also did not have sufficient potato production. Nevertheless the sincere efforts of Central Potato Research Institute and All India Coordinated Potato Improvement Project have successfully reversed the situation to an extent that now we are in a position to export food items including potatoes. Besides, CPRI has been leading us towards a bright agriculture since potato now occupies the place of pride among food crops.

I am confident that the Conference will discuss various issues relating to enhanced potato production, post harvest handling, export promotion etc. to suggest the ways and means to achieve the desired goal not only for India but all the countries wherein potato is yet to achieve its potential.

I convey my best wishes for the success of the Conference.

Rama Devi

(V.S. Rama Devi)

Nitish Kumar
Minister of Agriculture
Govt. of India

सत्यमेव जयते

कृषि मंत्री
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MINISTER OF AGRICULTURE
GOVERNMENT OF INDIA
KRISHI BHAWAN
NEW DELHI-110 001

Dated the 3 Nov., 1999

MESSAGE

I am happy to learn that a Global Conference on Potato is being organized by the Indian Potato Association and Central Potato Research Institute to celebrate the Golden Jubilee of the Institute as well as the Silver Jubilee of the Association.

Potato has been a very significant crop for India not only to supplement food requirements of the masses but also as a profitable crop for the farmers. The scientists of Central Potato Research Institute have done commendable job towards developing high yielding and disease resistant varieties of Potato, seed production technology and package of practices for different agro-climatic zones. While congratulating them for their sincere and dedicated service to the cause of Potato, I extend my heartiest greetings for the success of the conference.

(Nitish Kumar)

हुक्मदेव नारायण यादव
Hukumdeo Narayan Yadav

सत्यमेव जयते

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नई दिल्ली-110 001
MINISTER OF STATE FOR AGRICULTURE
GOVERNMENT OF INDIA
KRISHI BHAWAN
NEW DELHI-110 001

Message

I am indeed pleased to learn that the Indian Potato Association and Central Potato Research Institute have decided to organise a Global Conference on Potato in New Delhi during December 1999. I understand that Potato Research and Development in India has been doing remarkably well since the inception of CPRI in 1949. This has brought applause to the country from all corners of the world with India at presents ranking fourth both in area and production. It is also heartening to note that many of the Indian potato varieties/hybrids have been introduced abroad and while many Asian and African subtropical countries have benefitted from our potato production technology.

I am confident that the Global Conference would help the Indian potato research workers develop linkages and also benefit from the international exposures during the deliberations of the conference. I wish all success to both the organizers and participants.

19/11

(HUKUMDEO NARAYAN YADAV)

सत्यमेव जयते

सोमपाल
SOMPAL

कृषि राज्य मंत्री
भारत सरकार
कृषि भवन
नई दिल्ली-110 001
MINISTER OF STATE FOR AGRICULTURE
GOVERNMENT OF INDIA
KRISHI BHAWAN
NEW DELHI-110 001

September 30, 1999

MESSAGE

I am glad to know that Central Potato Research Institute and Indian Potato Association are organising a Global Conference on Potato and bringing out a special Souvenir for the occasion.

Agriculture is one of the foremost components of country's economy. Therefore, it is important that we should employ the latest scientific technologies to help the farmers, society and development of the country. It is also important to deliberate on the different agro-ecological problems, shrinking agricultural land due to population pressure and industrilization, so that maximum productivity can be achieved to meet the challenges of increasing food requirement.

I am confident that the participants would deliberate not only on the listed subjects in the programme but would also consider it important to come out with suitable recommendations for agriculture based industry, sustainable cropping for maximization of crop production with minimum inputs so that both the farmer and consumer benefit to the maximum.

I extend my heartiest greetings for the success of the Conference.

Sompal.

(SOMPAL)

Prof. Dr. S. Solahuddin

MENTERI PERTANIAN
REPUBLIK INDONESIA

Message

I would like to compliment CPRI and Indian Potato Association for this timely theme of the Global Conference which I am sure will contribute to a great extent towards stability in potato production for meeting food requirements of ever growing population. I look forward to the deliberations and recommendations of the Global Conference which will immensely help in developing new strategies.

Agriculture Minister
Indonesia

Hon'ble Chakra Prasad Bastola
Minister for Agriculture

His Majesty's Government of Nepal

Phone 491024
225109
His majesty's Government
Ministry of Agriculture
Singh Durbar, Kathmandu
Nepal

Date 15 August, 1999

MESSAGE

It gives me pleasure to learn that Indian Potato Association/Central Potato Research Institute are holding a Global Conference on Potato. No doubt potato is the only non-cereal crop that can meet food requirements of ever growing population in developing countries. Because of the richness of nutritional qualities, potato serves energy and protein needs of our masses and this calls for concerted research efforts to boost potato production and support its development particularly from the point of view of marketing, storage and processing.

I wish the Conference organisers all success.

(C.P. Bastola)
Minister for Agriculture

Richard F. Celeste

AMBASSADOR OF
THE UNITED STATES OF AMERICA
NEW DELHI

September 23, 1999

To the Organizing Committee
Global Conference on Potatoes

I am pleased to learn that a Global Conference on Potatoes is being organized by the Indian Potato Association and Central Potato Research Institute. Last year I had the benefit of visiting the Institute and was greatly impressed with its staff, facilities and achievements.

Development of the potato processing industry attests to the promising future of the potato in India. I'm sure that the interactions facilitated by this Conference will further benefit the potato industry in India and participating countries.

I send my best wishes to the organizers and all participants and hope that this global conference, centered on one of mankind's most important crops, will be a great success.

Sincerely,

Richard F. Celeste

Richard F. Celeste

DER BOTSCHAFTER
DER BUNDESREPUBLIK DEUTSCHLAND
THE AMBASSADOR
OF THE FEDERAL REPUBLIC OF GERMANY

New Delhi, September 23, 1999

Dr. Heinrich Dietrich Dieckman

Mr. G.S. Shekhawat
Central Potato Research Institute
(Indian Council of Agricultural Research)
Shimla - 171 001, Himachal Pradesh

Sir,

It gives me great pleasure to send this message on the occasion of the forthcoming Global Conference on Potato" in New Delhi during December 6-10, 1999 being jointiy organized by the Indian Potato Association in collaboration with the Central Potato Research Institute.

I am sure that this conference will further the potato research in India as well as the international collaboration in this field. With satisfaction I have noted that two scientist from Germany will take an active part in the deliberations.

Let us hope that the findings of the conference can be implemented soon. I am sure that companies in Germany engaged in potato harvesting, processing and storing technology can offer efficient solutions for the Indian Potato industry.

Wishing the conference to be a success I remain

Yours faithfully

(Heinrich-Dietrich Dieckmann)

AMBASSADOR
OF THE REPUBLIC OF INDONESIA
NEW DELHI

Message

It is a matter of great pleasure and satisfaction to us that Central Potato Research Institute has completed 50 years and is going to celebrate its Golden Jubilee by holding a Global Conference on Potato. I understand that since the inception of the Potato Institute in 1949, its scientists have made valuable scientific advances and provided technological support in improving potato production and productivity.

I believe, many Asian countries, including Indonesia can emulate what has already been achieved in India in the field of potato production. The praiseworthy march of the Indian scientists in this direction, especially that belonging to the Potato Institute of India could go a long way in helping to diversify the agricultural produce of Indonesia, which incidentally is the need of the hour.

I would like to compliment CPRI and Indian Potato Association for this timely theme of the Global Conference which I am sure will contribute to a great extent towards stability in Potato production for meeting food requirements for ever growing population. I look forward to the deliberations and recommendations of the Global Conference, which will help immensely developing new strategies.

Gatot Suwardi

Ambassador

Ambassador
of
the Republic of Poland

New Delhi

September 23, 1999

Dr GS Shekhawat
Chairman, Organising Committee
Global Conference on Potato 1999
Central Potato Research Institute
Shimla - 171 001 (Himachal Pradesh)

Dear Sir,

I am indeed very glad to know that both Central Potato Research Institute and Indian Potato Association are jointly organising. a Global Conference on Potato in a grand style and are going to publish a Souvenir to mark the Golden Jubilee of the Institute and Silver Jubilee of the Association.

Please accept our heartiest greetings for the occasion and I wish the Global Conference a great success.

We greatly depend on potatoes in our country, both for food and feed and take pride to learn that India also has greatly advanced in potato research, due to which potato occupies a place of pride in meeting food requirements of her people. We earnestly hope that mutual cooperation between Poland and India would be important not only for us but the entire mankind by solving the global food shortages.

Looking forward to recommendations of the Global Conference which I am sure will address all important issues pertaining to research and development for potato.

Sincerely yours

Jan Krzysztof Mroziewicz

50-M Shantipath, Chanakyapuri, New Delhi - 110021
Phones : 688-9211 & 467-9158; Fax: 687-1914

Ambassade van het
Koninltrijk der Nederlanden
Royal Netherlands Embassy
Ambassador's Office
6/50 F Shantipath
Chanakyapuri
New Delhi 110021
India

Date 7 October 1999
Our Ref: NDE/CdP-348
Page 1/1
Encl. -
Re Global Conference on Potato from 6-10 December 1999

Contact P.F.C. Koch
Tel. 011-6884951
Fax 011-6884956
E-mail nde-cdp@nde.minbuza.nl

Dr GS Shekhawat
Chainnan, Organising Committee
Indian Potato Association and
Central Potato Research Institute
Shimla-171 001, H.P.

Sir,

It is commendable indeed that the Indian Potato Association in collaboration with the Central Potato Research Institute is holding a Global Conference on Potato from 6-10 December 1999 at IARI, New Delhi.

India today has a special place in the worldwide production of potato. The Netherlands too plays a leading role in this field. I am sure that in the near future there will be a close cooperation between our two countries in the development of the potato varieties and in the production of seeds for export in the region; and perhaps at a later stage wider.

I am confident that the Global Conference will provide a suitable Platform for experts from different parts of the world, to come together to discuss issues of common interest and to learn from each other's experiences.

May I extend my best wishes to the organisers and participants of the Conference.

Yours sincerely,

(P.F.C. Koch)
Ambassador

Mangala Moonesinghe
High Commissioner for
Sri Lanka in India

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21st September, 1999

High Commission for the Democratic Socialist Republic of Sri Lanka
27, KAUTILYA MARG, CHANAKYAPURI, NEW DELHI - 110 021

Message by his excellency the High Commissioner

I am pleased to learn that the Indian Potato Association and the Central Potato Research Institute are organising a Global Conference on Potato in December, 1999. I am also happy to note that India is hosting this important event being the second largest potato producing country in Asia.

Although the Potato crop was domesticated in the highlands of the Andes of South America, it is now cultivated in many parts of the world as a popular part of the daily diet. At present potato is the fourth most important crop in developing countries after rice, wheat and maize. It is estimated that more than three billion people consume the potato. Potatoes are rich in vitamin C and provide more edible dry matter annually than that which is contained in the combined world output of fish and meat. Potatoes are also virtually fat free and contain the protein equivalent of milk along with substantial amounts of vitamins and minerals.

It is interesting to note that the Global Conference on Potato will cover all vital sectors of scientific research related to the crop. In this age of globalization and greater trade liberalisation among nation States, the rational use of biotechnology which will result in substantial increases in yield would be an essential research priority for the agricultural scientists.

Sri Lanka too grows a considerable amount of potatoes and the crop is confined to the cooler climatic areas. It is important that the agricultural scientists working on the potato establish greater cooperation with a view to exchange the latest findings and promote collaborative research. An Action Plan has been finalised for cooperation in the field of agriculture between India and Sri Lanka. The Potato crop too has been identified for collaborative research between the two countries. In this context Sri Lanka looks forward to a positive outcome from the Conference.

I wish every success to the organisers and the delegates participating in this important Global Conference.

(Mangala Moonesinghe)
High Commissioner for Sri Lanka in India

Prof. V. L. Chopra
B.P. Pal National Professor

National Research Centre on Plant Biotechnology
Indian Agricultural Research Institute
New Delhi - 110 012 (INDIA)

No. PS/6-1/99

July 20, 1999

MESSAGE

I am very pleased to learn that the Central Potato Research Institute is organising a Global Conference on Potato in New Delhi in December 1999 as a part of the celebrations of Golden Jubilee Year of the Institute. The Institute can justifiably look back with great satisfaction at the success of its sustained work which has laid foundations for the outstanding rate of growth of both production and productivity of potato. It is ironical that while the contributions of green revolution to improvement of productivity of rice and wheat are well known, the remarkable success of improvement of potato is not generally that known. The work at CPRI done for elevating the genetic production potential of potato and incorporation of tolerance to both biotic and abiotic stresses has resulted in perhaps the fastest rate of growth of any crop in India. Potato is now emerging as a very important food crop and a Global Conference would provide an ideal platform for not only highlighting success of our efforts in the past but also for assessing the current situation to work out strategies for the future. I wish the Conference all success.

(V.L. CHOPRA)

Bhaskar Barua
सचिव, भारत सरकार
Secretary
Government of India
September 27, 1999

सत्यमेव जयते

कृषि मंत्रालय
कृषि और सहकारिता विभाग
कृषि भवन, नई दिल्ली-110 001
Ministry of Agriculture
Department of Agriculture & Cooperation
Krishi Bhavan, New Delhi-I 10001
दूरभाष/Phone : 3382651
फैक्स सं०/Fax No.:3386004

MESSAGE

I am indeed pleased to learn that Indian Potato Association (IPA) in collaboration with Central Potato Research Institute (CPRI), Shimla is organising a Global Conference on Potato, from 6-10 December, 1999 in Delhi. The Conference has special significance as CPRI has completed 50 years and IPA 25 years, both the organisations complementing and supplementing each other's efforts for research and development in potato in the country. As we look back, it is highly satisfying that the area and production of potatoes have increased from 0.23 million hectare, and 1.5 million tonnes in 1950 to 1.31 million hectare and 25.07 million tonnes during 1996-97. Productivity has also increased from 6.58 tonnes per hectare to 19.17 tonnes per hectare during the same period. These significant achievements have been largely due to adoption of high yielding cultivars and technologies. However, challenges ahead are many, which would require careful examination for developing an action plan. Organisation of this Conference is timely to identify the weaknesses which can be converted to an opportunity and capitalise upon the strength.

I am sure the Global Conference on Potato will address all the constraints in potato production, and drawing the research and development agenda for harnesting the potential, and ensure sustainable production especially in developing countries. I wish the Conference all the success.

(Bhaskar Barua)

Dr. R.S. Paroda
Secretary &
Director-General

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद्
कृषि मंत्रालय, कृषि भवन, नई दिल्ली 110 001
GOVERNMENT OF INDIA
DEPARTMENT OF AGRICULTURAL RESEARCH & EDUCATION
AND
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
MINISTRY OF AGRICULTURE, KRISHI BHAVAN, NEW DELHI 110 001
Tel. 3382629; Fax: 91-11-3387293; E.Mail: rsp@icar.delhi.nic.in

July 22, 1999

MESSAGE

Tremendous progress has been achieved in potato production in India over the last 4-5 decades. This has been mainly because of excellent research support, good extension efforts, appropriate policies and above all untiring efforts of the potato growers in translating the technology. Enhanced production by thirteen times within a span of 5 decades is incredible. But we should not forget that the potential is yet to be fully tapped. Therefore, we must work towards realising the fullest potential by bridging critical gaps to help the farmers through concerted efforts by all concerned for transfer of technology.

Potato excels the cereals not only in production and calories but also in quality of protein and still takes much shorter time. Thus potato can really be instrumental in solving the food problem, particularly in developing countries. For fully tapping the production potential of the crop it is important to cultivate potato on larger area covering even the non- traditional areas and the plateaux under kharif conditions. This calls for attention to different vital aspects like seed quality, storage, marketing and processing, which are highly essential in promoting the overall cause of the crop in the national scenario. Quality seed is vital for potato cultivation and the high quantity of seed requirement is a limiting factor for the replacement of the varieties at a much faster rate. Therefore, different innovations have been made for effective seed production including micropropagation through biotechnology. Once the technology is fully integrated and exploited through use of effective inputs, there may be sudden fluctuations in prices as a result of surplus production and/ or scarcity situations created by the middlemen involved in potato marketing. Such a situation limits potato growers who suffer serious losses. This needs to be overcome through effective marketing intervention mechanism not only in the production centres but also by developing suitable infrastructure in the major consuming areas to ensure remunerative prices to the producers yet attractive for the consumers. Looking at the enormous genetic diversity at hand and global research in progress, potato production has a really bright future.

I am pleased to learn that the Indian Potato Association and Central Potato Research Institute, Shimla are jointly organizing a Global Conference on Potato. I am sure the deliberations by scientists, coming from all over the globe, would enable us to evolve and integrate strategy for research, production, marketing, processing etc, to help the farmers as well as the consumers. I send my best wishes for the successful organization of such an important Conference.

(R.S. PARODA)

डा. (श्रीमती) मंजु शर्मा
Dr. (Mrs.) Manju Sharma

सत्यमेव जयते

सचिव
भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
बायोटेक्नोलॉजी विभाग
ब्लाक-2, 7 वां तल, सी.जी.ओ. कम्पलेक्स
लोदी रोड, नई दिल्ली-110003
SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
Block-2 (7th Floor) CGO Complex
Lodi Road. New Delhi-110003

MESSAGE

Potato is nutritionally rich and a delicacy food item. Its per capita availability yet in India is very low: 18.5 kg annually as compared to 50 kg of the world average. Potato is most amenable for use by research advances made especially in the area of biotechnology and process industry. It occupied nearly one percent of global transgenic crop market in 1998. However, the area is expected to grow significantly in the near future as the adoption rate increases in both USA and Canada as multiple traits are being introduced. Under Indian conditions, our researchers should aim at developing short-duration, early bulking varieties having good dormancy and good keeping quality. True potato seed (TPS) is another emerging area of research. Further, any increase in production can not be sustained in the future without a matching development in post-harvest technology. Main emphasis on processing is essential to be commensurate with increased potato production.

Potato can contribute substantially towards producing both food and nutritional security in the years to come. The Global conference being organized by Indian Potato Association, CPRI, Simla and IARI, New Delhi is therefore timely. I am sure that the conference would focus on these aspects and the recommendations would go a long way in resolving some of our key problems.

I congratulate the organizers for holding the conference at the right time and wish them a great success.

Manju Sharma

(Manju Sharma)

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Dr. H. Zandstra
Director General

INTERNATIONAL POTATO CENTER (CIP)
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Phones: (51-1) 349-5619; 349-5769; 349-5783
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E-mail: cip@cgnet.com
Office of the Director General
October 11, 1999

MESSAGE

Potato production in developing countries entered a new, rapidly expanding phase in the 1990s. Output surpassed 100 million tons by mid-decade, up from less than 30 million tons in the early 1960s. The growth rate in potato production has nearly doubled over the last twenty years - faster than that of many other major food commodities such as maize, wheat and rice. Confounding many specialists in commodity projections, growth rates for area planted have also accelerated. This has increased potato's relative importance, particularly in Asia.

Recent collaborative research involving the International Food Policy Research Institute (IFPRI) and the International Potato Center (CIP) has included a detailed analysis of historical trends and future projections for potatoes in developing countries. Estimated growth rates in potato production for the period 1993-2020 are between 2.02 percent and 2.71 percent. These calculations show that the potato will most likely maintain, if not increase, its relative economic importance in the food basket for developing countries in the decades ahead.

The integrated control of late blight and bacterial wilt are among the priorities for potato research on CIP's agenda for the years to come. We will also continue to seek means of promoting the effective adoption and use of true potato seed (TPS) technology where it is appropriate and will support the development of adequate local seed systems, a major challenge to the realization of the full potential of this crop.

We congratulate the Indian Potato Association, CPRI, Shimla and ICAR, New Delhi for organising this Global Conference to help us develop concerted action towards the fullest use of this important crop.

H. Zandstra

भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली-110012
INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI-110012 (INDIA)

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Telex : 031-771611ARI-IN

Prof. K.L. Chadha
ICAR National Professor (Horticulture)

23.9.99

MESSAGE

I am happy to be associated with the Global Conference on Potato being organized by the Central Potato Research Institute and Indian Potato Association at Indian Agricultural Research Institute, during December, 1999 in New Delhi. The importance of potato as a human food hardly needs any emphasis. India has emerged as a major producer of potato in the world during the last two decades. This has been mainly due to the excellent research contributions of scientists of Central Potato Research Institute, Shimla and also the promotional activities of Indian Potato Association. Nevertheless, sustainability of potato production has not been achieved to the desired extent and the growers often suffer because of constant fluctuations in potato prices mainly due to surplus production or artificial scarcity. This situation, therefore, calls for concerted efforts in developing suitable post-harvest technologies and also marketing strategies including possibilities of contractual export of both seed and table potato.

I am confident that the Conference will deliberate on such aspects and shall come up with recommendations to help solve problems of the farmers.

I convey my best wishes for the participants and success for the conference.

K.L. Chadha
(K.L. Chadha)

Formerly, Deputy Director General (Horticulture). ICAR; Executive Director, National Horticulture Board; Horticulture Commissioner. Govt of India: and Director. Indian Institute of Horticultural Research. Bangalore

DR. S.P. Ghosh
Dy. Director General
(Horticulture)

Tel : Off. 91-11-3382534
Res. : 91-11-6443196
Fax : *91-11-3382534/3387293*
Telex : 031-62249 ICAR-IN
E-Mail : spg@icar.delhi.nic.in

भारतीय कृषि अनुसंधान परिषद्
कृषि भवन, डा. राजेन्द्र प्रसाद रोड, नई दिल्ली-110001
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
Krishi Bhawan. Dr. Rajendra Piasad Road, New Delhi - 110001

Dated July 27, 1999

MESSAGE

India has domesticated potatoes by producing short duration potato varieties suitable for mild and short winter. In the post independence era in India a major breakthrough has resulted in several times enhanced potato production and productivity as a result of R&D. Besides, the seed plot technique developed for multiplication of healthy seed potatoes in the plains resulted in an enhanced seed production overcoming the need of seed import. Balanced manuring and fertilization as well as mechanized farming and development of cold storage network have favourably helped potato industry in the country. In recent years potato varieties for processing have been released.

Despite all this, potato production in the country often receives setback because of unstable production resulting either in gluts or shortage, and poor returns. Similarly, there are problems of crop protection and production in different seasons or agro-ecological conditions due to natural vagaries as well as lack of proper inputs at a suitable time. We also lack in varieties suitable for maximizing potato production in the plateau under rain-fed conditions and relatively warm environments. Such conditions also exist in the northern plains if planting is staggered for early and late crops. Mid-hills pose yet another problem of various soil borne pathogens, while late blight continues to be menace if not prevented in the hills and even plains.

I am glad that the Indian Potato Association and Central Potato Research Institute, Shimla are organizing a Global Conference on Potato during December 6-10, 1999 in New Delhi. I hope that all those involved in this noble endeavour would make use of the wisdom and achievements made so far in evolving fresh strategies to overcome the limitations and problems which hold back further progress of potato. I earnestly hope that the Conference will focus its attention on such problems to suggest solutions from the available technology and how to go further about the potato R&D.

S. P. Ghosh
(S.P. Ghosh)

Dr. Kirti Singh,
Former Chairman,
ASRB, Pusa Campus,
New Delhi 110 012

New Delhi

24.11.1999

MESSAGE

It is a matter of great pleasure for me to have been associated with the Indian Potato Association ever since its inception in 1949 and also Central Potato Research Institute for last over three decades. The scientists of the Institute have made valuable contributions for improving production and productivity of potato in India. This has brought applauses to the country from all corners of the world, as India now ranks fourth both in area and production. I therefore, feel happy that IPA and CPRI have rightly decided to organize a Global Conference on Potato, in New Delhi during December 1999, to celebrate important jubilee years for both of them.

Potato is the only non-cereal crop that can meet food requirements of ever growing population in the developing countries. Because of the richness of the nutritional qualities, potato meets energy and protein requirements of our masses, hence deserves concerted research efforts to boost potato production and support for its further development.

I am confident that the Global Conference will provide an excellent exposure to the world about the outstanding achievements made under the Indian potato research programme. Besides, it will help all the participants, especially those from the host country, in developing linkages with other institutions in different areas.

I wish the organizers and the participants of the Global Conference on Potato, all success.

(Kirti Singh)

सत्यमेव जयते

कृषि अनुसंधान और शिक्षा विभाग
कृषि मंत्रालय, भारत सरकार, नई दिल्ली
DEPARTMENT OF AGRICULTURAL RESEARH
AND EDUCATION MINISTRY OF AGRICULTURE
KRISHI BHAWAN, NEW DELHI-110 001

बी.के. चौहान
B. K. CHAUHAN, IAS
Secretary ICAR and
Joint Secretary to the Government of India

Dated 24.09.99

MESSAGE

It is indeed heartening to learn that the Central Potato Research Institute has completed fifty years and is celebrating its Golden Jubilee by organising a Global Conference on Potato during December 6-10, 1999 in IARI, New Delhi.

No doubt, the Institute has much to its credit regarding potato R&D in the country yet enough has to be done with regard to marketing and processing of potatoes to make the country self-reliant in food and also give a lead in potato production to the Asian countries especially in South-West Asia.

Looking forward to useful recommendations from the Conference.

(B.K. Chauhan)

Phone:3384450, E-mail:bkc@ icardelhi.nic.in Fax.91-11-3387293 Telex:031-62249 ICAR IN

A-I/91, Paschim Vihar,
New Delhi-110 063

Dr. Ramphal
Ex-Director General, BANISS &
Former Assistant Director General, ICAR.

September 25, 1999

MESSAGE

It is a matter of immense pleasure that the Central Potato Research Institute and the Indian Potato Association are jointly holding a Global Conference on Potato research and development.

I have had the pleasure of having been associated with Central Potato Research Institute and also Indian Potato Association for a fairly long time while serving at the ICAR Headquarters. Therefore, I have the pleasure to congratulate the Institute and the Society for outstanding service for last few decades in promoting the potato research and development in the Indian sub-continent. Holding an International conference of global dimension for jubilee celebrations is a further effort to the good cause of increasing food production not only in the continent but in the world as a whole to meet its ever growing requirements. Also, it would be appropriate that we reminisce and pay respects to the founders of potato research in India namely Dr. S. Ramanujam, Dr. Pushkarnath, Dr. Mukhtar Singh and others.

It is gratifying to note that not only potato research but all other related aspects will form a part of the deliberations of the Global Conference. Therefore, the equally important developmental aspects like marketing, storage and processing have to be analysed in depth and the constraints in such fields have to be identified for working out suitable remedies. Not much attention has been paid to the processing in the past and calls for greater attention in the future research and development programmes.

I earnestly hope, the participants will have successful deliberations and enjoy rewarding experience during the conference. The useful discussions and deliberations will lay foundations for durable interactions amongst the scientific community.

(Dr. Ramphal)

Dr. B.S. Dhankhar
Assistant Director General (VC).

Indian Council of Agricultural
Research, Krishi Bhavan,
Dr Rajendra Prasad Road,
New Delhi - 110 001.

September 23, 1999

MESSAGE

I am glad to note that the Indian Potato Association in collaboration with Central Potato Research Institute is organizing Global Conference on Potato to mark its own Silver Jubilee and Golden Jubilee of CPRI. Potato is the only non-cereal food crop that can help meet challenges of the upcoming world population particularly in the third world countries. Potato is also important by providing enough employment. It holds a great promise for meeting the food requirements of the developing countries.

By organizing the Global Conference, Indian Potato Association has taken a step in the right direction and I hope the deliberations of this conference would find solutions in further enhancing potato production, productivity and also raising the economic status of potato growers in developing countries.

Wishing you all a happy jubilee celebration and successful deliberations in the conference. I look forward to suitable recommendations emerging from the global meet.

(B.S. Dhankhar)

John S. Niederhauser
September 22, 1 999
2474 Camino Valle Verde
Tucson, Arizona 85715

MESSAGE

Dear Dr. Shekhawat ,

It is with deep regret that I must inform you that I shall be unable to attend the Global Conference on Potato 1999, to be held in New Delhi, December 6-10, 1999. It is for medical reasons that I have been obliged to make this decision.

I have been very honored by your invitation to participate, and to have an important role in the progam. At this time I am advising you that I must cancel my plans to attend, so that you can make the proper adjustments in the program.

Personally, I also regret that I shall not have the opportunity to meet once more with some of my Indian colleagues with whom I have had the privilege to collaborate during the past 50 years. The important role that India has assumed in world potato production is eloquent testimony to the impact of your work.

I wish you success in this Global Conference on Potato, and congratulate you and your colleagues for this contribution you are making to international collaboration in the future contribution of the potato to the world food supply.

With best regards, I remain,

Sincerely yours,

John S. Niederhauser

Dr. G. S. Shekhawat
Director , Central Potato Research Institute
Shmla
171 001 Himachal Pradesh
India

Dr. A.B.M. Salahuddin
Director

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Joydebpur, Gazipur- 1701, Bangladesh
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Dated : 29-09-1999.

MESSAGE

I am, indeed, very happy to learn that the Global Conference on Potato is going to be held to celebrate the Golden Jubilee of the Central Potato Research Institute and the Silver Jubliee of the Indian Potato Association at IARI, New Delhi, India, during 6-10 December, 1999. The conference will, no doubt, facilitate exchange of ideas and opinions among the educators, researchers and other specialists from home and abroad which is much needed to broaden and sharpen our understanding on the needs and challenges of potato development in the future.

To meet the challenges of the next millennium this conference will offer us an opportunity to critically review our progress and exchange ideas about the potato research and development, in particular on Late blight and Virus diseases, producing quality planting materials, high production with low per hectare yield, reduction in considerable post-harvest losses in the developing countries like Bangladesh. I express my sincere thanks and gratitude to the organizers and to all those who have taken considerable troubles to make it a success.

A.B.M. Salahuddin

CPRI : Research Achievements and Impact...

Potato is an important food crop after wheat, rice and maize. It follows these crops in production both in the world and India. The total production of potato represents nearly half of the total annual output of all the root and tuber crops. More than one billion people consume potato throughout the world. Potatoes form part of the diet of nearly half a billion people in developing countries.

Potato is not native to India. It was first cultivated in the Andes near lake Titicaca located on the borders of Peru and Bolivia. At the time of Spanish conquest, in the early sixteenth century, nearly hundred potato varieties were found being cultivated in the highlands of Bolivia, Chile, Columbia, Equador and Peru as revealed by the historical documents. The Spanish invaders are believed to have brought potatoes to Europe where it was first grown as botanical curiosity and later slowly assumed a status of a food crop. Names of Sir Walter Raleigh and Sir Francis Drake are associated with the introduction of potatoes in legends. But it is more likely that potatoes arrived in England on a Spanish ship, captured by the English seamen around 1590. Portugese traders, who landed North of Bombay and opened trade route to India, are believed to have brought potatoes in India in sixteenth century. However till 17th century, its diffusion in cultivation was very slow and was being grown only as a garden vegetable in parts of western India. The Britishers promoted its cultivation and initially the crop was used to be grown in the hills of North and South India during summer months. From hill cultivation, it slowly extended to the plains by the early 19th century where it was grown during winters. The crop took more than 100 years to reach southern parts. Considering its importance, it was only on April 1, 1935 that the then Imperial (now Indian) Agricultural Research Institute, New Delhi set up three potato production and multiplication stations at Shimla and Kufri, both in hills of HP and at Bhowali in the Kumaon hills of UP. The main activities of these stations focused mainly on production of disease-free seed of potatoes primarily through roguing out diseased plants and fungicidal applications to control late blight disease. These stations also conducted a few surveys regarding potato cultivation.

Establishment of Central Potato Research Institute

Realising the importance of potato in the food economy, an idea was conceived to establish a full-fledged research Institute to work on breeding of suitable varieties for different agro-ecological zones available in the country, development of package of practices for potato cultivation and seed production system in the sub-tropical climate of the country. A scheme for the establishment of Central Potato Research Institute (CPRI) was drawn up under the able guidance of the then Agriculture Advisor to Govt. of India, Sir Herbert Stewart in 1945. Dr S Ramanujam, who was then working as Economic Botanist at IARI was asked to implement the scheme and was appointed as Officer on Special Duty in 1946. It took more than 3 years before the Central Potato Research Institute (CPRI) came into being in August 1949 with the Institute's Headquarters at Patna. The eastern region having major area under potato and Bihar State being in the main seed producing belt,

Dr. S. Ramanujam

were the main considerations for establishing the Headquarter of CPRI at Patna. The Institute started working in August 1949 on a 10 ha piece of land provided by the Govt. of Bihar with an old single storey barrack now named as the Ramanujam Hut. Dr. Ramanujam was appointed as the first Director and the three seed producing stations at Shimla, Kufri and Bhowali were transferred to the Institute. Drs Mukhtar Singh, Agronomist, MJ Thirumalachar, Pathologist, RP Chaudhry, Entomologist and Pushkarnath, Economic Botanist joined the Institute and initiated research activities for breeding, agronomy, disease and pest management.

Dr. Pushkarnath

During the course of next few years of research, it was realised when Dr. Pushkarnath was the Director of the Institute that Patna was not the ideal place for carrying out the fundamental research on potato because of the following reasons:

i) Most of the genotypes did not flower under prevalent short photo-period of the plains. Therefore, it was not possible to exploit the available wide spectrum of germplasm for breeding.

ii) Prevalence of high aphid population during the crop season, responsible for rapid and high virus infiltration, hampered maintenance of germplasm and segregating hybrid progenies in healthy conditions thereby impeding development of new potato varieties.

Keeping in view the above problems, an expert committee was appointed by the Govt. of India to suggest remedial measures. The committee recommended shifting of CPRI headquarters from

Ramanujam Hut, HQ of CPRI at Patna, 1949 to 1955

Main building of CPRI at Shimla

Patna to high hills in Shimla. Accordingly, it was done in 1956 and it became possible to maintain germplasm collection and segregating populations in healthy condition for a long time. The long photoperiod conditions of summers in Shimla/Kufri allow profuse flowering in potato. This also helped in the initiation of systematic hybridization programme and development of several high yielding varieties.

The expert committee had also recommended opening of five regional centres of the Institute named as Potato Experimental and Trial Centres at Jalandhar in Punjab; Babugarh in UP; Rajgurunagar in Maharashtra; Shillong in Meghalaya and Ootacamund in Tamil Nadu. The existing

CPRS, Patna

cetnre at Bhowali in Nainital district was shifted to Mukteshwar in the same district. Considering the importance of problem of wart, a research station to carry out work on breeding and management of this disease was also opened at Darjeeling in 1963. Govt of UP provided about 120 ha of land at Daurala (Merrut) in northern plains for production of healthy seed potatoes. A research station was also opened at Modipuram 7 km away from Daurala on Muzaffarnagar highway in 1978. Babugarh station was, therefore, shifted and merged into Modipuram centre. All these Potato Experimental and Trial Centres were renamed as Central Potato Research Stations in 1978. The Institute opened another new station at Morena in MP in 1979 to take up potato seed multiplication in central plains which was later shifted to Gwalior being a more suitable location. During 1975, a regional station in southern India at Kodaikanal was also opened for undertaking work on potato seed production. But it had to be closed in 1983 due to endemic problem of cyst nematodes. After the objectives of the regional stations at Mukteshwar and Darjeeling were achieved, it was felt essential to close them. Thus, at present, the Institute has eight regional stations located in Kufri-Fagu in HP, Jalandhar in Punjab; Patna in Bihar; Shillong in Meghalaya; Modipuram in UP; Gwalior in MP; Ootacamund in Tamil Nadu and Rajgurunagar in Maharashtra.

CPRS, Modipuram (UP)

CPRS, Jalandhar

CPRS, Kufri (HP)

The Mandate

i) To undertake basic and strategic research for developing technologies to enhance productivity and utilisation of potato.

ii) To produce disease-free basic seed of different notified varieties developed by the Institute.

iii) To act as national repository of scientific information relevant to potato.

iv) To provide leadership and co-ordinate network research with state agricultural universities for generating location and variety-specific technologies and for solving area-specific problems.

v) To collaborate with national and international agencies in achieving the objectives.

vi) To act as a centre for training in research methodologies and technology for up-grading capabilities of scientific manpower in modern technologies for potato production.

vii) To provide consultancy in potato research and development.

Chronology of Potato Development in India

1. In 1917, a scheme on potato breeding was started by the then Imperial Council of Agricultural Research at Nanjanad in Nilgiris. Later again, the then Imperial Council of Agricultural Research sanctioned schemes to upper Shillong farm in Assam, Nanjanad Potato Research Station in Nilgiris and Potato Stations in Shimla and Murrie hills (now in Pakistan) and Palampur in the undivided Punjab (now in HP) in early forties. The objective of the schemes was to select a suitable location for taking up potato breeding and seed production work.

2. IARI, New Delhi started a scheme in 1935 on potato breeding in North India at Shimla.

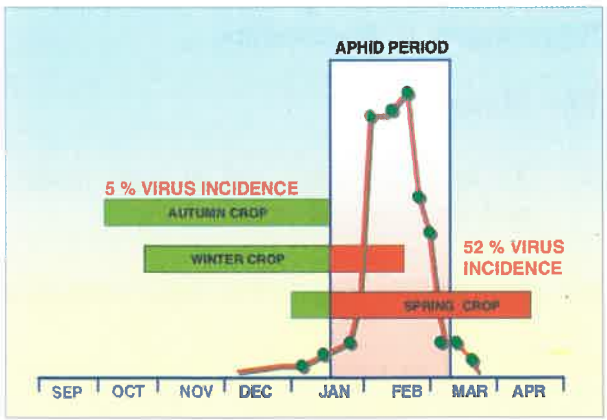
3. During 1942-44, three additional schemes started under IARI, viz. (Potato Seed Certification Scheme, Kufri, (1942), (ii) Seed potato production scheme at Karnal (1944), (iii) potato breeding and seed production at Bhowali in the mid hills (1943).

4. In 1942, another scheme on pests and diseases of potato was started by the Imperial Council of Agricultural Research at Sabour, Bihar.

5. The CPRI was set up by the Ministry of Agriculture, Government of India in 1949 at Patna. It took over from IARI, the Breeding and Seed Certification and Production Schemes functioning at Shimla, Kufri and Bhowali. Headquarters were shifted to Shimla in 1956 while Patna, Kufri and Bhowali continued as the experimental stations.

6. A potato research network was established by setting up Potato Experimental and Trial Centres of CPRI during 1957-64 at Jalandhar (Punjab), Ootacamund (Tamil Nadu), Rajgurunagar (Maharashtra), Babugarh, Mukteshwar (Uttar Pradesh), Darjeeling (WB) for Wart Testing Shillong (Meghalaya), Daurala (Uttar Pradesh), in 1971 and Gwalior (Madhya Pradesh) in 1979.

7. During 1964-65 to 1967-68 National Acceptability Trials and National Demonstrations were conducted with indigenously developed varieties/ hybrids in important potato growing states. These trials proved superiority of the indigenously developed varieties over the exotic ones and led to their wide scale adoption and popularity in the country.



Aphid population build-up in northern plains in India

8. The aphid free or low population periods were identified in the plains of India. Based on this, the technology of seed production was perfected (for essentials, see Appendix i) which is termed as "Seed Plot Technique". This technique became popular during early eighties in Punjab, parts of western Uttar Pradesh, and also eastern and central plains. Its gradual adoption gave a quantum leap in availabiliy of quality seed of high yielding short duration potato varieties of right physiological age for planting both in the hills and plains of India.

9. Central Seed Law was enacted in 1966 and enforced in 1969. Under this Act, a "Central Seed Committee" and a " Variety Release Sub-Committee" were set up to notify varieties and to fix seed standards. A potato seed production programme was organised for both hills and plains in 1966 and CPRI started producing breeders' seed for supply to NSC and the State Departments of Agriculture/ Horticulture for further multiplication in Foundation I and II and certified seed stages.

Crossing block at CPRS, Modipuram

10. In 1966, a potato seed production and distribution committee was set up by the Government of India to decide upon seed production programme to be taken up and to allot Breeders' Seed produced by CPRI to NSC and State Departments of Agriculture/Horticulture.

In 1971, All India Coordinated Potato Improvement Project (AICPIP) was set up with 5 main centres in CPRI stations and initially 8 main centres in SAUs which later were further increased to 13 centres. At present, the project has a total of 5 + 14 centres while IGKV, Raipur, GBPUAT, Ranichauri and UP State Horticulture Centre at Babugarh (Ghaziabad) are working as voluntary centres. Besides two seed preparation units are working at Kufri and Modipuram for hills and plains respectively. The project functions are co-ordinated by the Project Coordinator with the administrative help from CPRI and technical control of ICAR.

ICAR Best Institution Award-1995. Dr GS Shekhawat receiving the Award

The project acts as a link between CPRI and SAUs as well as other organisations, viz. International Potato Center etc., for testing and recommending potato varieties and technology at national level and also developing suitable regional technologies for the crop development.







Infrastructural facilities of CPRI

In 1975, a National Seed Project (NSP) was sanctioned with the assistance of World Bank to support all facets of seed production including certification and marketing. Under this programme, independent seed certification agencies and marketing boards started functioning in several states.

11. In 1987, the SAU's were also involved to produce breeders'/foundation seed potato to augment availability of seed in the respective regions.

12. In 1989, True Potato Seed technology was put forth as an alternative for ware and seed potato production.

13. In 1991-92, a Revolving Fund Scheme was started for breeder seed production which has been a success. The RFS generates Rs. 160 lakhs annually.

14. In 1995, the CPRI won the Best Institution Award for its contributions to potato R & D in the country.

15. For the first time in 1998, Indian potato varieties for processing, namely, Kufri Chipsona 1 and Kufri Chipsona 2 were released.

Infrastructure

The CPRI holds a total of 500 Äha of farm land and sophisticated equipment like automatic weather station, transmission electron microscope, growth chambers, etc. and up-to-date laboratories for work in biotechnology, radio tracers, etc. There is a potato cold store at Jalandhar centre. The Institute also has an up-to-date computer facility under ARIS cell (Agricultural Research Information System) with several application packages for word processing, statistical analysis, graphics and internet and E-mail. Besides the regular office buildings, the Institute has a museum, large modern library, conference hall and also a big auditorium, two hostels-one each at Modipuram and Shimla for the trainees and farmers.

Services Provided

1. *Consultancy*

(a) Potato Seed Production (b)True Potato seed production technology, (c) Rapid multiplication of planting material (d) Potato cultivation & harvesting and other equipment fabrication, manufacturing etc. (e) Micropropagation (f) Potato starch manufacture technology and (g) Granulosis virus production for control of PTM.

2. *Contract Research*

Post entry quarantine and handling of imported material (b) Multiplication trials for testing yield and processing quality of imported cultivars (c) Quality assessment and (d) ELISA Kits and testing for viruses, viroids etc.

3. *Contract Services*

Testing of agro-chemicals viz, pesticides, growth promotors, sprout suppressants, fertilizers & fertilizer additives, etc. for the crop.

4. *Information and documentation*

a) Inter library exchange, (b) Publication of technical, extension and research bulletins, news letters (c) Documentation of recent articles on potato; list of current periodicals in CPRI library and classified listing of additions as well as, providing current awareness service, etc.

5. *Miscellaneous*

(a) Advisory service to potato growers (b) Supply of breeders' seed (c) Supply of antisera for virus testing and (d) Organisation of national & international conferences.

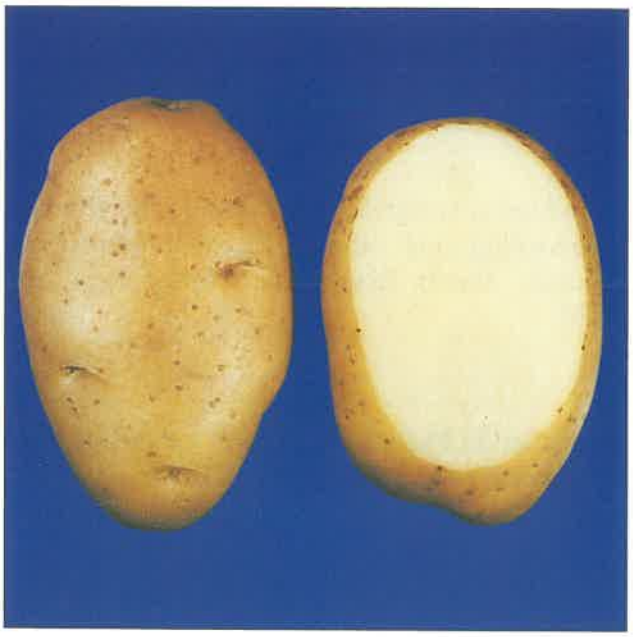
6. *Trainings*

Training is provided in the following fields–

(a) Modern methods in potato production
(b) Potato seed production & certification
(c) Potato research methodology
(d) Tissue culture techiques
(e) Virology with reference to potato
(f) Post-harvest technology and
(g) True Potato Seed technology.

Salient Research Achievements

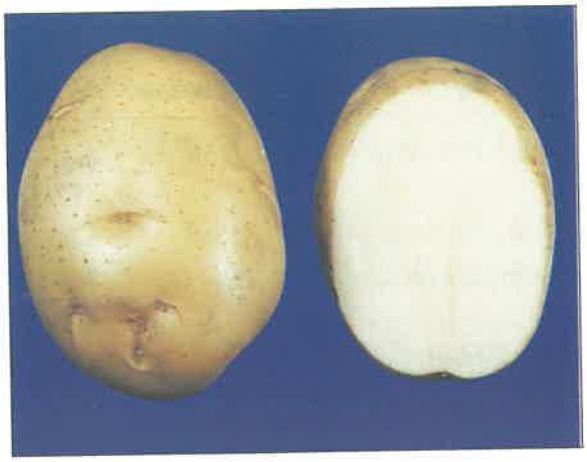
- Established a germplasm collection which presently has about 1200 accessions of *Solanum tuberosum* ssp. *tuberosum*, and 1000 accessions of *Solanum tuberosum* ssp. *andigena*, and more than 200 accessions of wild and cultivated species. This collection is being maintained *in vivo* and *in vitro* and in true seed form. Parental lines resistant to late blight, potato tuber moth, charcoal rot, common scab, etc., were identified from this collection. The identified accessions grown in hybridization garden at Kufri (HP) are used in breeding programmes.



Kufri Ashoka

- Bred and released 34 high yielding potato varieties so far. Seven of these varieties, i.e., Kufri Jyoti, Kufri Chandramukhi, Kufri Sindhuri, Kufri Badshah, Kufri Bahar, Kufri Lalima and Kufri Lauvkar have gained wide popularity, almost all over the country. Resistance to late blight, ability to give economic yields under short days and short growing periods of the plains, tolerance to viruses, immunity to wart disease, a moderate level of suitability for processing, and resistance to cyst nematodes (cv. Kufri Swarna) are some of the qualities present

in these varieties. Recent development and release of varieties are Kufri Ashoka, Kufri Sutlej, Kufri Jawahar, Kufri Pukhraj, Kufri Anand for the plains, late blight resistant variety Kufri Giriraj for hills and varieties Kufri Chipsona 1 and Kufri Chipsona 2 suitable for processing. Indian cultivars and hybrids have also been adopted in other countries. These are Kufri Jyoti in Sri Lanka and Nepal, Kufri Sindhuri and Kufri Lalima in Bangladesh; and Kufri Chandramukhi in Afghanistan. Besides the 5 Indian numbers from CIP collection are also grown commercially in different parts of the world. These are 1-654 (CCM - 69.1 in Mexico), 1-822 (cv. India in Bolivia and cv. Red Skin in Vietnam), 1-1085 (cv. Sita in Sri Lanka) and BSUP -04 in Philippines.



Kufri Sutlej

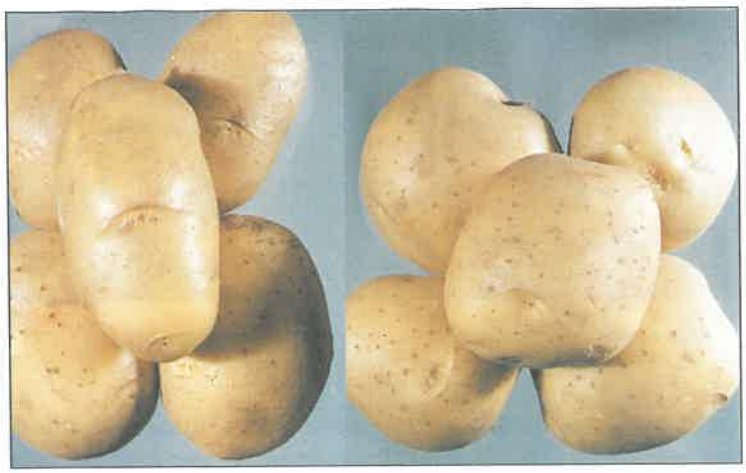
List of potato varieties released by CPRI and AICPIP

Variety	Year of release	Salient features and adaptability
Kufri Kisan	1958	Late-maturing. North Indian plains
Kufri Kuber	1958	Medium-maturing. Bihar and Maharashtra
Kufri Kumar	1958	Late-maturing and moderately resistant to late blight. North Indian hills
Kufri Kundan	1958	Medium-maturing, moderately resistant to late blight and good keeping quality. Himachal Pradesh and hills of Uttar Pradesh
Kufri Red	1958	Medium-maturing and good keeping quality. Plains of Bihar and West Bengal
Kufri Safed	1958	Late-maturing and good keeping quality. North Indian plains
Kufri Neela	1963	Late-maturing and moderately resistant to late blight. Nilgiri Hills
Kufri Sindhuri	1967	Late-maturing, essentially short day adapted variety with red tuber. Heavy yielder even on low inputs. North Indian plains
Kufri Alankar	1968	Medium-maturing. North Indian plains
Kufri Chamatkar	1968	Late-maturing and resistant to early blight
Kufri Chandramukhi	1968	Early-maturing and good for processing. North Indian plains and plateau region of peninsular India
Kufri Jeevan	1968	Late-maturing. Himachal Pradesh
Kufri Jyoti	1968	Medium-maturing, good for processing,field resistant to late and early blights and immune to wart, and tolerant to viruses. Wide adaptability
Kufri Khasigaro	1968	Late maturing and resistant to both late and early blight. Hills of Meghalaya

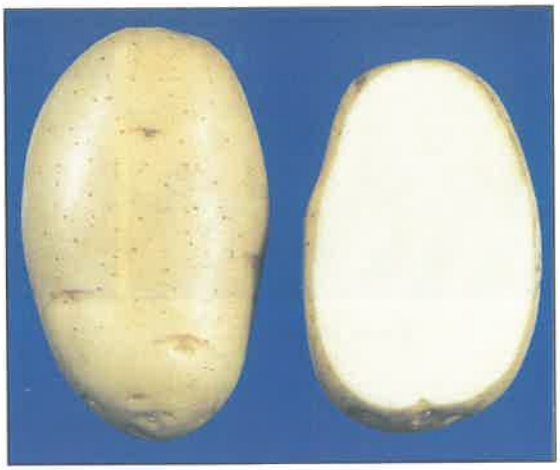
Contd.

Contd.

Variety	Year of release	Salient features and adaptability
Kufri Naveen	1968	Late maturing and resistant to late blight and immune to wart. Northern hills of West Bengal and Meghalaya
Kufri Neelamani	1968	Late maturing and resistant to late blight. Nilgiri hills
Kufri Sheetman	1968	Medium to late-maturing and resistant to frost. North Indian plains and *tarai* area of Uttar Pradesh
Kufri Muthu	1971	Medium-maturing and resistant to late blight. Nilgiri hills
Kufri Lauvkar	1972	Early-maturing and rapid bulking under warmer conditions, suitable for processing. Plateau region of peninsular India
Kufri Dewa	1973	Medium maturing, good keeping quality and resistant to frost. *Tarai* area of western Uttar Pradesh
Kufri Badshah	1979	Medium - maturing, resistant to both late and early blights and PVX. North Indian plains and plateau region of peninsular India
Kufri Bahar	1980	Medium-maturing and heavy yielder. North Indian plains
Kufri Lalilma	1982	Medium-maturing with red tuber and resistant to virus 'X'. North Indian plains
Kufri Sherpa	1983	Medium-maturing,resistant to late blight and immune to wart. Hills of West Bengal
Kufri Swarna	1985	Medium-maturing, resistant to late blight and cyst nematode. Nilgiri hills
Kufri Megha	1989	Medium-maturing, late blight resistant. Hills of Meghalaya
Kufri Ashoka	1996	Short duration (75 days). Plains of central and eastern Uttar Pradesh, Bihar and West Bengal
Kufri Jawahar	1996	Medium-maturing, resistant to late blight and ideal for inter-cropping. Punjab, Haryana and the plateau regions of Madhya Pradesh, Gujarat and Karnataka
Kufri Sutlej	1996	Medium-maturing and resistant to late blight. Western and central Indo-Gangetic plains
Kufri Pukhraj	1997	Medium-maturing and resistant to late blight. Northern plains and plateau region
Kufri Chipsona-1	1997	Medium-maturing and resistant to late blight. Excellent for chip making. Indo-Gangetic plains
Kufri Chipsona-2	1997	Medium-maturing and resistant to late blight. Excellent for chipping. Indo-Gangetic plains
Kufri Giriraj	1997	Medium to late-maturing and resistant to late blight. North western hills
Kufri Anand	1998	Medium maturing and resistant to late blight. Heavy yielder. Northern plains



Kufri Chipsona 1 and Kufri Chipsona 2



Kufri Anand

- Developed the Seed Plot Technique which made it possible to carry out disease-free seed production in the plains and established a national disease-free seed production programme for hills and plains, utilising the low aphid periods/locations identified in the plains. This programme helps produce about 2600 t of breeders' seed annually, sufficient for the country's requirement when multiplied into FI/II and CS stages. It is also recommended that one multiplication is done at the farmer's level to produce home grown seed.

  Good quality potato seed tubers have become available in sufficient quantity as a result of basic seed production programme of CPRI. Availability of healthy potato seed is the major reason for the significant increase in the crop production in India over last many years.

  Our neighbouring countries continue to import seed potatoes from Europe. The current price of Dutch seed potatoes in Pakistan and Sri Lanka is US $ 56 - 60 per 50 kg, CPRI produces 2,600 t of basic seed annually, and supplies 2000 t to State Departments of Agriculture / Horticulture for further multiplication in three stages, viz. Foundation I, Foundation II and certified seed. In each stage, the minimum multiplication rate is 6 times. Thus, 2000 tonnes breeders' seed should give 2000 × 6 × 6 × 6 = 432000 t certified seed. The indigenously produced seed is available to the farmers @ Rs. 5000-7000 i.e. US $ 139 to 194 per tonne as against US $ 1120-1200 per tonne in the neighbouring countries. Thus, the indigenous seed production system is saving the country foreign exchange equivalent to Rs. 17424 million annually.

- Identified suitable parental lines for production of botanical/true potato seed and developed technology for raising a commercial crop using true potato seed.

- Recommended schedules for fertiliser application and other cultural practices for diverse agro-climates based on studies relating to the dosage, placement, form, timing, yield responses, residual effects, and interactions of NPK fertilisers, micronutrients and organic manures. Besides, standardized seed size and spacing for maximising yields and minimising wastage of irrigation water; and competition through weeds.

- Developed efficient methods for testing of soils and plant tissues to identify nutrient deficiency.

Potato planter

Potato digger

Potato size grader

- Identified profitable potato-based cropping systems in different agro-climates including inter-cropping of the potato either with sugarcane or wheat, and fertiliser, manure application and weed management schedules for them.

- Developed agricultural implements for mechanising potato cultivation including an oscillating tray type potato grader, fertiliser applicator-cum-line marker, potato culti-ridger, soil crust brakers, granular insecticide applicator, potato digger, potato planter (two row, four row automatic and bullock-drawn).

- Developed a late blight forecasting system for the hills. Identified race-non-specific resistance in Indian cultivars and hybrids, and the components of such resistance. The forecasting system has also been recently developed for plains.

- Developed integrated packages of practices for management of late blight, bacterial wilt, viruses (*see* Appendix ii -iv) and soil and tuber-borne diseases. Identified sources of resistance to the major diseases.

Potato transgenics

Alginated nodal cuttings

Farm women at CPRI, Shimla

- Developed modified ELISA procedures and optimized immunosorbent electron microscopy for detection of potato viruses and application of NASH through cRNA probes for viroid detection.

- Conducted periodic surveys of the potato crop in Darjeeling hills, which showed the continued presence of the wart pathogen despite saturation of the areas with wart immune varieties, indicating the need for continued and intensified regional quarantine.

- Demonstrated the efficacy of bio-products like Lantana leaves and the Granulosis virus and pheromones in reducing PTM damage. Identified a number of predators and parasites that have the potential for biological control of PTM.

- Identified two cyst nematode species *Globodera rostochiensis* and *G.pallida* in Nilgiri and Kodaikanal hills and developed control measures based on long-term rotation, nematicides and resistant varieties.

- Carried out basic studies on photosynthetic activity and its relationship with tuber yields. It generated information on inter-genotypic, leaf age dependent, seasonal and diurnal variations in photosynthetic rate and its modification by leaf water deficits and light intensity.

- Developed methods to screen for high thermoperiod resistance. They have been used to select heat resistant lines for breeding varieties for tropics.

- Worked out the relationship between tuber dry matter content and specific gravity for different cultivars in five agro-climatic zones, and identified areas for producing high dry matter potatoes suitable for processing. Studied sugar accumulation in potatoes stored at different temperatures and identified genotypes that accumulated less reducing sugars. Also established relationship between low reducing sugar content and good chipping quality when grown in the North Indian plains.

- Demonstrated the efficiency of CIPC for control of sprouting during non-refrigerated storage and the feasibility of on-farm storage of potatoes in the North-western Indian plains upto 3-4 months in a passively evaporated cool store.

- Studied morphological, anatomical, and physiological characteristics of tuber in relation to their keeping quality under refrigerated storage and identified characteristics associated with good keeping quality.

- Standardised methods for micro-propagation and production of *in vitro* potato microtubers.

- Demonstrated that an *Azotobacter* strain can partially supplement the nitrogen requirement of the potato crop.

- Developed potato tuber moth (PTM) resistant transgenic lines using synthetic Cry I Ab gene and late blight, and drought resistant transgenic potatoes carrying the Osmotin gene.

- Developed a user-friendly computer programme civCNS Version 2.07 for day-to-day management of an active *in vitro* repository of potato germplasm.

- Vitrification-based cryopreservation of potato shoot tips has been initiated for long-term conservation of potato germplasm.

- DNA fingerprinting of Indian potato varieties using randomly amplified polymorphic DNA (RAPD) and Simple Sequence Repeats (SSR).

- Disseminated information on potato production and research achievements through 70 extension and technical bulletins.

- Transferred potato technology under Lab-to-Land, ORP, TAD and other programmes, and used innovative extension techniques like "Potato School on AIR", alongwith impact assessements and constraint analysis in adoption of improved technology.

- Collected and maintained country-wide statistics on potato production, area, yields and prices and prepared annual reports of Quick National Outlook Surveys for estimating potato production and prices. Conducted annual trainings on Modern Methods of Potato Production and Seed Certification, besides the regional Farmer *Melas*, etc.

- Established one of the largest biosciences library in the northern part of India, which currently has about 42,000 documents and subscribes to about 450 current periodicals. Created a comprehensive computerised databases on Indian potato periodic literature since 1901 and the Indian theses on potato covering the period from 1937 to 1995.

Resource Generation

Revolving Fund Scheme for breeders' seed production, was started in 1991-92 with a seed money of Rs. 40 lakh. Up to the end of 1998-99 (in 8 years), cummulative receipts were Rs. 1080 lakh, by the sale of breeders' seed. During 1998-99, the total receipts under RFS was Rs. 275.8 lakhs while other receipts were Rs. 60 lakhs. The total expenditure of the Institute during the period was Rs. 1150.3 lakhs (under Plan and Non-Plan). Thus, the receipts were about 30% of the total expenditure.

Transfer of Technology

During 1974-75 to 1993-94, 6000 farm demonstrations were conducted at various locations of the Institute under First Line Extension Education System (FLEES). The average yield of potato obtained in these demonstrations was 253 q/ha which was much higher as compared to national average (176 q/ha.). The knowledge and adoption indices to the ORP farmers was 79 and 75 per cent, respectively for different components of potato technology and that half of the farmers (45%) perceived the impact to be of moderate nature while 31.6 per cent perceived this to have a high impact. The average productivity on farmers' fields increased by 78.3, 75.1, 37.1,12.80 and 98 per cent during I, II, III, IV and V phases of LLP, respectively. Through human resource development programme (HRDP), a total of 1918 farmers and 3000 field functionaries and scientists (including 150 from South Asian countries) were trained through institutional/non-peripatetic courses. Besides, the Institute has developed a strong programme of production and distribution of technical, scientific and extension literature on potato covering all aspects and updating communication of latest research achievements to its intermediate and ultimate users. Four documentary films were produced on different aspects of potato for providing strong media support developed for transfer of potato technology. Special programme, 'Potato School on AIR' from Shimla for HP farmers contributed 81% overall net gain in knowledge of the listeners, was unique in itself.

A new programme

Technology Assessment and Refinement (TAR) through Institute-Village linkage was started in 1996 and operated in Patna District (Bihar) and Shimla District (HP) adopting 700 and 300 farm families respectively. In all, 755 demonstrations were conducted under IVLP resulting in an average increase of 27 to 30% in yield of various crop enterprises.

Publications

The Institute has so far published 52 technical bulletins on various aspects of potato. The dissemination of information about potato technology through extension bulletins is a regular feature of CPRI. So far 30 Extension Bulletins have been published which are revised /updated from time to time.

Impact assessment

Growth

Potato production in India in 1996-97 was 24.22 million tonnes from an area of 1.25 million ha with an average yield of 19.4 tonnes /ha. In 1997-98, production came down to 17.65 million tonnes from an area of 1.21 million ha due to inclement weather. In 1998-99, the production again went up to 23.5 million tonnes from an area of 1.23 million ha with an average yield of 19.10 tonnes/ha. This can be compared to 1949-50, the year of establishment of CPRI, when the total production was 1.54 million t from an area of 0.234 million ha with an average yield only 6.59 t/ha.

As a result of indigenous potato varieties and suitable production technology for sub-tropical conditions, India ranked fourth in production and area in 1997. The impact of indigenous technology on national potato productivity is shown in text figures 1 and 2.

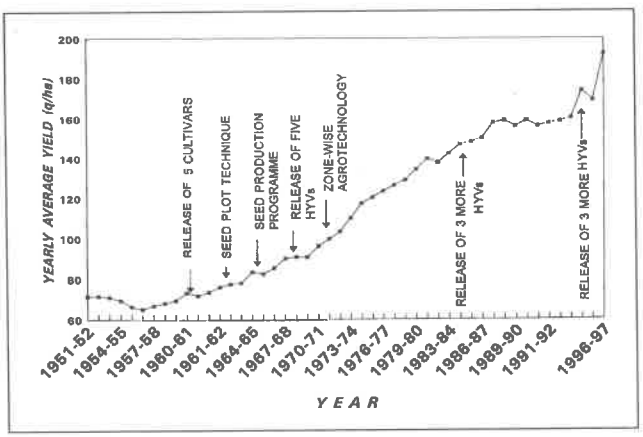


Fig. 1 : Impact of Potato Indigenous Varieties-Seed PlotTechnique and Production Technology on Yields of Potato in India

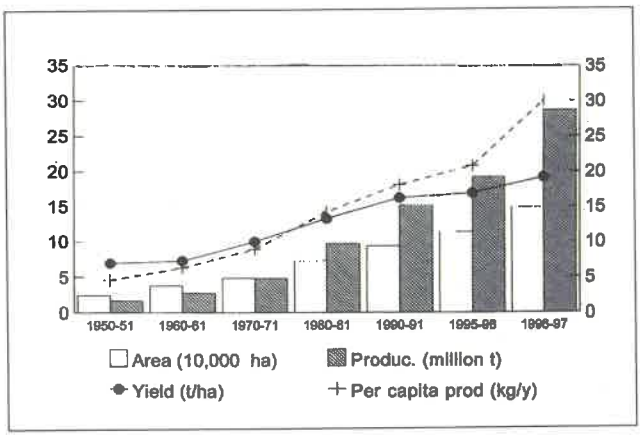


Fig. 2 : Area Production, Yield and per Capita Production of Potato in India (1950-51 – 1996-97)

During the five decades (1949-50 to 1996-97), the annually compounded growth rates (ACGR) of production, area and average yields of potato in India have been 5.96, 3.51 and 2.37%. respectively.The production, area and yield increased by 16, 5.2 and 2.9 times respectively. Annual increase of 5.96% in potato production in India can be compared to 5.50% for wheat, 2.77% for rice and 2.72% for total food grains for the same period in the country. The increase in yield per hectare of potato during this period has also been better than in all food grain crops except for wheat. The ACGR for production, area and average yield of the potato in the world during the last five decades have been 0.64, 0.06 and 0.70%, respectively. It may thus be appreciated that potato has been established as one of the major food crops in India.

Input / output assessment

The growth in potato production described above shows that the investment for potato R & D has paid good returns. The potato also contributes effectively to the national economy.

In 1970-71, potato was grown only on 0.3% of the total cropped area in the country while it contributed Rs.2420 million, i.e 1.4% of the total value of agricultural output of the country. Over the last two and a half decades, potato has made significant strides. In 1988-89, it contributed 1.76% of the total value of agricultural output and by 1995-96 this has further increased to 2.55%. In contrast, paddy and wheat occupying 22.7 and 11.0% of the cropped area in 1970-71, and yet contributed only to the tune of 26.3 and 10.4% respectively, of the total value of agricultural output. In 1995-96, wheat accounted for 13.9% of the total cropped area but contributed only 11.87% while rice which occupied 23.1% of the cropped area, contributed only 20.91% of the total agricultural output.

In 1998-99, the outlay on research and development of the potato was almost Rs.1000 lakh, that is, 0.17% of potato's contribution of Rs 5,87,800 lakh to the national economy.

Options for future

When we look back upon the past four decades, we see that the potato has made a considerable progress as a result of the establishment of a national programme for disease-free seed production, conventional breeding for high yields and adaptability to diverse agro-climates, and the development of recommendations for agro-techniques. Nevertheless, the following problems need urgent attention in view of the changed scenario.

Only a small part of the genetic variability available for potato has been exploited for evolving improved potato varieties. This calls for strengthening of existing germplasm resources and their better utilisation for incorporating a wider genetic base into future varieties.

1. Although potato is basically a temperate crop, wide variability in adaptation to high thermo-periods is available in the gene pool. There is a need to develop varieties and agro-techniques that would enable the spread of potatoes to non-conventional areas and seasons.
2. In the light of the increased demand for processing, varieties with high tuber dry matter, low reducing sugars and good processing attributes need to be developed.
3. Similarly, to reduce dependence on energy intensive refrigerated storage, there is a need to develop varieties with good keeping quality.
4. Heavy emphasis be given to basic research, particularly in the fields of molecular biology and genetic engineering.
5. There is a strong need to develop varieties for low input, sustainable and environment-friendly agro-techniques for reducing dependence on chemical fertilisers, toxic chemicals, systemic insecticides, etc.

–GS Shekhawat
Director,
Central Potato Research Institute, Shimla

Essentials of Seed Plot Technique

1. The seed should be essentially free from the viruses, soil-borne diseases like wart, cyst nematode and also bacterial wilt, common scab, root-knot nematode, etc.

2. There should be at least 75 days period free from aphids so that an economical yield could be obtained from the seed crop using early bulking varieties.

3. The maximum temperature should be 16 to 28°C during the crop season.

4. Apply systemic granular insecticides such as Thimet @ 15kg/ha at the time of planting against sucking insects such as aphids.

5. Use pre-sprouted healthy, large size tubers (50-150g) with multiple sprouts.

6. Full earthing up may be done at planting and apply herbicides for control of weeds to avoid spread of contagious viruses.

7. Inspect seed crops 2-3 times at 45, 65 and 80 days during growing season and remove all off types and diseased plants showing symptoms of viruses.

8. Spray the crop with Dithane M-45 @ 2 kg/ha from 3rd week of November at 10 days interval and Ridomil @ 2.5 kg/ha when epidemic of late blight is observed.

9. Spray the crop with systemic insecticides Rogor (100ml in 100 litres of water) or Metasystox (125ml in 100 litres of water) in the first week of December against aphids in case of their early appearance.

10. Kill the haulms as soon as aphids reach the critical level of 20 aphids per hundred compound leaves.

11. Harvest the crop 15-20 days after haulms killing when the fields are in workable conditions and tuber skin is hardened

12. Treat the seed tubers with boric acid (3%) for 20 min against surface-borne diseases and dry under shade. Put the seeds in bags and label.

13. Adopt hot weather cultivation and 2-3 year's crop rotation as recommended to avoid build up of soil borne pathogens such as black scurf, common scab, etc.

14. Grow the seed crop with minimum isolation distance of 25 metres from the ware crop.

Integrated Management of Late blight (*Phytophthora infestans*)

Cultural Practices

1. Use disease-free and/or treated seed.

2. Remove/rogue out all ground keepers (voluntary potato plants).

3. Adjustment in planting time is helpful. In the plains, seed crop should be planted by 20th October.

4. High ridges and proper earthing up must be adopted to avoid exposure and infection of seed-tubers. This prevents further carrying over and dissemination of *P. infestans* spores.

5. Water management - Allow only light irrigation or withhold it, when the blight is likely to appear.

6. Killing of haulms at 75% crop damage.

Chemical

1. Application of a prophylactic spray of contact fungicide and subsequently only need based fungicide application is recommended. In years of prolonged winter-rains, in the plains, one-two spray(s) of systemic fungicide is desirable and helpful.

2. In the hills, first and/or third spray of systemic fungicides need to be applied alternating with contact fungicides.

Host Resistance

1. Cultivation of late blight resistant varieties, cv. Kufri Jyoti, Kufri Giriraj in NW hills; Kufri Megha in Meghalaya hills, 'Kufri Kanchan' in Darjeeling hills and Kufri Badshah, Kufri Jawahar and Kufri Sutlej in the plains.

Integrated Management of Bacterial Wilt of Potato*

1. Use healthy, disease-free whole tuber as seed. India has large areas in the North-western high hills and North-western and Central plains free of bacterial wilt, where the disease-free seed is produced.

2. Full earthing up must be done at planting to reduce root injury and consequent infection.

3. Plough the field after potato harvest in April and leave it exposed to high temperatures (35-40^{0}C) during summer months in the plains. In hills, plough the field in October and expose it to low temperatures (0-4^{0}C) in winter months.

4. Follow 2-3 years crop rotation with millets or non-solanaceous vegetables.

5. Apply stable bleaching powder @ 12 kg/ha mixed with fertilizer at planting.

6. Plant early for summer crop i.e. in Feb-March and harvest by first week of July in the hills.

7. Plant the autumn crop in September in the hills.

8. Seed treatment with bioagents *Bacillus* spp and avirulent form of *Ralstonia solanacearum* is also effective.

*In the absence of any bacterial wilt resistant cultivar of potato, use of healthy seeds has given maximum control of the disease. By using combination of the above practices, bacterial wilt of potato can be kept under check both in endemic and non-endemic areas.

Schedule of Integrated Control of Potato Viruses

Field/Crop stage : Control measures

i) Previous crop

Inspect seed areas to assure health of the seed crop; reject the fields with incidence of mosaics higher than prescribed. Kill vines at the prescribed date or earlier when aphids cross critical level. Allow no regrowth of vines. Destroy voluntary plants and weeds to eliminate virus(es) reservoirs. Apply insecticides to check aphids. Use disinfected tools for the harvest.

ii) Between crops

Destroy potato volunteers.

Iii) Preplanting

Remove weed hosts and voluntary potato tubers/plants.
Apply soil systemic insecticides.

iv) At planting

Maintain proper isolation of the seed crop. Ensure good sanitation during planting. Plant the best quality certified seed. Avoid use of cut tubers. Plant seed crop at a specified date for the region.

v) Pre-emergence

Apply pre-emergence herbicides.

vi) Post-emergence

Minimize chances of virus spread through farm men and machinery. Control weeds with herbicides. Monitor the population of vectors. Apply insecticides when necessary. Rogue out the virus diseased plants as early as detected alongwith tubers.

vii) Pre-harvest

Kill vines at a specific date or earlier if needed. Do not allow regrowth of the vines. Stop irrigation 10-15 days before harvest.

viii) Harvest and Storage

Disinfect the tools before harvest. Use proper sanitation in storage. Avoid rubbing of chitted/ sprouted tubers in stores or while taking them to field.

Awards to CPRI

Year	Name of Award	Name of Awardees
1968	Rafi Ahmad Kidwai Award	Dr. Pushkarnath
1979	Guinness Award	Drs. BB Nagaich, AK Singh, KP Sharma and LC Sikka
1981	Best Paper Award from Fertiliser News (1981)	Drs. JS Grewal and RC Sharma
1986	Best Paper Award by Indian Phytopathological Society	Drs. MN Singh, BB Nagaich and Hari Om Agarwal
1981	Kheti Award for Best Hindi article	Drs. BB Nagaich, KP Sharma and Mr. Kuldeep Sharma
1991	Best Paper Award by Potash Research Institute.	Drs. JS Grewal and KC Sud
1992	Best Paper Award of Indian Phytopathological Society	Drs. BP Singh and SK Bhattacharyya
1992	Dr. Mundkur Memorial Award/Gold Medal of Indian Phytopathological Society	Dr. SM Paul Khurana
1992	Phosphate Potash Institute of Canada FAI Award for maximisation of potato yield in tribal area in North-eastern Hills	Dr. UC Sharma
1993	Phosphate Potash Institute of Canada FAI Award for management and balanced use of inputs in achieving maximum yield	Drs. JS Grewal, RC Sharma, SS Lal, SP Trehan, JP Singh, VS Kushwah, MC Sood, KC Sud and NC Upadhayay
1993	Fertiliser Association of India-Silver Jubilee Award for outstanding doctoral research in fertilisers use	Dr. JP Singh
1994	Best Paper Award by Indian Phytopathological Society	Drs. BP Singh, SK Bhattacharyya, S Roy and GS Shekhawat
1995	Fakhruddin Ali Ahmed Award for developing agro-techniques in tribal areas of NEH region	Drs. UC Sharma and Kamla Singh
1995	Rafi Ahmad Kidwai Memorial Award (1990-92) for developing management practices for control of PTM in NEH region	Dr. Lakshman Lal

Contd.

Contd.

Year	Name of Award	Name of Awardee
1988	Dr. S Ramanujam Memorial Lecture Award of Indian Potato Association	Dr. NM Nayar
1995	Best Institution Award-1995 of the Indian Council of Agricultural Research	Central Potato Research Institute
1996	Best Paper Award by Indian Potato Association	Drs. SK Pandey and PK Gupta
1996	Best Paper Award by Indian Potato Association (IPA)	Drs. TP Trivedi and D Rajagopal
1997	NS Randhawa Medal for Best Essay by Punjab Agril. Univ., Ludhiana	Dr. Jai Gopal
1997	ICAR Young Scientist Award-1996	Dr. D Sarkar
1997	Jawahar Lal Nehru Award for Best Ph.D Thesis	Dr. (Mrs.) SK Sandhu
1997	Best Paper Award by Assoc. of Food Scientists & Technologist, India, Delhi Chapter	Drs. SV Singh, Devendra Kumar, SK Pandey and PC Gaur
1997	Dr. GA Dastane Gold Medal & IARI Merit Medal	Dr. Praveen Kumar
1997	Dr. Mundkur Memorial Award of Indian Phytopathological Society	Dr. GS Shekhawat
1998	Best Poster Presentation Award of IPA	Drs. BP Singh, SK Kaushik and RK Birhman
1998	Dr. Anand Prakash Award of AZRA	Dr. SS Misra
1998	Jawahar Lal Nehru Award for best Ph.D thesis	Dr. Jai Gopal
1998	Hari Om Ashram Trust Award	Drs. PS Naik and D Sarkar
1996	Best paper Award of IPA	Drs. Sarjeet Singh and H Barker
1997	Best paper Award of IPA	Dr. JP Singh et al.
1998	Best paper Award of IPA	Dr. SM Paul Khurana *et al.*
1998	Dr. S Ramanujam Memorial Lecture Award	Dr. GS Shekhawat
1999	Prof. RK Hegde Memorial (Award) Lecture	Dr. SM Paul Khurana

*This list contains awards received by CPRI Scientists for R&D work only. List does not contain distinguished fellowships and honorary fellowships of scientific societies. Several other honours, awards won by CPRI scientists and staff for exhibitions, sports, debate, etc. have also not been included.

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

BEST INSTITUTION AWARDS

1995

CITATION

The Best Institution Award for the year 1995 is bestowed upon the Central Potato Research Institute for its **pioneering research work in developing high yielding pest resistant, short duration potato varieties, developing low input technologies, and feasible potato based cropping systems for different parts of the country.**

The CPRI through its effective multi-disciplinary approach has developed 5 new potato varieties during the last decade which are resistant to late blight, cyst nematode/wart disease besides being high yielding and of short-medium duration. The Institute has perfected a low investment-high return production technology based on true potato seed. Profitable and feasible potato based cropping systems have improved the fertilizer economy, increased cropping intensity to 200-400%, improved the maintenance of soil fertility and reduced the incidence of diseases and pests.

The CPRI has well **established and highly efficient Breeders' Seed Production Programme to meet the national demand.** It has already achieved the target of 2500 tonnes of annual production of Breeders' seed set up by the National Commission on Agriculture for the year 2000. The latest diagnostic techniques have been perfected and the newer areas of disease free seed production identified. **The Institute has been generating funds to the tune of 30 per cent of its annual budget mainly through the Breeders' Seed Production Programme of Potato.**

As a result of the concerted and systematic research efforts, excellent team work and with efficient management of the Institute, India has witnessed 73 per cent increase in the production and 35.1 per cent increase in productivity of potato during the last decade. During 1995 the average yield per hectare was 16 metric tonnes while the production was 18 million metric tonnes of potato.

The Central Potato Research Institute was established at Patna in 1949 and was shifted to its present location at Shimla during 1956.

CPRI Publications

Ad-hoc Publications

- CPRI Brochure (Hindi and English)
- Research Programmes and Achievements 1984-1989
- Research and Development Programmes 1990-1995
- CPRI : A Profile 2020
- Profiles : Directors of CPRI
- CPRI : Last 5 Years 1989-1994

Periodicals

- Annual Reports (Every year)
- Research Highlights* (1984 to 1989 only)
- Newsletter (Quarterly) – 'Potato'

Books and Proceedings/Reports

- Recent Technology in Potato Improvement
- Potato Production, Storage and Utilization
- True Potato Seed Technology and its Commercial Utilization
- Potato Research in India: Bibliography

Technical Bulletins

1. Potato in India*
2. Potato in India-Bibliography
3. Potato Cultivation in Kashmir
4. Potato Cultivation in Mysore
5. Hairy Sprout Disease of Potato
6. Breeding Potato Varieties Resistant to Charcoal Rot
7. Utilisation of Haploids in Breeding and Genetics of Potato
8. Investigations on Purple Top Roll and Witch's Broom Diseases of Potato
9. Hereditary Variation in the Ability of *Myzus persicae* to Transmit Potato Leaf Roll and Virus "Y"
10. Breeding Potato Varieties Resistant to Brown Rot

11. A Potato Store run on Passive Evaporative Cooling
12. Potato Cultivars Released by CPRI
13. Catalogue of Potato Germplasm Collection, Group Tuberosum
14. Selection Procedure in Potato Breeding
15. Potato in Himachal Pradesh
16. Potato Tuber Moth with Special Reference to India
17. Potato in Karnataka
18. Potato in North-eastern India
19. Wart Disease of Potato in Darjeeling Hills
20. Agronomic Studies on Potato under All India Co-ordinated Potato Improvement Project
21. Bacterial Soft Rot of Potato in India
22. Riverbed Potato Cultivation in Gujarat, India
23. Micronutrient for Potatoes
24. True Potato Seed for Potato Production in India
25. Potato Equipment Developed at CPRI
26. Potato Aphids
27. Potato Late Blight
28. Water Management in Potato
29. Soil and Plant Tests for Potato
30. Potato Based Cropping Systems
31. Phosphorus and Potassium Nutrition of Potato
32. Nitrogen Management in India
33. Weed Management in Potato
34. Potato Processing in India
35. Potato Viruses and Viral Diseases
36. Inventory of Potato Germplasm (Group Tuberosum) Collection
37. Agro-techniques for Potato Seed Production
38. Potato Bacterial Wilt in India
39. Tissue Culture Techniques for Potato Health, Conservation, Micropropagation and Improvement
40. Potato Statistics : India and The World
41. Soil and Tuber Borne Diseases of Potato
42. Transfer of Potato Technology
43. 20 Years of Potato Research - AICPIP
44. Economics and Marketing of Potato in India
45. Potato Pests and Their Management.
46. Inventory of Potato Germplasm (Group Andigena) Collection
47. Storage of Potatoes in India

48. A guide to Potato Processors in India
49. Potato– a Wholesome Food
50. Indian Potato Varieties
51. Potato Varieties for Processing
52. World Potato Statistics

Extension Bulletins

1. Potato Varieties*
2. Seed Plot Technique*
3. Potato a Food Crop and The Need for its Promotion
4. Why Potato?*
5. Potato Cultivation*
6. Seed Potato*
7. Diseases of Potato*
8. Potato Pests*
9. Potato, a Food Crop*
10. Hints for Successful Potato Cultivation*
11. Potato Cultivation in UP Hills*
12. Potato Cultivation in North-eastern Hills
13. Potato Cultivation in Nilgiri Hills
14. Package of Practices for Seed and Table Potato Production in North-western Hills*
15. Package of Practices for Seed and Table Potato Production in Western Indo-Gangetic Plains*
16. Package of Practices for Seed and Table Potato Production in Central Indo-Gangetic Plains*
17. Package of Practices for Seed and Table Potato Production in Eastern Indo-Gangetic Plains*
18. Package of Practices for Seed and Table Potato Production in Plateau Region
19. Dormancy Breaking in Seed Potato*
20. Use Whole Tuber as Seed*
21. Bacterial Wilt of Potato and its Management*
22. Potato Tuber Moth and its Management
23. Late Blight of Potato in Northern Plains of India
24. Alu Ki Sudhri Kheti (in Hindi)
25. Coping-up with Drought in Potato Cultivation*
26. Solar Dehydrator*
27. Potato Cultivation Equipments
28. Kufri Swarna - A High Yielding Late Blight and Nematode Resistant Potato Cultivar Suitable for Cultivation in Tamil Nadu Hills

29. Kufri Megha- A High Yielding Late Blight Resistant Potato Cultivar Suitable for North-eastern India Hills
30. Manual for True Potato Seed (TPS) Production and Utilisation*

Special Publications

1. Souvenir– Golden Jubilee of CPRI (1949-1999)
2. Potato Research in India– A Success Story of Fifty Years
3. Vision - 2020 (Perspective Plan of CPRI)
4. Social Impact of Potato Research & Development in India

* Hindi Versions also published
Most of the technical and extenion bulletins are revised and reprinted from time to time.

Potato : Facts and Figures

Potato is one of the most important food crops in the world. In terms of production, it ranks after wheat, maize and rice with respective production of 612, 585, 580 and 292 million tonnes in 1997. Potato production represents roughly half of the world's total annual output of 628 m tonnes from all root and tuber crops. Over one billion people consume potatoes world-wide and potatoes are part of the diet of half a billion people in the developing countries.

The home of potato is in the Andes in the vicinity of Lake Titicaca, at present the border of Peru and Bolivia. Historical evidence shows that at the time of Spanish conquest in the early sixteenth century, hundreds of potato varieties were cultivated in the highlands of Bolivia, Chile, Colombia, Ecuador and Peru. Salaman (1949) quotes evidence that potatoes were bought in 1573 at Serville and concludes that they could have arrived in Southern Spain in 1570. Potato appeared in Europe in last quarter of sixteenth century. Later, it was introduced into England between 1588 and 1593. After Spanish introduction, it diffused through continental Europe and parts of Asia. From England, it spread to Ireland and to the British colonies including northern America. From Spain, the potato spread throughout Europe as a botanical curiosity and was thought to possess mysterious medicinal properties. It became a part of a regular human diet within two centuries. But at times, the potato was denounced as unhealthy causing rickets, scrofula, flatulence, leprosy, narcotic and encouraging lust (why else Irish peasant families be so large ?). Such prejudices still persist in developing countries.

The potato was first said to have been brought to Russia by Peter the Great at the end of the seventeenth century from Holland. In North America, it became popular only from early seventeenth century and was introduced in New Zealand by the French explorer, de Surville. Potatoes were brought to India and China in the 17th century by the Portuguese traders or by British missionaries. Prior to 18th century, potatoes were grown as a garden vegetable in western India, but the potatoes reached South India only in the 1880s. The British promoted potato cultivation in the hills of northern India. From the hills, potatoes spread to the plains and by beginning of 20th century, small plots of potatoes were grown scattered throughout India near the towns. Thus having struck roots, the first half of the twentieth century (1900-1949) is marked as the transitional phase of potato development in India.

The potatoes first established as a food crop in Ireland and by the end of eighteenth century the life and economy of the nation became dependent on the crop. It is reported (Smee, 1846) that 'an Irishman in health and activity is said to eat from ten to twelve pounds of potato as per diem' i.e. 4.5-5.4 kg per day. In Holland, potatoes also formed a major part of the diet of the poor of Utrecht by the middle of the eighteenth century. By the end of the eighteenth century, the potato gained wide-spread acceptance as a food in France, Germany and the rest of Europe.

While potato was accepted as a food crop in the eighteenth century, it gained popularity in the nineteenth century in Europe. However, the danger of complete dependence on a single food crop was tragically illustrated when the potato crop failed in Ireland during 1845 and 1846 due to attack of *Phytophthora infestans* (blight or 'late blight') introduced into Europe in the early 1840s

perhaps through diseased tubers from central America. The Irish potato famine led to death of a million and emigration of over 1.5 million people from a population of 8 million during 1845 and 1860.

The twentieth century showed crop diversification and a decline in dependence on potatoes in Europe. In western Europe, the area under potatoes decreased by 52% over 25 years and eastern Europe witnessed 23% reduction. Only a few countries like the Netherlands, Greece, Portugal etc. recorded an increase in area and production. By 1980, potato was cultivated in 126 countries; 33 in Africa, 31 in Asia, 29 in Europe (including the then USSR), 17 in North and Central America, 10 in South America and 6 in Oceania. Of the total 18 million hectare area, Europe accounted for 69.8 per cent followed by the USSR 38.5%, Africa 3.3%, Asia 17.3%, North and Central America 3.7 and 5.5%, and Oceania 0.2-0.3%.

In the early 1990s, the developing countries accounted for about 30 per cent of global potato output, up from 11 per cent in the early 1960s. If this trend continues, the developing countries of Asia, Africa and Latin America, will produce a lion share of the crop. Potato would play a great role in the socio-economic transformation of the their economies and meeting the food needs of the ever increasing population.

During 1997, potato was cultivated in 143 countries of the world. The region-wise break-up is Africa (35), North-central America (14), South America (10), Asia (40), Europe (40) and Oceania (4). Potato still continues to be a European crop since the continent accounted for 51.6 per cent of world area and 52.2% production in 1997, followed by Asia with 34.1 per cent area and 30.5 per cent production. North-central America topped the world in yield (34.2 t/ha) followed by Oceania 31.5 t/ha compared to world average of 16.1 t/ha.

The genus, Solanum, to which the cultivated potato belongs, is an extremely large one, containing over 2000 species. It extends all over the world except for the far North and South, with a strong concentration of species diversity in South and Central America on the one hand and Australia on the other.Today we have eight species of cultivated potatoes - 4 diploid, 2 triploid, 1 tetraploid and one pentaploid. While *S. andigena* is cultivated in North America and South America, the sub-species *S.tuberosum* has become most widespread and cultivated in Europe, Asia and elsewhere. Besides, seven other cultivated species and 154 wild species of potato are generally recognised. The tuber-bearing species are completely confined to the American continent and many are of considerable interest to the potato breeders because of their resistance to pests and pathogens and their adaptation to climatic extremes.

World Trends

The growth trends in potato area and production at world and regional levels are quite revealing. These are presented in Table 1 to 9 and in Figs 1 to 3. The area under potato in the world increased by 43.1 per cent, output by 79.0 per cent and yield by 29.8 per cent during 1997 over the base year of 1950. This does not include the data up to 1950 for the former USSR being not available. Therefore,a critical comparison between average data of 1960 and 1997 for these parameters reveals that the area declined by 26.4 per cent, the production was static but the yield increased by 43.8 per cent (Table 1). During this period, the per cent share of developed countries in potato area in the world decreased from 78 to 64.8% with corresponding per cent shares of production being 85 and 64.8 per cent. On the contrary, the developing countries increased their

POTATO: TREND IN AREA

(Asia, India and World)

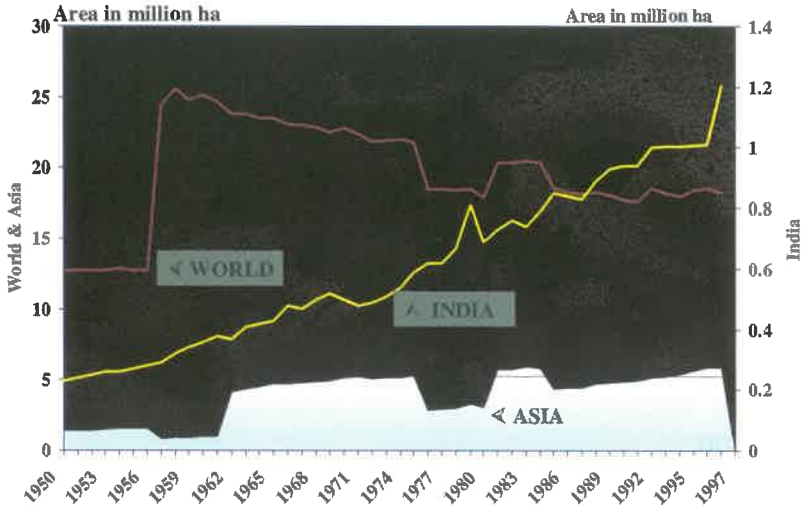


Fig.1

TREND IN PRODUCTION

(Asia, India and World)

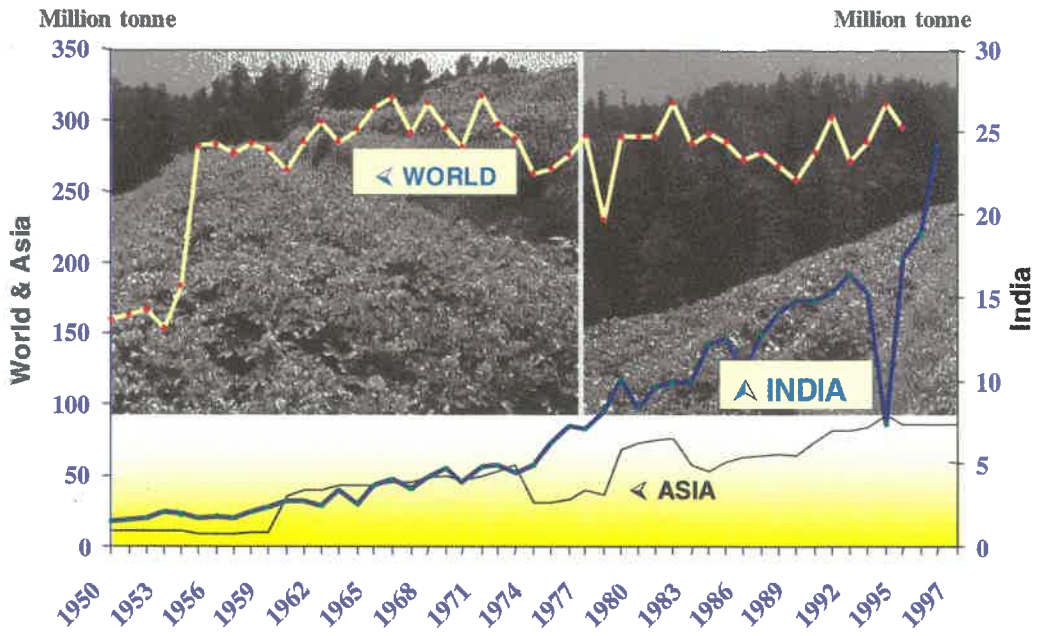


Fig.2

TREND IN YIELD

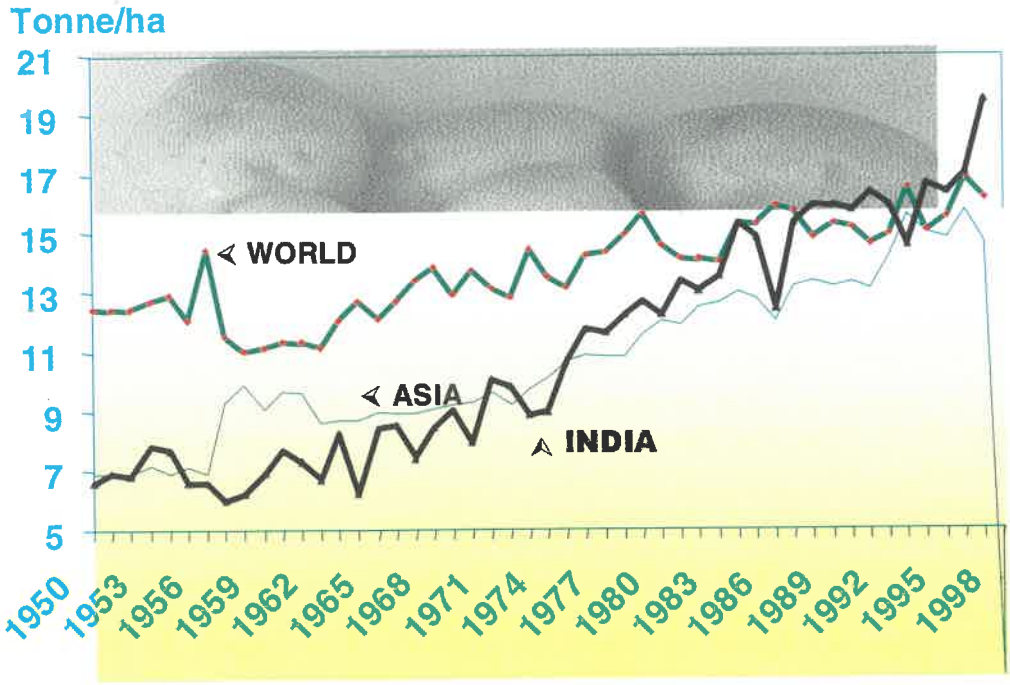


Fig.3

area share from 22% in 1960 to 40.9 per cent in 1997 and the production shares being 15 and 35.2 per cent respectively.

The growth rates in respect of potato area for the period 1950 to 1997 (Table 2) were negative with regard to World, Europe, North-central America, South America, Oceania, and former USSR. The shift in area was significantly higher in the case of Europe because of decrease in demand due to negative elasticity and decreasing requirement for animal feed. In Europe, the area went down by 62.3%, production by 38.3% while yield was up from 13.8 t/ha in 1950 to 22.6 t/ha in 1997 showing 63.8 per cent increase (Table 5). The decline in area and production in the former USSR is attributed to similar factors coupled with the potato becoming non-profitable due to the serious losses caused by Colorado beetle (Table 9). On the other hand, area planted in Australia, Canada and the United States remained virtually unchanged over the last three decades. However, in North central America, the area declined by 10.9% but output increased significantly by 105.8% and yield by 131.1 per cent respectively. During the same period, the area decreased by 16.7 per cent in Oceania (Table 8). The decrease in area in developed countries was partially made good by the increase in yields per hectare as underscored by the positive growth rates (Table 2). In the Netherlands, the boost to exports of seed potatoes, table potatoes and processed products have been instrumental in an increase in area and production. The growth of processing industry and exports of processed products such as chips and French fries made the potato farming profitable.

During the same period, developing countries in Asia and Africa registered remarkable improvement in potato area, production and yield. Africa showed higher growth rates of 4.24 and 5.36 per cent per annum in respect of area and production compared to 3.21 and 4.92 per cent

Table 1 : Average area, production and yield of potato in the world (1950 to 1997)

Year	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1950*	12800	159300	12.4
1960	24900	279567	11.2
1970	22569	298884	13.2
1980	18940	268792	14.7
1990	17826	267251	15.0
1997	18314	285140	16.1
% change in 1997 over 1950	43	79.0	29.8

*The data is the average of 1948-52 (excluding the former USSR) and subsequently (1960 to 1990) the average of 1959, 1960 and 1961 for 1960 and so on. The data for 1997 pertains to one year only.

Source : FAO production year-books, various issues.

for Asia. But Asia excelled Africa by recording the higher compound growth rate of 1.65 per cent per annum yield than that of 1.08 per cent for Africa. The highest growth in yield was observed in India (2.38%,Table 6) followed by SAARC countries (2.31%), Oceania (2.29%), South America (2.10%) and North Central America (1.69%). In the developing countries of Africa and Asia, where potatoes are treated as a poor man's food, the increasing population and rising household income

Table 2: Region-wise compound growth rates (% per annum) of area, production and yield of potato in the world– (1950-97)

Region	Area	Production	Yield
Africa	4.24	5.36	1.08
Asia	3.21	4.92	1.65
Europe	-2.19	-1.20	1.02
North-central America	-0.02	1.66	1.69
South America	-0.12	1.98	2.10
Oceania	-0.25	2.04	2.29
Former USSR	-1.18	-0.58	0.59
SAARC@	3.11	5.37	2.31
India	3.48	5.94	2.38
World	-0.05	0.67	0.73

Source : Annual compound growth rates were worked out by the authors on the basis of data sources from FAO production year-books. However, the data for India have been taken from the 'Agricultural Statistics at a Glance', 1999, Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India, New Delhi.
@For SAARC, the ACGR pertain to 1967 to 1997.

imparted a boost to the demand of potato. Africa recorded an increase in area by 341.8 per cent, production 827.5 per cent and yield 110.2 per cent while corresponding increases for these parameters in Asia were 300.5, 752.0 and 113.0% during 1950 to 1997 (Table 3 and 4). The other developing region i.e. South America also reported an improvement in potato area, production and yield to the tune of 18.6, 196.4 and 149.1% respectively (Table 7).

Table 3 : Average area, production and yield of potato in Africa (1950 to 1997)

Year	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1950	170	1000	5.9
1960	187	1487	8.0
1970	341	2706	8.0
1980	565	4994	8.8
1990	748	7586	10.1
1997	751	9275	12.4
% change in 1997 over 1950	341.8	827.5	110.2

Source : FAO.

Table 4 : Average area, production and yield of potato in Asia (1950 to 1997).

Year	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1950	1470	10130	6.9
1960	987	9353	9.5
1970	5128	48167	9.4
1980	4040	47903	11.8
1990	4896	64628	13.2
1997	5888	86310	14.7
% change in 1997 over 1950	300.5	752.0	113.0

Source : FAO.

Table 5 : Average area, production and yield of potato in Europe (1950 to 1997)

Year	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1950	9390	130000	13.8
1960	9060	137897	15.2
1970	7211	126851	17.6
1980	5695	109652	19.2
1990	4532	93645	20.6
1997	3541	80168	22.6
% change in 1997 over 1950	-62.3	-38.3	63.8

Source : FAO.

Table 6 : Average area, production and yield of potato in North central America (1950 to 1997)

Year	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1950	880	13020	14.8
1960	767	14330	18.7
1970	758	17424	23.0
1980	704	18732	26.6
1990	771	22436	29.1
1997	784	26794	34.2
% change in 1997 over 1950	-10.9	105.8	131.1

Source : FAO.

Table 7: Average area, production and yield of potato in South America (1950 to 1997)

Year	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1950	860	4530	5.3
1960	983	6183	6.3
1970	1057	8924	8.4
1980	971	9719	10.0
1990	878	10659	12.1
1997	1020	13429	13.2
% change in 1997 over 1950	18.6	196.4	149.1

Source : FAO.

Table 8 : Average area, production and yield of potato in Oceania (1950 to 1997)

Year	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1950	60	580	9.7
1960	52	717	13.9
1970	55	1073	19.5
1980	44	1087	24.7
1990	50	1406	27.9
1997	50	1592	31.8
% change in 1997 over 1950	-16.7	174.5	227.8

Source : FAO.

Table 9 : Average area, production and yield of potato in the former USSR (1950 to 1997)

Year	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1960	9187	85082	9.3
1970	8017	93739	11.7
1980	6920	76706	11.1
1990	5951	66892	11.2
1997	6280	77840	12.4
% change in 1997 over 1950	-31.6	-8.5	33.3

Source : FAO

SAARC Scenario

Amongst the seven SAARC countries, the leading potato producing countries are India accounting for 77.2% area, followed by Bangladesh (9.2%), Nepal (7.2%) and Pakistan (5.6%). India's share in SAARC potato production is about 84 per cent, followed by Bangladesh 6.7%, Pakistan 4.7% and Nepal 4.1% (Table 10). During the last three decades, potato development in the SAARC region has been spectacular. The area increased by 143.3 per cent, production 394.2 per cent and yield by 102.6 per cent.

Table 10 : Average area and production of potato in SAARC countries for 1995 to 1997

Country	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
Bangladesh	133(9.2)	1489(6.7)	11.2
Bhutan	3(0.2)	34(0.2)	11.3
India	1116(77.2)	18627(83.9)	16.7
Nepal	105(7.2)	911(4.1)	8.7
Pakistan	81(5.6)	1044(4.7)	12.9
Sri Lanka	8(0.6)	95(0.4)	11.9
SAARC	1446	22200	15.4

Parentheses indicate percentages to SAARC total figures.

Source : FAO Production yearbook, 1997.

The organised research on potato in India was launched on April 1, 1935 under an ad-hoc scheme and Central Potato Research Institute (CPRI) came into being in August 1949. India produced 1.54 million tonnes of potatoes from 0.23 million hectares with yield of 6.6 t/ha in 1949-50. Potato is cultivated on 0.6 per cent of total cropped area but it contributes handsomely to national economy. According to provisional crop estimates, India produced 23.58 million tonnes of potatoes from 1.23 million hectare of area with a yield level of 19.1 t/ha during 1998-99. The increase in area, production and yield has been of the order of 434.8, 1431.2 and 289.4 %

respectively in 1998-99 over 1949-50. Potato has excelled both rice and wheat by registering the highest growth rates except for that of wheat yield. These were 3.67, 5.81 and 2.07 per cent per annum for area, production and yield respectively. The respective ACGRs (annual compound growth rates) for rice were 0.77, 2.67 and 1.89% and for wheat 2.21, 5.47 and 3.18 per cent per annum. The potato revolution has been brought about even without any price support to the crop as extended to these principal cereal crops. India has released 34 HYVs of potatoes including two processing varieties. Over 93 per cent area in the Indo-Gangetic region, the potato bowl of India, is under HYVs varieties released by CPRI. Both white-skinned and red-skinned varieties are cultivated in India. India ranks fifth in area and productions of potato in the world. According to the 1997 FAO figures, the first four positions go to China, Russian Federation, Ukraine and the USA.

Potato is a commercial crop in Bangladesh. Its introduction in the territory now constituting Bangladesh dates back to 1772. In 1950-51, potato was cultivated on 36 thousand hectares and the production was only 211 thousand tonnes with yield of 5.9 t/ha. According to FAO, the country produced 1508 thousand tonnes of potatoes from 134 thousand hectares area with a yield of 11.3 t/ha during 1997. The increase in area, production and yield was 272, 614.5 and 91.5 per cent respectively in 1997 over 1950-51. Bhutan is a small country. It reported cultivation of potatoes on 2 thousand hectares area with a production of about 14 thousand tonnes and yield of 6.7 t/ha in 1962. Over 35 years in 1997, the area went up to 3 thousand hectares, production 34 thousand tonnes and the yield 11.3 t/ha registering 50, 142.9 and 68.7% increase respectively. As regards Nepal, potato occupies fifth position in area, fourth in total production and first in productivity compared with the main staple crops i.e. rice, maize, wheat and millet. Potato is a staple food for the highlanders and a vegetable in other areas. Potato is grown in all parts of Nepal and the yields vary from 2 to 35 tonnes per hectare across the country. During 1997, the area, production and yield in Nepal were 111 thousand hectares, 997 thousand tonnes and 9.0 t/ha respectively.

According to Pakistan Agricultural Research Council (PARC), potato was not a significant crop in the country at the time of independence. In 1947-48, only 2760 hectares were under potato cultivation and the production was only 27 thousand tonnes with an yield of 9.8 t/ha. Both white-skinned and red-skinned varieties are cultivated in Pakistan. Mostly exotic varieties are grown in Pakistan. Under the National Potato Programme only two varieties i.e. Laal-e-Faisal and Sialkot Sufaid were released in 1986 and 1990. The potato crop ranked fourth among food crops after wheat, rice and maize and sixth in overall ranking when sugarcane and cotton are also taken into account. Potato is a very profitable enterprise in Pakistan but the development so far has mainly been dependent on imported seed potatoes and Pak-Swiss Potato Development Project. During 1997-98, an improvement in area production and yield of potato was reported. The respective figures are 97000 ha area, 1307 thousand tonnes output and 13.5 tonnes per hectare yield.

Utilization

Potato is a staple food in European countries and North America and a vegetable in the developing countries while a delicacy in some other countries. It is utilized as fresh food, processed product, animal feed and seed. Horton (Potato, 1987) has noted that nearly 40 per cent of world potato production was used as fresh human food in 1972 - 74 and 31 per cent as stock-feed. In Europe and the former USSR, stock consumed more potatoes than did humans, mainly because of higher proportion used in stock-feeding in Poland (63.9%) and in the former USSR (32.6%) but utilization on this score has later increased in the USSR while it has gone down in Poland.

Table 11: Average area, production and yield of potato in SAARC countries (1967 to 1997)

Country	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1967	609	4622	7.6
1970	661	5879	8.9
1980	937	11052	11.8
1990	1219	17612	14.5
1997	1482	22844	15.4
% change in 1997 over 1950	143.3	394.2	102.6

Source : FAO Production yearbooks, various issues.

Table 12 : Average area, production and yield of potato in India (1950 to 1997)

Year	Area ('000 ha)	Production ('000 mt)	Yield (t/ha)
1950	230	1540	6.6
1960	360	2600	7.3
1970	500	4480	9.0
1980	740	9380	12.7
1990	940	14940	16.0
1997	1250	24220	19.4
% change in 1997 over 1950	443.5	1472.7	193.9

Source : Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India, New Delhi.

Potato is a nutritious food. It is estimated that an adult male's total daily energy requirement - 2550 calories - could be met by consuming about 3.3. kilograms of boiled potatoes. Consumption levels at this rate have been reported in Ireland and the Andes earlier. The data presented in Table 13 indicate that potatoes have very high biological value next only to the eggs and higher than soybean, maize, wheat flour, peas and beans.

Table 13 : Nutritive value of eggs, potatoes and selected crops

Item	Biological Value*
Egg	96
Potato	73
Soybean	72
Maize	54
Wheat flour	53
Peas	48
Beans	46

*Biological value is an index of the portion of absorbed nitrogen retained in the body for growth or maintenance or both.

Source : Kaldy, M.S. 1972. Protein Yield of Various Crops as related to protein value. Economic Botany 26, 1972 (as referred to by Horton D. 1981. Potato. Ceres, Jan-Feb 1981 p30).

Per Capita Production and Consumption in different Regions of the World (1997)

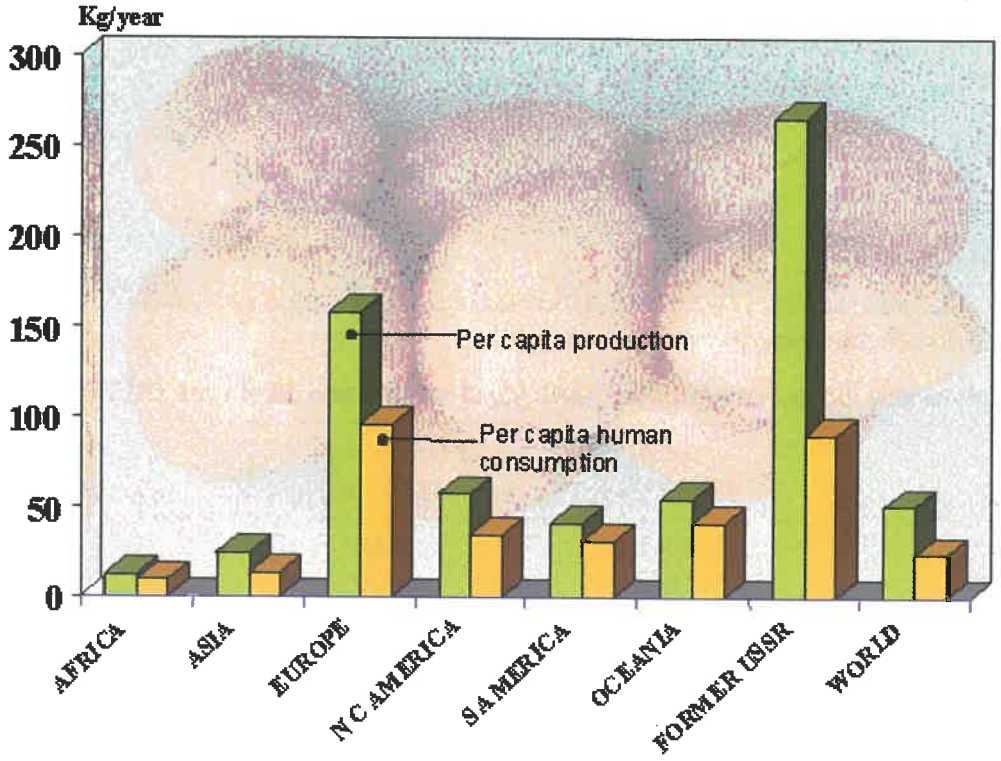


Fig.4

According to the FAO (1995 - Potatoes in the 1990s - Situations and Prospects of the World Potato Economy), the lion's share of total world production is used as fresh food. Its percentage share increased from 42 in 1961 - 63 to 48 in 1991 - 92. The highest fresh potato consumption of 78% (1991-92) is recorded in Africa, followed by Latin America 76%, western Europe 61% and lowest in eastern Europe 27%. Countries in Eastern Europe such as Poland and the former USSR utilized 39 and 27% of total production for stock-feeding. Potatoes are mainly used for animal feed on a significant scale in Europe and former USSR, even though it is a costly feed for stock-feeding. However, China also reported a sizeable part of potato production being used for animal feed being 34%. Developing countries such as Indonesia (88%), Vietnam (84%), Bangladesh (80%), Egypt (80%), Argentina (84%), Cuba (82%), Pakistan (80%) and Iran (84%) made use of potatoes as fresh food, mainly in vegetable form. But some developed countries such as Japan (87%), Australia (87%) and Italy (82%) also registered equal percentage use in this mode like the developing world.

Globally, the per capita consumption of potatoes, declined from 35.1 kg/year in 1961-63 to 25.1 kg/year in 1991-92. This is attributed to significant reduction in production and consumption of potatoes in Europe and in former USSR showing a fall from 102.3 to 79.3 kg/year in Western Europe and 131.8 to 78.0 kg/year in the former USSR. During 1997, world per capita potato consumption was reported 24.2 kg/year (Table 14, Fig. 4). Negative income elasticity of demand for potatoes and consumer preferences for cereal grains, coupled with relative decline in their prices and increasing availability of soyabean and fish meal for livestock are adduced as reasons for decrease in potato demand resulting in shift in area under potato cultivation and fall in potato production.

Per Capita Production and Consumption in developing countries of the World (1997)

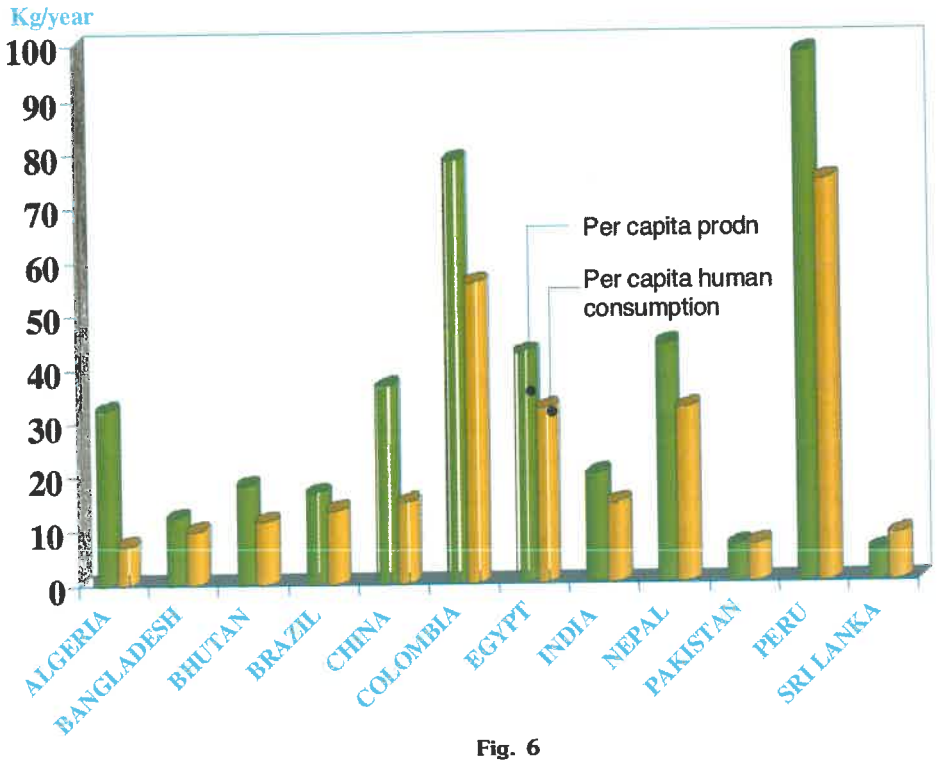


Fig. 6

The consumers have some quality preferences. For instance, by and large, white-skinned potato varieties are preferred in India but the consumers in the states of Bihar, certain pockets of West Bengal and North-eastern states prefer red-skinned varieties. The potatoes grown in the hill regions are called 'pahari aaloo' (hill potatoes), which fetch premium prices. Such consumer preferences are observed in other developing countries as well. The changing life styles and increasing demand for fast foods have given a big boost to potato processing both in the developing countries and developed countries. It increased from 2 per cent of total output in 1961-63 to 6 per cent in 1991-92 in the developing countries. But developed countries showed still higher increase from 4 to 14 per cent in the corresponding period. China with 12% of total production using for processing is a leader amongst the developing world. In India potato processing is done at household level for self-consumption, cottage industry level and in the organized industrial sector. Potato processing is growing rapidly in the country. The demand for starch in India is expected to increase from the current level of 25000 t to around 1,00,000 t early in the next century, as a result of increased demand for paper and corrugated board.

Potato processing is a big industry in Europe and the USA. The USA used 57.6 per cent of the total crop for processing in 1997. A vigorous processing industry has been established in the EU-15 countries. Over 30 per cent of total crop in EU is used for manufacture of starch and human consumption products. The processing industry is concentrated in the centre and west of EU where yields are high and consistent enough to allow development of industry. Aviko is the potato products

giant of Holland and it processes 1.4 million tonnes of potatoes annually. The USA, Netherlands and Canada are the World's largest suppliers of French fry products and Japan is the largest importer of French fry products. The Netherlands is the world's largest exporter of French fries and the country exported about 1 million tonnes of French fries during 1997-98. The Central Asia's first potato chip factory, with a capacity of 150-180 kg an hour has been established in Almaty district of Kazakhastan. In Russia only 3% of the Russian crop is processed compared with more than 60% in North America. This is attributed to high prices of potatoes being equivalent of US $ 200/tonne in the Russian Federation as against US $ 100-120/tonne in North America over the last 5 years.

Imports and Exports

Even though potato is a bulky and semi-perishable commodity, international trade in potatoes takes place at a significant scale. Region-wise imports and exports data are presented in Table 17 and 18, and Figs. 7, 8. The imports and exports of table and seed potatoes were about 1.2 per cent of total world output in 1950 but the volume of trade had increased by more than 100 per cent in 1997. According to FAO estimates, while considering the exports of processed products such as French fries, chips etc on fresh weight basis, roughly 4 per cent of annual global production of potatoes is traded internationally. The bulk of potato exports originate from developed countries which account for 80 per cent of global shipments.

The regional pattern of imports during 1950-1997 indicates that the imports had declined in Africa, North America, Oceania and South America mainly because these regions had made progress in potato production thereby decreasing their dependence on imports. Europe showed substantial increase in its world percentage share from 59 in 1950 to 70.1 in 1997. It is because of decline in European potato output and the increased availability of fresh potatoes from Egypt, Cyprus, Turkey, Morocco and of late Israel as well.

During 1996, a total of 7265 thousand tonnes (2.4 % of world potato output) was exported. The top ten countries and their respective percentage shares in world exports were the Netherlands 18.6, Germany 13.4, Belgium, Luxembourg 10.7, France 9.6, Canada 7.7, Egypt 5.7, Italy 4.2, U.S.A. 3.9, Turkey 3.3 and Cyprus 2.5 as per FAO estimates. Taken together, these ten countries accounted for 80 per cent of total world exports of potatoes. The imports also followed a somewhat similar pattern and the ten leading importing countries and their respective percentage shares were Netherlands 19.1, Germany 10.9, Belgium Luxembourg 9.9, U.K. 5.9, U.S.A. 5.9, Italy 5.6, Spain 5.3, France 4.0, Canada 3.1 and Portugal 1.8, totalling 70.5 per cent for all these countries. The international trade pattern indicates that the export-import is mainly within the European countries, mainly because of demand for fresh potatoes, for processing purposes and for seed requirements. The Netherlands dominates the world seed potato exports. During 1998, it exported over 226 thousand tonnes of seed potatoes to 33 European countries, 16 African countries. 17 Asian countries and 12 American countries.

As regards potato imports to India, the same have gone down from 0.37 per cent of world imports in 1950 to zero per cent in 1997. On the contrary, over the corresponding period the exports from India have increased from zero per cent in 1950 to 0.58 per cent of world exports in 1997.

Table 17. Average imports of potato in different regions of the world and India (% share in world imports)

Region/ Country	1950	1970	1990	1997
Africa	8.9	5.3	4.2	6.6
Asia	8.1	5.8	8.7	10.0
Europe	59.0	77.0	65.3	70.1
North America	15.1	8.9	8.3	11.3
Oceania	0.6	0.5	0.2	0.3
South America	8.3	2.5	0.9	1.7
Former USSR	N.R.	N.R.	12.4	@
World ('000 MT)	1903	3454	7214	6907
India ('000 MT)	7.10	1.40	0.00	0.30
India's percentage share in world imports	0.37	0.04	0.00	0.00

@ the USSR broke up in 1991 and hence data not reported.

N.R. = not reported.

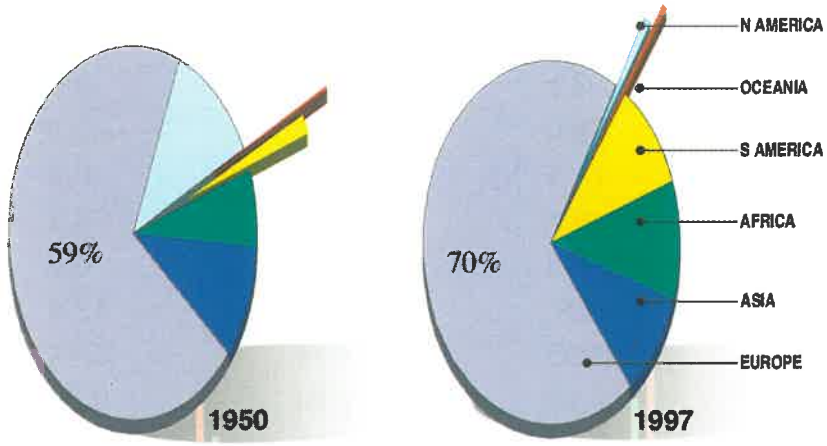
NB : Three yearly average figures such as for 1970, the average of 1969, 1970 & 1971 has been taken & so on. But in case of 1997, data are for one year only.

Source : FAO Trade yearbooks, various issues.

Table 18 : Average exports of potato by different regions of the world and India (% share in world exports)

Region/Country	1950	1970	1990	1997
Africa	7.3	5.7	4.1	4.7
Asia	3.5	7.7	10.0	8.4
Europe	67.1	74.4	77.0	74.2
North America	20.6	9.2	8.1	11.4
Oceania	1.3	0.7	0.3	0.8
South America	0.2	1.4	0.5	0.5
Former USSR	0.0	0.9	0.0	@
World ('000 MT)	2042	3464	7226	6872
India ('000 MT)	0.00	1.90	2.83	40.00
India's percentage share in world exports	0.00	0.05	0.04	0.58

Region-wise import of potatoes in the world

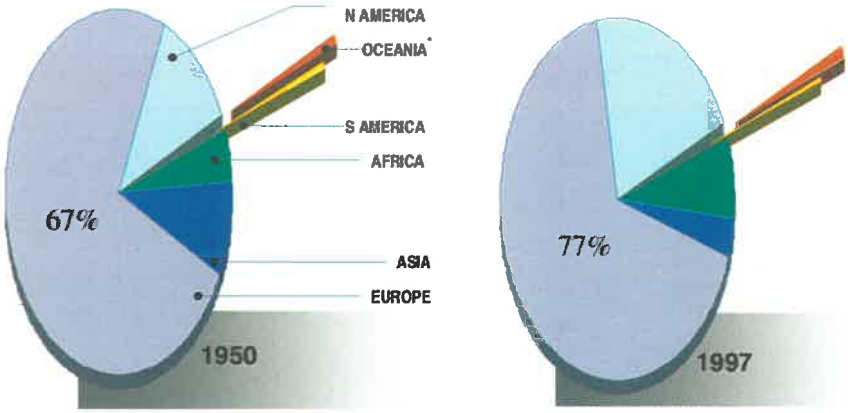


Word Import 1950 - 1903 (`000 MT), 1997 - 6907 (`000 MT)

Note: Data in respect of former USSR for 1950 and 1997 not reported

Fig. 7

Region-wise export of potatoes in the world



World Export 1950 - 2042 (`000 MT), 1997 - 6872 (`000 MT)

Note: Data in respect of former USSR for 1950 reported as nil and for 1997 data not reported

Fig. 8

Emerging Research Thrusts and Technological Advances

Potato improvement has taken place on account of introduction of improved varieties evolved through conventional breeding, having sound seed production and seed certification systems, resource use efficiency, better delivery systems for inputs supply and facilitating marketing and utilization. The use of botanical seed known as True Potato Seed (TPS) has had its impact in selected regions in China, India etc. The development of cold storage industry has made potatoes available for longer periods and adoption of indigenous storage structures by the farmers has increased fresh (non-cold stored) potatoes supply for processing industry.

But, of late, according to Dr. Howard Devies of the Scottish Crop Research Institute, the MNCS are spending very large sums of money on GMO (genetically modified organisms), which offer great potential to the potato industry for increasing yields, reducing growing costs or improving and expanding the range of processed products availability. During East-West Potato 1999 conference held in August 1999 in Finland, Prof. K. Skryabin, Chairman of the Biotechnology Council of the Russian Academy of Sciences, asserted that there was GM solution for twenty potato diseases.

Monsanto argues that biotechnological advances in research hold the hope for meeting the world's needs for food security. It has developed New leaf GM potatoes. These cultivars had been grown on 19800 hectares in the US during 1998 and the area under GM potatoes is estimated to be 35000 ha during 1999. Monsanto has also developed and marketed in North America genetically modified (GM) varieties which are resistant to Colorado beetle. Several countries have allowed field trials of genetically modified potatoes. The New Zealand Institute of Crop & Food Research would undertake fields tests to study resistance of GM potatoes to bacterial soft rot and tuber moth. Dutch company Avebe has developed a GM starch potato variety, which yields 100 per cent amylopectin in the starch. However, the E.U. Scientific Committee on plants is examining this claim. It may be noted that high starch potatoes take less fat when fried and are thus preferred for processing purposes. Similarly, Danish government has approved field trials of GM varieties which can tolerate frost and provide higher quality starch. Canada has also granted regulatory approval for seed production, commercial production and food use of three GM potato varieties with 'stacked traits'.

The developments on the GM potatoes front have aroused strong suspicions on the food value of these varieties. The protests got intensified in the UK and Europe when a scientist of Rowett Research Institute (RRI), at Aberdeen, UK had said in a TV programme in August 1998 that feeding GM potatoes on rats had adverse effects. A strong movement is under way in the European countries and the U.S.A. in favour of labelling of GM foods so that consumers can decide whether to buy them or not. It is said that the consumers are not interested in genetically modified varieties with either improved yield, enhanced pest and disease resistance or tolerant to herbicides. They prefer products which have nutritional advantages, cost them less and whose production results in less environmental pollution.

Potato in the Next Millennium

The potato crop has made successful strides over the last fifty years despite the fact that the role and potential of potatoes has not been fully appreciated so far as feeding the teeming millions is concerned. According to the United Nations Fund for Population Activities (UNFPA's World Population Report, 1999), the world population reached the six billion mark in October 1999. UN estimates suggest that the world population would be close to 10 billion by 2050 and 95 per cent

of the incremental population growth would take place in the developing world. Consequently, the human pressure on land would increase tremendously in the time to come. In order to avert malnutrition and hunger, there is an imperative need to exploit our land resources in such a sustainable way that the increase in food stocks not only keeps pace with the population growth but is rather on the higher side. The potato crop can alleviate the situation substantially in this regard.

Potato is a versatile food. It is an efficient food producer and has the potential to occupy the coveted position of becoming a supplementary staple in the developing world. In the developed countries, it is already an essential ingredient of diet despite the declining trends in its consumption but in the case of the developing countries, where the potato - a capital intensive crop - is cultivated by small land holders, the complex marketing and utilization problems need to be resolved effectively. Enlightenment of the people at large on its food value and giving a fillip to processing at household, cottage and industrial level may go a long way in putting potato on its well-deserved pedestal. It is pertinent to add here what Derek Tribe (Feeding and Greening the World, 1994) has said in this regard, "although most of the published projections of future global demands for food focus on cereal consumption, in many regions of the world non-cereal staples such as roots, tubers, and plantains are also of great importance in the diets and income of the poor. For example, it has been estimated that these non-cereals supply as much as 40% of the food energy of that half of the South Asia and Sub-Sahara Africa (SSA) population that is at risk of hunger or starvation. Crops like potatoes, sweet potatoes, cassava, taro, yams, bananas and coconuts play a highly significant part in the lives of poor people in many parts of Asia, the Pacific and Latin America as well as in Africa. Greater efforts to accelerate the productivity of these crops need to be an integral part of future effort to secure global food security". In the ultimate analysis, potato is not there to supplant the cereals but to supplement them effectively as a staple for nutritional and food security in the next millennium.

-Prem Singh Dahiya
and **Hoshyar Chand Sharma**
Central Potato Research Institute,
Shimla 171 001 (HP)

vii) **National Seminar on**
Potato production constraints in low productivity areas, September 6, 1997, OUAT, Bhubaneshwar (Orissa).

5. Confer awards and honours on eminent potato workers, growers, etc.

Honorary Fellows

The Association has so far conferred Honorary Fellowships on 16 distinguished potato workers/growers for their outstanding contributions in the field of potato research and development. They are:

1. Dr. S Ramanujam*
2. Dr. Pushkarnath*
3. Sh. Hari Kishore*
4. Sh. IS Dhillon
5. Dr. BB Nagaich
6. Dr. KL Chadha
7. Dr. Kirti Singh
8. Sh. S N Bhargava*
9. Dr. BP Pal
10. Dr. MD Upadhya (Peru)
11. Dr. NM Nayar
12. Dr. RP Singh (Canada)
13. Dr. JG Hawkes (UK)
14. Dr. JS Grewal
15 Dr. J.Horvath (Hungary)
16. Sh. LC Sikka
17. Dr. Mukhtar Singh *

* deceased.

Distinguished Fellows

The Association elects distinguished fellows from among its members. So far 22 scientists have been elected as Distinguished Fellows of the Association. They are:

1. Dr. SK Bhattacharyya
2. Dr. KC Dubey
3. Dr. SM Paul Khurana
4. Dr. JT Nankar
5. Dr. ML Pandita
6. Dr. KP Sharma
7. Dr. GS Shekhawat
8. Dr. JP Singh
9. Dr. RA Singh
10. Dr. RP Singh
11. Dr. SC Verma
12. Mr. SS Shivalli
13. Dr. NM Nayar
14. Dr. MS Rana
15. Dr. RC Sharma
16. Dr. KD Verma
17. Dr. PC Gaur
18. Dr. UC Sharma
19. Dr. SNS Srivastava
20. Dr. AK Singh
21. Dr. NP Sukumaran
22. Dr. GS Kang

Awards

The Association has instituted several awards to promote excellence in the field of potato research and development in the country. They are:

1. IPA Medal for the Best Paper published in the Journal of the Indian Potato Association.

2. Best Poster Award.

3. Ramanujam Memorial Award Lecture.

4. Grower of the Year Award.

Publications

1. Journal of Indian Potato Association - Quarterly.

2. Newsletter : Quarterly.

3. Books/ Proceedings.

List of Books/Proceedings

1. Potato in Developing Countries
   Proceedings of International Seminar "Approaches Towards Increasing the Potato Production in Developing Countries" held at Central Potato Research Station, Jalandhar, November 20-23, 1978.

2. Current Facets in Potato Research
   Proceedings of the National Seminar held at Central Potato Research Station, Modipuram, December 13-15, 1989.

3. Strategies for Potato Production, Marketing, Storage and Processing
   Proceedings of the National Symposium held at Indian Agricultural Research Institute (IARI), New Delhi, December 21-23, 1990.

4. Potato : Present and Future
   Proceedings of the National Symposium held at Central Potato Research Station, Modipuram March 1-3, 1993.

Past Presidents

During its journey over 25 years, the Association has been presided over by the following seven distinguished scientists:

The Global Conference on Potato (1999) has been organized to mark the Silver Jubilee celebrations of the Indian Potato Association (IPA) which would be a milestone in the history of the Association.

-BP Singh
Secretary, IPA, CPRI, Shimla

Down the Memory Lane

Dr S Ramanujam, Director and staff of CPRI when HQ was at Patna (26 January, 1956)

Shri AP Jain, Union Minister for Food & Agriculture at the inauguration of CPRI building (15 June, 1957)

Shri AP Jain, Union Minister for Food & Agriculture inspecting the exhibits at CPRI (1957)

Dr Pushkarnath receiving Rafi Ahmad Kidwai Award from Smt Indira Gandhi, Prime Minister of India (1968)

Dr BP Pal, DG, ICAR signing the visitor book at CPRI (1971)

Dr BP Pal, DG, ICAR with Dr Mukhtar Singh Director, during Silver Jubilee of CPRI (1974)

Dr MS Swaminathan, with a team of Achievement Audit Committee at Fagu Farm (1975)

Shri Jagjiwan Ram, Union Minister for Food & Agriculture and Dr. YS Parmar, Chief Minister of HP on a visit to CPRI during July 1976

Dr Ms Swaminathan, DG, ICAR being received at CPRS Jalandhar (1978)

Dr MS Swaminathan, DG, ICAR and Dr HW Howard at the inauguaral function of International Seminar on Potato (November, 1978)

Shri US Kang, Advisor (Agriculture) Planning Commission discussing some point of interest with Shri LC Sikka and Dr SM Paul Khurana (November, 1978)

Dr NS Randhawa DG, ICAR, releasing the CPRI publication (May, 1985)

Shri Vir Bhadra Singh, Chief Minister, HP releasing a special stamp on potato (May, 1985)

Contd.

Year	President	Vice Presidents	Secretary	Joint Secretary	Treasurer	Editor-in-Chief
1991-92	JS Grewal	GS Shekawat UC Sharma GS Kang Jagpal Singh VS Khushwah RK Arora	VK Chandla	MK Dhingra	SR Yadava	SK Bhattacharyya
1993-95	GS Shekhawat	RA Singh UC Sharma GS Kang KD Verma Janardan Jee Gowada P Madappa	SK Pandey	R Chandra	KC Sud	SM Paul Khurana
1996-97	SM Paul Khurana	RC Sharma Kamla Singh JP Singh Jagpal Singh R Sinha KSK Prasad	BP Singh	Shiv Kumar	RK Birhman	GS Shekhawat
1998-99	GS Shekhawat	PC Gaur BK Nehra IP Chaubey Janardan Jee PM Govinda Krishnan	BP Singh	KC Sud	SR Yadava	SM Paul Khurana

About CIP, Lima (Peru)...

Dr H. Zandstra, DG, CIP

The International Potato Center - CIP - was founded in 1971. CIP headquarters are located in the suburb of La Molina, near Lima, Peru in the foothills of the Andes, the birthplace of the potato and of many other valuable root and tuber crops. CIP is one of the 16 international agricultural research centres funded by the CGIAR - the Consultative Group for International Agricultural Research - an informal group of 58 countries, foundations, and regional and international organizations. The center's mandate is focused on reducing poverty and preserving the environment through the sustainable use of potato, sweet potato and nine lesser known Andean root and tuber crops.

The heart of CIP's operation are its germplasm collections, which preserve the vast genetic diversity of the crops under the mandate and serve as a source of characteristics that may be crucial to the crops of tomorrow. CIP's world germplasm collections are maintained in trust under the auspices of FAO. The potato collection is the largest bank of potato germplasm in the world, comprising 1,500 samples of about 100 wild species that have been collected from eight Latin American countries, as well as covers almost 4,000 native Andean and other cultivated potatoes. This valuable genetic reserve provides the raw material for developing new and better potatoes. Material provided by CIP - be it improved clones from its own breeding programs or material provided by others worldwide- has been selected and released by national programs throughout the developing world: a total to date of 225 potato varieties.

In 1987, CIP assumed responsibility for the development of sweet potato, a crop of great potential that has received scant attention from agricultural researchers. More than 95% of the global sweet potato crop is grown in developing countries. Although it is seventh in importance on the list of the world's major food crops, in many producer countries it ranks as high as fifth, i.e., just after potatoes. CIP has also embarked on a program to preserve the genetic resources of nine other Andean root and tuber crops and to improve their viability in the world market. The gene bank holds some 1,000 samples of these crops. Like the world potato and sweet potato collections, these lesser known Andean roots and tubers are maintained in field collections, as botanical seed, and *in vitro*.

The Consortium for the Sustainable Development of the Andean Ecoregion, known by its acronym CONDESAN, was formed by consensus among experts and institutions from five Andean countries - Bolivia, Colombia, Ecuador, Peru and Venezuela - under the sponsorship of IDRC (Canada), SDC (Switzerland) and CIP. One of the most important goals of CIP's work is to reduce the amount of harmful agro-chemicals used to produce crops, particularly potato. More pesticides and fungi-

biochemical indices and variability, ecological flexibility and stability of selections. Gene pool is also screened against potato wart and cyst nematode (pathotype Ro 1).

For the last 10 years, the Belarusian Research Institute for Potato Cultivation is engaged in research concerning the evaluation and release of new potato varieties. The basic parameters for release comprise varietal response to different soils and the level of mineral nutrition, optimal plant stand, technique for planting seed tubers, planting and harvesting time, storage conditions, suitability for processing, reaction to certain stress factors, etc.

Our research efforts have resulted in development of a large number of varieties and resolved many problems concerning potatoes. The problem of potato wart was solved by way of breeding a number of wart immune cultivars which have been distributed almost in all the regions of the former USSR. Cultivar Temp is very popular with the Belarusians (the area is 400 thousand ha), it is noted for its high performance and excellent culinary and consumer qualities, cv. Loshitsky (170 thousand ha) combines high starch and protein contents and is suitable for production of high quality processing products; cvs. Zazersky, Agronomichesky, Belorussky ranny, Ogoniok, Prigozhy 2 and others, contributed much to increasing total production in the Republic. For many decades, the area under Belarusian potato cultivars was more than 80 per cent and in the former USSR, they made up 1/3rd of all the potato area. At present, 13 varieties of Belarusian selection are grown in Russia, while a number of cultivars have been released in the Baltic countries, Ukraine and Uzbekistan.

Annually, the average selection volume makes up 180 - 200 thousand first year seedlings. The intensive screening begins at the initial stages of breeding depending on the trends and the complex of necessary parameters introduced into the cultivar model. For late maturing varieties, we carry out artificial inoculation of seedlings with late blight. The breeding for early maturing varieties is conducted by determining the intensity of foliar/top growth and early tuberization.

The task for releasing early varieties, to ensure commercial production of 15.0 - 20.0 t/ha has been achieved through release of cv. Aksamit, Lazurit, Yavar, Delfin, Orkhideya, Dina, also noted for rather high quality. Cv. Lazurit and Delfin are resistant to drought, cv. Yavar has a long physiological resting period and justifies expenses on mineral fertilizers. Cvs. Aksamit and Orkhideya meet culinary and consumer preferences. Belarusians also use the technique of ecologically distant hybridization. When choosing the parents, preference is given to specific combining ability with careful analysis of the best combinations.

Parallel with the search for donors to combine earliness and late blight resistance characters in a cultivar, release of early and medium-early varieties is important as they are able to give a high yield before the disease appearance. Further, early dehaulming is indispensible. This also helps in reducing the number of applications of fungicides.

In the beginning of the nineties, the Republic was short of medium - early varieties. The problem has been practically solved since 1994 when three cvs. Rosinka, Altar and Scarb were recognized and two cvs. Yakhant and Zhivitsa have been cleared for release by the state. All these cultivars are resistant to potato cyst nematode and meet other requirements of the given variety group.

Breeding for high tuber dry matter and starch content is a primary trend of Belarusian Selection School, founded by the academician PI Alsmik. He considered starch content to be a polygenic

Basic characteristics of Belarusian potato cultivars

Cultivar	Potential of		Physiological resting period of tubers, days	Late blight resistance score		Year of release	Groups of ripeness	Suitability for processing
	Yield (t/ha)	Starch content(%)*		Leaves	Tubers			
Aksamit	58.0	17.2	57	4	3	1994	early	
Lazurit N	58.0	15.7	70	5	5	1998	early	
Delphin N	54.2	15.2	90	6	5	1998	early	
Yavar	68.0	15.5	115	4	5	1994	mid-early	
Dina N	58.6	17.4	60	6	4		mid-early	ipp
Orkhideya N	52.1	21.0	90	5	5		mid-early	
Rosinka N	59.9	19.0	98	7	5	1994	mid-session	ipp, ch
Altair N	67.8	17.6	80	4	4	1996	mid-session	
Skarb N	62.9	17.5	120	6	6	1997	mid-session	
Yakhant N	44.5	21.5	105	5	8		mid-session	ipp, ch, fr.p.
Zhioitsa N	55.8	18.6	101	8	5		mid-session	ipp, ch, fr.p.
Lasunak	55.8	22.0	60	7	5	1988	mid-late	ipp, ch, fr.p.
Veras N	71.8	19.0	90	7	6	1995	mid-late	ch
Verba	56.1	29.0	90	7	6	1981	mid-late	ipp
Garant	47.0	24.5	90	6	8		mid-late	ipp, ch, fr.p.
Belorussky 3N	43.7	21.1	96	8	6	1989	late	ipp, ch, fr.p.
Syntez	40.0	26.5	100	7	9	1995	late	ipp
Vytok	62.0	24.9	80	6	8	1998	late	ipp, ch
Atlant N	47.5	21.8	110	8	8		late	ipp, ch, fr.p.
Orbita	48.0	19.5	70	5	7	1990	late	ipp, ch, fr.p.
Suzorye N	54.6	21.2	110	8	8	1998	late	ipp, ch, fr.p.
Alpinist N	42.0	22.2		8	7		late	ipp, ch, fr.p.

Ipp -instant potato puree, ch - chips, fr.p- freezed potato.
(* this probabaly refers to the total dry matter - editors)

feature with dominant character of inheritance and on this basis the method of cumulative crosses was proposed. As a result of breeding by stages, the level of starch content of 25 - 29% was achieved in the cvs. Verba and Syntez. Later the work was continued with regard to overcoming the negative inter-relation between starch content and large tubers, starch content and late ripening (cvs. Vytok, Garant). The Institute is also engaged in work on raising starch content in groups of early ripening (medium - ripe cv. Yakhant has level of starch of 18 - 21.5% and medium early cv. Orkhideya - 21%). Belarus is planning to go on with work concerning the quality starch characteristics, with high fraction of large grains and higher amilopectin content. This trend is an inseparable part when selecting cultivars for suitable processing. For all this, we solve the tasks of combining high dry matter content with the low rate of accumulation of reducing sugars and nitrates, good morphological tuber characteristics and a several other indices.

The pressing problem of today is the task of releasing the cultivars resistant to cyst nematode that is connected with the sharp increase of potato production on private farms where monoculture predominates as the main disease source. A resistant variety is known to be the most efficient control means from ecological and economic points of view. As a result of purposeful work in 1988, out of 25 released and promising cultivars 13 are resistant to golden nematode, nine cultivars being from this Institute. Out of 16 cultivars which passed the state testing for the period of 1991 - 1997, 14 are resistant to the pathogen. Together with breeding of varieties resistant to common pathotype Belarus uses hybridization in the initial material of cultured varieties and interspecific hybrids resistant to other aggressive nematode pathotypes including that of *G. pallida*.

The basic characteristics of new potato cultivars of Belarusian selection are presented in the table. Seed potato production in the Republic is founded on the application of original technologies for obtaining healthy material with the use of tissue culture, highly effective inhibitors of viruses and synthetic substrates. The Institute is the centre of seed production, more than 80 thousand healthy *in vitro* plants are grown annually and more than one thousand tons of prebasic seed are certified for further multiplication. Nine - year plan of potato seed production is adopted in Belarus. It includes three stages of prebasic, basic and reproductive propagation. Technological research is carried out for type of soil, climate conditions, intensification rate, machine and tractor facilities, etc.

Crop rotation, choice of soils, balanced application of required fertilizers and manure, accurate preparation of seeding material, mechanized planting on optimal dates, plant treatment with herbicides, insecticides and fungicides, timely dehaulming, mechanized harvesting are important elements of perspective technologies.

-SA Bamadysev
Director,
Belarusian Research Institute for Potato Growing (BRIP)

Development of Potato Research in the Czech Republic

The Czech republic had been having the idea to establish a State Potato Research Institute in the Czechoslovakia since 1921. Unfavourable situation for growing potato and its utilization contributed to such a step as well as the expectation that establishment of a research institution would help to improve conditions for potato growing, development of potato industry and better potato utilization in the country. This effort was successful and in 1923 a State Potato Research Institute was founded providing only the basic minimum necessities for research work. The facilities though changed only modestly after 1939, when personnel situation also improved and the Institute/Deptts. were arranged with a purposeful distribution of research, consultancy and control activities.

Organizational structure of State Potato Research Institute and their direction remained status quo from 1938 till 1951, until changes in agricultural research were brought about, leading to separation of farms for agricultural experimentation and the research centres. That year, Research Institute for Potato Agronomy and Breeding was founded in Havlickuv Brodo with State Research Agricultural Station in Valecov, which is the oldest for research in breeding and extension services in the Czech Republic (this station was founded 136 years ago). The whole series of various organizational changes followed, which brought about significant changes in the structure of the Institute, its staff, research and breeding programmes.

Despite the most important influencing changes, work of the Institute, after separation of research and breeding functions, interventions did not lead to real separation of research and breeding work and a certain degree of co-operation and mutual linkage, was always maintained. This fact is also true at present though potato research has been independent since 1990 and conducted solely by the Potato Research Institute. However, breeding is centralized in four completely independent joint-stock companies.

In the past, the main activities of the Institute included scientific research covering nearly all the problems of potato growing. As regard research work, there was self-evident co-operation with all the national and foreign institutions. A part of this was to provide comprehensive consultancy for potato growers and processors.

After social reforms in the Czechoslovakia since 1989 and foundation of the Czech Republic, certain modifications have also been brought about in research programmes.

The present Potato Research Institute continues to work as previously in the sections of genetics and breeding, physiology, tissue culture, chemistry and quality, virology, agrotechnology and nutrition, and plant protection. Scientific research work includes almost the whole range of agronomic problems, except mechanization, which is provided by another institute in the Czech Republic. Planning of research work depends upon the practical needs of potato cropping. It is supported by the Ministry of Agriculture of the Czech Republic or by Czech or foreign funding organizations. An intensified information and consultancy system has been developed.

Most important activities include development of parental lines for breeding for resistance to pathogen at diploid and tetraploid level, collection and study of potato germplasm. Further, the research focuses on physiological problems of production, tuber quality, maximization of yield and tissue culture, virus diseases, their laboratory diagnosis for seed certification and quarantine. It is also the authorized agency for evaluation of pesticides in potatoes. Agronomic research is particularly focused for technology of growing autumn and spring crops, tillage, inter-row spacings, balanced organic-mineral fertilization, nutrient utilization, etc. The inseparable part of our activity is research on developing schedules for integrated disease and pest management, including weed control.

The Institute's work involves other activities based on needs of the industry or growers, users for research results. The international co-operation is gradually developing on novel and rational basis. Research laboratories of the Institute are interested in the development of co-operation in any of the above mentioned fields. At present, we are collaborating with research laboratories in Peru, Federal Republic of Germany, Poland, Slovakia, Slovenia, France, the U.S.A., Canada, Holland, Spain, Great Britain, Estonia, etc.

–Bohumil Vokal
Potato Research Institute,
Dobrovskeho 2366, 580 01 Havlickuv Brod,
Czech Republic

About Danish Institute of Agricultural Sciences...

It was established on April 1, 1997 with the merging of the Danish Institute of Animal Science and the Danish Institute of Plant and Soil Science. DIAS is one of the largest research institutions in Denmark integrating animal husbandry, plant production and technical research. The Institute embraces a broad range of agricultural areas, and to apply both discipline and holistic approaches within these areas. DIAS aims to conduct research and accumulate knowledge of importance to agriculture. Emphasis is on responsible resource utilization, environmental impacts both internal and external, animal welfare, and the quality and competitiveness of the products.

With the establishment of DIAS and its organizational structure, emphasis is on promoting holistic and interdisciplinary activities. This provides the Institute with an opportunity to initiate and participate in research which involves different scientific areas, disciplines, issues and research forms. The aim is to encourage innovation and new ways of thinking in research which, in turn, foster greater development in agriculture and related industries. The DIAS is committed to the development of sustainable production systems which secure environment, welfare and landscape, and offer increased productivity and earning capacity for agriculture and related industries.

At present, the total area under potatoes is ca.40,000 ha, which is approximately 2% of the arable land in Denmark. Of this, about 6,000, 10,000 and 23,000 ha are used for growing seed, table and starch potatoes respectively. For all this, the research support comes from the DIAS. However, within the last few years, DIAS has undergone a drastic reorganization and the former Dept of Forage Crops and Potatoes has been reduced to be merged with Dept of Crop Physiology and Soil Science. The research on potato mainly focuses on seed potato production, potatoes for starch and table purposes as well as with special reference to quality of organically grown potatoes. The potato program and facilities are listed here.

Research facilities

- Facilities and equipment for potato field trials, 35 ha.
- Grading and storage facilities for potatoes.

Research Centre, Foulum

- Central Laboratory for standard and routine analyses.
- Research laboratory at the department of –

  * Biotechnology: DNA markers
  * Biochemistry: Starch quality parameters, polyphenolics, enzyme activity
  * Biophysics: Viscosity, colorimetry, impact energy absorption
  * Microscopy: Image analysis.

- strengthening of both basic and applied research at Cornell, Eastern Europe and Mexico;
- implementation of a few carefully throughout projects which will serve as a demonstration model for effective late blight control;
- establishment of an international advisory committee which promotes late blight research worldwide;
- promoting the participation of the private sector for late blight management and technology transfer between the private and public sectors; and
- adoption of improved management strategies to combat late blight and thereby increase potato productivity-particularly for poor farmers.

Collaborators

The project recognizes the enormity of the late blight problem and realizes that successful achievement of the goal requires efforts from institutions and scientists worldwide. CEEM works in partnership with many institutions. A few major ones are the International Cooperative Project on Potato Late Blight Research (PICTIPAPA), and the National Potato Program in Toluca, Mexico; the Mlochow Research Center, Plant Breeding and Acclimatization Institute (IHAR),Poland; the N.I. Vavilov All-Russian Research Institute of Plant Industry (VIR) and the Moscow State University in Russia; and the Global Initiative on Late Blight (GILB), International Potato Center, Lima, Peru.

About AGRICO QUALITY Pvt Ltd...

AGRICO QUALITY Pvt Ltd is a company registered in India jointly controlled by M/s Agrico Project BV, Netherlands and M/s Quality Tea Plantations Pvt Ltd, of Calcutta. This joint venture company has its registered office in Calcutta. The Board of Directors of the Company comprise:

1. Mr Bal Krishna Dalmia. 2. Mr Kees Van Arendonk. 3. Mr Frans Holstein. 4. Mr Rajat Dalmia 5. Mr P Murari

Agrico Quality Pvt Ltd has entered into an MOU with ICAR and CPRI, Shimla for carrying out its programme in India. Every year working business plan would be made by both the parties to undertake collaborative work on.

i) promotion of export of seed potatoes of Indian varieties to the third world countries;
ii) production of high quality certified seed of Indian commercial varieties for export and domestic market;
iii) assessment of selected Dutch potato varieties of proven merit (possessing resistance to late blight, low rate of degeneration due to viruses, regular round/oval/oblong tubers with fleet eyes, early bulking i.e. ready for harvest in 90-100 days, capable of producing high drymatter and low reducing sugars under sub-tropical climate) for higher yields and processing quality in India;
iv) rapid multiplication of superior Dutch varieties, identified through results of trials conducted by CPRI and Agrico Quality Pvt Ltd for introduction into India; and
v) production of quality seed of Dutch varieties of proven merit for domestic use and for export.

R&D programme will be managed by the agriculturists from Agrico Quality Pvt Ltd with the assistance of CPRI. The programme would collect research data with the objective of helping the Indian farmers to continually improve upon potato quality and marketable yield. The results of the research will be communicated, free of charge, to the farmers procuring seeds from Agrico Quality Private Limited.

Seed Multiplication and Contract Farming

Seed Multiplication Programme

The availability of potato seed to the farmers in India is scanty. The breeders' seed (BS) is distributed to various state seed producing organisations and National Seeds Corporation for production of Foundation and Certified seeds (CS) for sale to the farmers.

The output of potatoes accounted for 1.8% of total agricultural output from 0.6% area as compared to rice which accounted for 23% of output from 28.8% of area. This fact will encourage the farmers and policy makers in India for more potato cultivation to increase food output.

Apart from CPRI and some other state level organisations, potato seed multiplication in India is not being done in an organised and scientific manner which in turn is resulting in low productivity.

The farmer is forced to multiply his home grown potato seed, in absence of quality seed, having low productivity. It is, therefore, appropriate to have potato seed production in private sector to ensure availability of quality seed to the farmers. The farmers look forward for seed of varieties which can give high yields and have tolerance/resistance to disease and pest thereby giving better returns.

Contract Farming

Agrico Quality Private Limited intends to work closely with the farming community in selected potato growing areas of Uttar Pradesh, Himachal Pradesh, Punjab and West Bengal for multiplication of seed potato. The company shall undertake sustained efforts to educate farmers and where necessary, in addition to providing basic seeds, will also provide fertilisers, pesticides and fungicides at competitive prices. The crops will be monitored by employee agriculturist through every stage of its growth for high productivity and quality.

Agrico Quality Pvt Ltd is really enthusiastic about the Indian farm sector. India being basically an agriculture based country, there is a lot of potential for the improvement and growth.

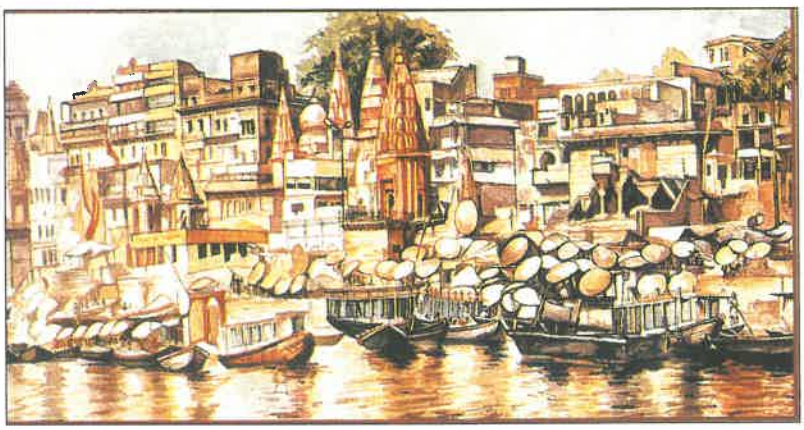
Agrico Quality Pvt Ltd intends to enter into pre-planting agreement with farmers for purchase of 100% of the seed produced at agreed prices. At the same time, the company shall make every effort to ensure that in due course of time the seed multiplication and supply system can be owned and managed by Indian farmers.

-AGRICO QUALITY PRIVATE LIMITED
502, Mangalam-'A'
24, Hemanta Basu Sarani
Calcutta - 700 001, India
Ph.No. 91-33-220-8274
220-4272
220-8994
Fax No: 91-33-243-0165

India : A Rainbow of Diversities

India is one of the oldest civilisations with a kaleidoscopic variety and rich cultural heritage. The country or sub-continent has over a million square km of scenic sights; the world's highest mountains, most awesome rivers and most fabulous valleys. Even the natural disasters, which afflict her, are on an epic. More than five thousand years of continuous civilisations - some of the most sophisticated of their epoch- have left us legacy of temples, monuments, palaces and sculptural masterpieces of inimitable aesthetic grandeur. India is an ancient land whose people have developed over the centuries a great number of customs and traditions that greatly affect their attitudes and relationships. The country's immense population, accounting for a sixth of mankind and increasing by nearly a million every three weeks, makes it the largest democracy on earth and the biggest free society in human history. The country is the sweet home of 16 per cent of world's population. The second largest populous country. India, however, accounts for only 2.42 per cent of the total world area.

With a wide range of climatic conditions from the torrid to the arctic, India has rich and varied vegetation, which only a few countries of comparable size possess. The Himalayas comprise three almost parallel ranges interspersed with large plateaus and valleys. Some of which, like the Kashmir and Kullu valleys, are fertile, extensive and of great scenic beauty. Some of the highest peaks in the world are found in these ranges. The high altitude limit travel only to a few passes, notably the Jelep La and Nathu La on the main Indo-Tibet trade route through the Chumli Valley, North-East of Darjeeling and Shipki La in the Satluj Valley North-East of Kalpa (Kinnaur). The Himalayan mountain belt to the North and the Naga-Lushai mountain in the East, are the region of mountain-building movement. Most of this area, now presenting some of the most magnificent mountain scenery in the world, was under sea some 60 crore years ago. In a series of mountain building movements commencing about seven crore years ago, the sediments and the basement rocks rose to great heights. The weathering and erosive agencies worked on those to produce the relief seen today. The Indo-Ganga plains are a great alluvial tract that separates the Himalayas in the North from the Peninsula in the South.



Kashi : Bathing Ghats

The plains of the Ganga and the Indus, about 2,400 km long and 240 to 320 km broad, are formed by basins of three distinct river systems-the Indus, the Ganga and the Brahamputra. These are one of the world's greatest stretches of flat alluvium and also one of the most densely populated areas on

the earth. The great desert and the little desert are the two parts of desert region. The great desert extends from the edge of the Runn of Kachch beyond the Luni river northward. The little desert extends from the Luni between Jaisalmer and Jodhpur upto the northern wastes. Between the great and the little deserts lies a zone of absolutely sterile country, consisting of rocky land cut up by limestone ridges. The peninsular plateau is marked off from the plains of the Ganga and the Indus by a mass of mountain and hill ranges varying from 460 to 1,220 metres in height. Prominent among these are Aravalli, Vindhya, Satpura, Maikala and Ajanta.

Republic day celebrations

The National Flag is horizontal tri-colour of deep saffron at the top, white in the middle and dark green at bottom in equal proportion. In the centre of white band is a wheel of navy blue which represents the charkha. Its design is that of the wheel which appears on the abacus of Sarnath Lion at Sarnath. It has 24 spokes. The design of the National Flag was adopted by the Constituent Assembly of India on July 22, 1947.

In the State Emblem adopted by Government only three lions are visible, the fourth being hidden from view. The wheel appears in relief in the centre of abacus with a bull on the right and a horse on the left and the outlines of the other wheels on the extreme right and left. The bell-shaped lotus has been ommitted. The words, *Satyameva Jayate* from the *Mundaka Upanishad* meaning Truth alone triumphs', are inscribed below the abacus in *Devnagari* script.

The Himalayan region extending from Kashmir to Arunachal Pradesh through Nepal, Sikkim, Bhutan, Meghalaya and Nagaland and the Deccan Peninsula is rich in endemic flora, with a large number of plants, which are not found elsewhere. Currently available data place India in the tenth position in the world and fourth in Asia in plant diversity. The vascular flora, which forms the conspicuous vegetation cover, comprises 15,000 species, of these more than 5000 are endemic and have so far not been reported anywhere in the world. The total plant wealth of the country includes not only the useful large flowered plants including flowering shrubs, but also a large number of non-flowering plants like ferns, liverworts, algae and fungi.

National Anthem

Nobel Prize winner, Guru Rabindranath Tagore's song Jana-gana-mana was adopted by the Constituent Assembly as the National Anthem of India Jan 24, 1950. The first stanza out of five stanzas of the song forms the National Anthem. It reads:

Jana-gana-mana-adhinayaka jaya he
Bharat-bhagya-vidhata
Punjaba-Sindhu-Gujrat-Maratha-Dravida-Utkala-Banga
Vindhya-Himachala-Yamuna-Ganga
Uchchhala-jaldhi-taranga
Tava subhname jage, Tava subha asis mange,
Gahe tava jaya-gatha.
Jana-gana-mangala-dayaka, jaya he
Bharat-bhagya-vidhata
Jaya he, jaya he, jaya he,
Jaya jaya jaya, jaya he.

English rendering of the stanza:
Thou art the ruler of the minds of all people,
Dispenser of India's destiny.
Thy name rouses the hearts of the Punjab,
Sind, Gujrat and Maratha,
Of the Dravid and Orissa and Bengal.
It echoes in the hills of the Vindhyas and Himalayas,
Mingles in the music of the Jamuna and the Ganges
And is chanted by the waves of the Indian Sea.
They pray for the blessings and sing thy praise.
The saving of all people waits in thy hand.
Thou dispenser of India's destiny,
Victory, victory, victory to thee.

The climate of India may be broadly described as tropical monsoon type. There are four seasons, winter from January to February, hot weather summer from March to May, rainy south-western monsoon from June to September, post-monsoon also known as north-east monsoon in the southern Peninsula from October to December.

India has great variety of fauna numbering 81,251 species. Of these, insects constitute about 60,000, molluscs a little over 5,000, mammals 372, birds 1,228, reptiles 446, amphibians 204, and fishes 2,546. The mammals include the majestic elephant, the guar of Indian bison- the largest of existing bovines, the great Indian rhinoceros, the gigantic wild sheep of the Himalayas, the swamp deer, the thamin deer, nilgai, the four-horned antelope, the Indian antelope or black-buck - the only representatives of these genera. Among the cats, the tiger and lion are the most magnificent of all; other splendid creatures such as the clouded leopard, the snow leopard, the marbled cat, etc. are also found. Many other species of mammals are remarkable for their beauty, colouring, grace and uniqueness. The great Himalayan range has a very interesting variety of faunas that includes the wild sheep and goats, markhor, ibex, shrew and tapir. The panda and the snow leopard are found in the upper reaches of the mountains. Several birds, like pheasants, geese, ducks, mynahs, parakeets,

National Animal and Bird

The magnificent tiger, *Panthera tigris* (Linnaeus), is a striped animal having yellow coat of fur with dark stripes. Out of eight races of the species known, the Indian race, the Royal Bengal Tiger, is found throughout the country except in the North-western region and also in the neighbouring countries, Nepal, Bhutan and Bangladesh. The combination of grace, strength, agility and enormous power has earned the tiger its pride of place as the national animal of India.

The Indian peacock, *Pavo cristatus* (Linnaeus), the national bird of India, is a colourful, swan-sized bird, with a fan-shaped crest of feathers, a white patch under the eye and a long, slender neck. The male of the species is more colourful than the female, with a glistening blue breast and neck and a spectacular bronze-green train of around 200 elongated feathers. The elaborate courtship dance of the male, fanning out the tail and preening its feathers is a gorgeous sight. The peacock is wildely found in the Indian sub-continent from the south and east of the Indus river, Jammu and Kashmir, and east Assam, south Mizoram and the whole of the Indian Peninsula. The peacock enjoys protection from the people, as it is never molested for religious and sentimental reasons.

Taste of India

Indian cooking-especially the vegetarian type - is delicious, easily digestible and wholesome - if taken in moderation. Breads are more of a staple than rice in the north, but both are served. Indian 'breads' can be cooked on griddle, in the oven or fried in deep fat, they are often served piping hot and are really very good. The most popular seems to be the ubiquitous chapati which is also known as roti or phulka. Basically the chappati is just a flour and water dough rolled thin and cooked as a pancake, the result tastes like the Mexican tortilla. A richer variation is the parantha which uses butter or other fat. Paranthas are grilled or roasted and served plain or stuffed with potatoes or other vegetables. Pooris are the same basic dough, with or without butter, which are deep fried. Another variation on the deep fried and stuffed theme is called kachouri and the long kind of oval shaped is made in the oven and is called nan. The omnipresent chappati is the common man's fare, but nan is regarded as the ideal complement to all tandoori or bar-be-cue preparation.

Delhi cooking is the most succulent in India. It owes a great deal to the Moghuls and reflects their love of the good life, therefore, the popular name Mughalai food. The streets of Delhi are famous as a nice eating place and some of them are also named like, Paranthewali Gali, Jalebiwali Gali, etc. Eating with fingers with dexterity is quite fun but it is not possible to avoid using fingers when someone eats jalebi or golguppa.

South Indians hold the record for rice consumption and it is in the South that the curry is to be regarded with respect - it isn't as rich as the northern kind but makes up for it in hotness. Vegetable dishes are samber and pachadi and the main dessert is the milk pudding paysaam. Masala dosa is the name of delicious wafer-crisp pancake.

In Mumbai, previously known as Bombay, food is quite different from that of the rest of India, probably, because of presence of the small but in influential communities like, Parsees, Goans, Gujratis, Maharashtrians, etc. Paobhaji, bhelpuri and coconut water are common features at Chaupati and Juhu beach in Mumbai.

A rice cum soupy curry, usually of vegetable and fish, called machchher jhol is the most favourite dishe in East India, or West Bengal. About the most spectacular eastern dish is malai curry made of prawns and coconut. Desserts too are more simple running the gamut from milk to milksweetened yogurt or mishti dhoi and various milk sweets with a country-wide reputation like rasgullah, gulabjamun, rasmalai, sondesh, kalakand, etc.

There are about fifty commonly used spices and a number used more rarely. Most of these spices also have distinct medicinial uses. They not only give an added fillip to the food but give the cook a chance to use some imagination and show off his skills. There is a large variety of vegetables, some of them are quite tasteless in their natural state and are only rendered palatable through intelligent preparation and by addition of judicious use of spices.

A feature of gracious living in India is the serving of *pan* or sweetned saunf after a meal. *Pan* is a betel leaf with lime and katha paste stuffed with grated betel nuts, aniseed and cardamom - and the idea is to give the mouth a clean taste after a rich meal.

pigeons, cranes, hornbills and sunbirds, inhabit forests and wet lands. Rivers and lakes harbour crocodiles and gharials, the latter being the only representative of crocodilian order in the world.

There are presently 84 national parks and 447 wildlife sanctuaries covering about 1.5 lakh square km area that is nearly 4.5 per cent of the total geographical area of the country. Much of the wild life of India's sanctuaries is peculiar to the sub-continent, and is not found in other parts of the world. India's wild life sanctuaries and national parks welcome visitors and offer them the chance to see a large variety of wild animals and birds in beautiful and diverse surroundings.

India is rich in natural resources and manpower. These resources have, however, not been exploited fully and are capable of greater utilisation. Indian economy is still predominantly agricultural. Agriculture has acquired a remarkable resilience in the last decade. About one-third of the national income is derived from agriculture and allied activities employing more than 660 million work force. India is endowed with the largest livestock population in the world. It accounts for 55 per cent of the world's buffalo population, and 16 per cent of the cattle population. India has a long and distinguished tradition in science from the accomplishments of ancient times to great achievements during this century; the latter half prior to independence has been related largely to pure research.

A range of industries from small to the most sophisticated has been established covering a wide range of utilities, services and goods. There is now a reservoir of expertise well acquainted with the most modern advance in basic and applied areas that is equipped to make choices between available technologies to absorb readily new technologies and provide a framework for future national development.

In India, cropping pattern is more diversified and cultivation of commercial crops has received a new impetus in line with domestic demands and export requirements. The agriculture sector accounts for about 18 per cent share of the total value of the country's exports. India ranks fourth in the world after USA, the erstwhile USSR and China in terms of gross fertilizer consumption. The country has the largest area in the world under pulse crops while in the field of cotton, India is the first to evolve a cotton hybrid. India has surpassed the USA in wheat production and has ranked second position in wheat production after China without increase in the area. There has been increase in area and production of horticulture crops over the years. India has already achieved the first position in fruit production in the world, and vegetable production, India's position is second in the world. As a result of indigenous potato varieties and production technologies, India ranks fourth in production and third in area.

A bewildering variety of races, religions, cultures, languages and customs was produced by this uninterrupted historic process. And yet all these have somehow produced a unity of cultural traditions and modern nation. India, one of the world's great spiritual sanctuaries, holds religious festivals all the year. India's strongest attraction lies in an unmatched interplay of contrasts. Nowhere do the past and present coexist in more colourful promiscuity, folklore, native arts, etc.

Music and Dance

In music and dance, India can legitimately be proud of her past, a tradition dating back to the days of Vedas. The basic character of Indian music is its melody. There are two systems of music

in India, the Carnatic and the Hindustani. Indian music has got the most complicated variety of *taal* (rhythmic cycles) structures in the world.

The flute, *nadaswaram*, *veena*, *gotuvadhyam*, *thavil*, *mridangam*, and the plain drum are some of the ancient instruments of music of India. The *sitar* and the *tabla* were late comers. The *sitar* appears to have infiltrated from Persia and has assumed great popularity. Except the *veena* which is neatly fretted, all instruments are negotiated by the method of trial and error. The violin, a totally western instrument has also been Indianised and become popular.

Kathak dance

Among the various dance forms in vogue in India are *Bharatnatayam*, *Chakiarkoothy*, *Kathak*, *Kathakali*, *Krishananattam*, *Kuchipudi*, *Manipuri*, *Odissi*, etc. Besides, there are umpteen numbers of folkdances peculiar to various regions and sub-cultures. Folkdances of India vary according to the region and have no specific grammar. They fit in with the scheme of festivals in each region.

–Anil K Sharma and
SM Paul Khurana
Central Potato Research Institute, Shimla (HP)

Beautiful India

The Golden Triangle

This is the beginning of the exciting Indian trail, it is here, in this Golden Triangle, that the seekers of India begin their voyage of discovery. Within this, is cradled the essence of India–Delhi, a rich tapestry of contrasts that is the theme of this complex land, Agra, the Zenith of art and an enshrined romance and Jaipur, exuberant with colour.

Delhi

Qutab Minar, Delhi

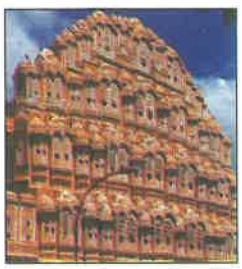
Around the capital city of Delhi are the remains of seven earlier cities that go back three thousand years. Ancient ruins in their landscaped gardens, imposing fortresses, palaces and onion-domed mosques merge harmoniously into the modern city, making it an exciting travel experience. **Places of interest**: Qutub Minar, Red Fort, Jama Masjid, Purana Quila, Himayun's Tomb, Jantar Mantar, India Gate, Rashtrapati Bhawan, Parliament House, National Museum, Lakshmi Narayan Temple, Rajghat, Teen Murti House. **Access:** Delhi is connected by air to all the major cities of the world. Linked by air, road and rail to most major Indian locations.

Agra

Taj Mahal

Agra was once the capital of the Mughal emperors. The passion of building has endowed it with some of the loveliest buildings in the world. **Places of interest**: Taj Mahal, Agra Fort, Fatehpur Sikri, Sikandra, Itmad-ud-Daula's Tomb. **Access**: Daily flights connect it to Delhi, Khajuraho and Varanasi. Well-linked by rail and road.

Jaipur



Hawa Mahal

Located at the edge of the Great Indian Desert, Jaipur is the gateway to the Rajasthan, the land of the Rajputs, of chivalry and martial traditions. It is an unselfconsciously medieval city, with stately palaces, colourful bazaars and a fort brooding over the city. Graceful women in swirling skirts and veils of red, yellow, orange and magenta, laden with silver jewellery, straight tall men in turbans and lurching carts drawn by camels, do nothing to dispel the illusion. **Places of interest**: Jantar Mantar, Hawa Mahal, City Palace, and Amber Fort. **Access**: Jaipur is connected by air, road and rail to Delhi, Agra and Mumbai.

Romance of the Desert

The romantic desert state of Rajasthan with its legends of chivalry and valour is one of its most

exciting destinations in India-splendid desert forts, beautiful lake palaces and temples transport the visitor back to the valiant times of the royal Rajputs. It is an invigorating, colourful land where the vivacity of its people, the colour of their costumes and crafts, and the exuberance of their celebrations add an extra dimension to a holiday.

Jodhpur

Located on the edge of the Thar Desert, Jodhpur, founded in 1459 by Rao Jodha, was once the capital of powerful state of Marwar. It is still a marvellous medieval city. **Places of interest:** Mehrangarh Fort, Jaswant Thada, Umaid Bhawan Palace. **Access:** Connected by air to Delhi, Jaipur and Mumbai. Linked by rail to Delhi and Ahmedabad.

Jaisalmer

An exotic little desert town that was once on the caravan route into central Asia–Jaisalmer is a golden city, for the entire town, its fort, its magnificent mansions and markets are all built out of the rich, golden sandstone typical of the area. **Places of interest:** The Fort, Havelis, Garisar Tank, Sam, Lodurva. **Access:** The nearest airport is Jodhpur (290 km). Jaisalmer is linked by rail and road to Jodhpur, Bikaner, Jaipur and to other major towns.

Bikaner

Another picturesque desert town, founded in 1488 by Rao Bikaji, Bikaner was an important link on the ancient trade route. **Places of interest:** Junagarh Fort, Lalgarh Palace and the Ganga Golden Jubilee Museum. **Access:** The nearest airport is Jodhpur (245 km). Linked by rail to Jodhpur and Delhi and connected by road to Delhi (460 km), Jaipur (330 km), Jaisalmer (320 km).

Resplendent Rajasthan

The royal city of Udaipur, once the powerful capital of the kingdom of Mewar, is the base for another interesting circuit in Rajasthan. This area, geographically different from the rest of Rajasthan, is hilly and wooded. Udaipur, Chittaurgarh and Mt. Abu complete a splendid travel experience.

Udaipur

Udaipur with its three beautiful lakes and fairy tale palaces is perhaps the loveliest city in a state that has some of the most exotic locations in India. **Places of interest:** Pichola Lake, Jag Nivas, Jag mandir, City Palace and Museum, Lake Fateh Sagar, Jagdish Temple, Pratap Smarak, Bharatiya Lok Kala Mandal Museum, Ahar. Around Udaipur: Eklingji (21 km), Nathdwara (48 km), Kumbhalgarh Fort (84 km), Ranakpur (90 km). **Access:** Daily air services connect Udaipur with Jodhpur, Jaipur, Aurangabad, Mumbai and Delhi. Connected by rail to Delhi, Jaipur and other important towns in the area. Well connected by road.

Mount Abu

Located on a plateau 1200m above sea level, Mount Abu is the only hill station in Rajasthan. A pleasant wooded retreat with a little lake, Mount Abu is also known for its beautiful Jain temples. **Places of interest:** Dilwara Temples, Guru Shikhar, Nakki Lake, Adhar Devi Temple. **Access:** The nearest airport is Udaipur (185 km). The nearest railhead is Abu Road. Taxis and buses ply from Abu road to Mount Abu. Linked by road to all the major towns in the region.

Himalayan Magic

There is a fairy tale quality about the mountain state of Himachal Pradesh with its beautiful valleys and the mysterious snow-clad Himalayan Peaks. The lower valleys of Kullu, Chamba and Kangra are green. In marked contrast is the stark splendour of the Lahaul and Spiti valleys. For the visitor, there are marvellous opportunities for mountaineering, trekking and fishing.

Shimla

Shimla, the capital of Himachal Pradesh, spills over the steep slopes of a 12 km ridge in the lower Himalayas. Once the glamorous capital of British India, Shimla is still an attractive summer and winter destination. **Places of interest:** The Mall, The Old Viceregal Lodge, Museum, Jakhu Temple, The Glen, Summer Hill, Prospect Hill, Tara Devi and Sankat Mochan, Mashobra, Kufri, Naldehra, Fagu. **Access:** The nearest airport is Jubbarhati (23 km). Shimla is well connected by rail. Kalka in the foothills is connected to Dehli and Chandigarh. A charming hill train connects Kalka to Shimla. Good bus services link Shimla to major towns in the area.

Kullu

The charming Kullu valley is known as the valley of the Gods. During its colourful Dussehra Festival, decorated palanquins convey gods and goddesses from temples all over the valley to Kullu, to pay homage to the reigning deity Raghunathji. **Places of interest:** Raison, Bijli Mahadev Temple, Manikaran, Katrain, Naggar. **Access:** The nearest airport is Bhuntar (10 km). Kullu is well connected by road to Chandigarh, Shimla and Delhi.

Manali

Situated at the northern end of Kullu valley Manali has spectacular views of snow-capped peaks and wooded slopes. Manali, with its Mountaineering Institute, is the popular base for trekking and mountaineering in summer and skiing in winter. **Places of interest:** Hadimba Devi Temple, Vashist Springs, Jagatsukh, Rohtang Pass. **Access:**The nearest airport is Bhuntar (50 km). The nearest rail head is Chandigarh. Manali is well connected by road.

Maiden of the Mist

The state of Jammu & Kashmir encompasses varying geographical features and people. Jammu region in the foothills of the Himalayas, the home of the rugged Dogras, the beautiful valleys of Kashmir in the northern part of the state, noted for its beautiful scenery and exquisite handicrafts and the stark Ladakh Plateau, distinct parts of the state predominantly Buddhist, with its splendid monasteries are there.

Jammu

In the gentle foothills of the Himalayas is the town of Jammu- once the capital of a royal principality, now the winter capital of the state of Jammu & Kashmir. It is the entry point to this beautiful state and the base for a pilgrimage to the famous temple of Vaishno Devi and to the other little shrines that dot this area. **Places of interest:** Raghunath Temple, Ranbireshwar Temple, Bahu Fort, Amar Mahal Palace, Dogra Art Gallery, Vaishno Devi Temple. **Access:** Jammu is linked directly by air to Srinagar (293 km), Delhi (586 km), Chandigarh (363 km) and Amritsar, connected by rail and road to all parts of the country.

Srinagar

The city of lakes, Srinagar nestles in the heart of one of the loveliest areas of the country, the beautiful Kashmir Valley. The Jhelum River and the Dal Lake–a series of interconnected lakes and waterways make Srinagar a visual delight. Splendid formal gardens laid out by the Mughal Emperors for their enjoyment, are beautifully maintained. Houseboats on the lake are an exciting alternative to the more traditional hotels. Srinagar is also a take-off point for some of Kashmir's hill stations and a base for variety of activities that range from trekking and mountaineering to fishing, golf and skiing. **Places of interest:** The Dal Lake, Shalimar Bagh, Nishat Bagh and Chasma Shahi, Pather Masjid, Hazratbal Mosque, Temple of Shankaracharya, Hari Parbat Fort. **Access:** Srinagar is linked by air to Delhi (876 km), Jammu, Chandigarh, Amritsar and Mumbai. Jammu is the nearest rail head(293 km). It is connected by road to Jammu, Leh (434 km), Kargil (204 km), Gulmarg (52 km), Pahalgam (96 km) and to all parts of the state.

Kashmir Valley, Srinagar

Pahalgam

Just 96 km from Srinagar, located on the beautiful River Lidder is Pahalgam. Surrounded by hill slopes covered with groves of pine, with the snow- capped peaks providing a scenic backdrop, Pahalgam is an ideal base for treks into the interiors. **Places of interest:** Amarnath, Chandanwari, Sheshnag, Panchtarni, Kolahoi Glacier, Phirilasan, Tarsar Lake, Marsar Lake, Tulian Lake. **Access:** Pahalgam is linked by road to Srinagar and Jammu.

Gulmarg

With pretty views and green undulating country, Gulmarg is a popular skiing resort and a good base for treks. A fine golf course- the highest in the country (2730m) is an added attraction. **Places of interest:** Alpather Lake, Khilanmarg. **Access:** Linked by road to Srinagar.

Leh

Ladakh, the northern-most district of Kashmir, in the rain shadow of the Himalayan ranges is distinctly different- a vast cold desert, where the snow-fed streams provide the main source of water for habitation and cultivation. Leh, its capital, once a major link on the " Silk Route" is located in a fertile valley that has several spectacular Buddhist monasteries. **Places of interst:** Alchi Gompa, Hemis Gompa, Thikse Monastery, Shey Palace, Leh Palace, Stok Palace.

Kargil

A major town in Ladakh, Kargil is located on the Srinagar- Leh route. It is an ideal base for an exploration of the remote Zanskar region. **Access:** Leh is connected by air and road to Srinagar. It is also linked by road to Manali in Himachal Pradesh.

A Punjab Panorama

The land of five rivers, Punjab, the centre of the Sikh faith, is known for its agricultural wealth and its rugged, handsome people. Amritsar, the holy city of the Sikhs, the royal cities of Patiala and

Kapurthala and other little places of piligrimage all set amidst the lush fields of wheat and mustard, make an attractive circuit, not far from Delhi.

Amritsar

Amritsar, the "pool of nectar"- is named after the sacred tank near the holiest of Sikh shrines, the Golden Temple - founded in 1577 by the fourth Sikh Guru, Ram Das. **Places of interest:** Durgiana Mandir, Jalianwala Bagh, Ram Bagh, Goindwal Sahib, Hari-ke-Pattan. **Access:** Air-linked to Delhi and Chandigarh. Connected by rail and road to the major centres in this area.

Mountain Vistas and Views

Uttar Pradesh has a large stretch of the Himalayan ranges along its northern edge- the Kumaon and Garhwal Hills- a kaleidoscope of green forested hills, tall ranges with their dusting of snow, meadows carpeted with flowers, ancient glaciers and clear lakes. These hills, noted for their scenic hill stations and various places of piligrimage are also ideal for a host of adventure activities like trekking, mountaineering, rock climbing, white water rafting and even skiing.

Mussoorie

A popular hill station at a height of 2000m, Mussoorie is just 22 km from Dehra Dun. Located on a horseshoe shaped ridge, it has a view of the plains on the one hand and the magnificent Himalayan ranges on the other. **Places of interest:** The Mall, Camels Back Road, Gun Hill, Lal Tibba, Jharipani Falls and Kempty Falls. There are also interesting treks to Dewalsari and Nag Tibba. **Access:** The nearest airport and rail head are Dehra Dun. Well linked by road.

Nainital

A beautiful lake is at the centre of the scenic hill town of Nainital. Interesting walking trails through the green canopy of pine or with views of the Hiamalayan Mountainscape make Nainital an ideal summer retreat and a good base for treks and rock climbing. **Places of interst:** The Naini Lake, the State Astronomical Observatory, the Hanumangarh Temple. Around Nainital: Sanjay Park, Cheel Chakkar, Tiffin Top. Vantage points close to Nainital offering spectacular views are Birla Mandir Peak, Snow View, Alma Peak, Naina Peak, Camels Back and Handi Bhandi. Beautiful lakes in the vicinity include: Sat Tal (25 km), Bhimtal (23 km) and Naukuchiatal (27 km). Mukteshwar (52 km) is a pretty retreat overlooking the Himalayan peaks and Ramgarh (26 km) is noted for its orchards. **Access:** Well connected by road to Delhi (322 km), Lucknow (401 km), Almora (66 km), Ranikhet (60 km). Luxury buses and tourist coaches ply from most major towns. The nearest rail head is at Kathgodam (35km), connected to Lucknow, Agra and Bareilly.

Almora

This beautiful little town has a collection of exquisite temples and is also noted for its colourful fairs and festivals. An excellent base for treks. **Places of interst:** Interesting trips and treks and possible through this scenic area to Katarmal (17km), Binsar (30 km), Gananath (47 km) and Jogeshwar (34km). **Access:** The nearest airport is Pantnagar (127 km). The nearest rail head is Kathgodam (90 km). Well connected by road.

Pilgrimages along the Ganga

The sacred river Ganga- the life giver -has exerted a powerful hold over the imagination of all Indians. A pilgrimage to its many sacred towns is the ultimate desire of the pious Hindu. Survival

of ancient customs, rituals and patterns of life that are peculiar to the towns make them fascinatng for the visitor.

Rishikesh

It is quiet, serene spot surrounded by hills, where the Ganga is still a mountain stream making its swift way down to the plains. Rishikesh is, as its name implies, a place for the Rishis- the sages and monks who live in the *ashrams* along the banks of the river. Rishikesh is the base for pilgrimages into the Himalayas, to places like Badrinath, Kedarnath and to Yamunotri and Gangotri- sources of the Yamuna and the Ganga. It is also a base for exciting treks to the beautiful Valley of flowers, to ancient glaciers and for adventure sports like white river rafting. **Places of interest:** Lakshman Temple, the Bharat, Shatruguna and Venkateswara Temples, Lakshman Jhula. **Access:** Linked by rail to Hardwar on a branch line. Regular bus services make Rishikesh easily accessible.

Hardwar

Hardwar, where the river Ganga descends into the plains, is considered a sacred place of pilgrimage. The Kumbh Mela is held here once every 12 years. **Places of interest:** Har ki Pauri, Daksh Mahadev Temple, Sapt Rishi Ashram, Parmath Ashram, Mansa Devi Temple. **Access:** Linked by rail to Delhi (222 km) and Lucknow. Hardwar is accessible by road from Delhi and Dehra Dun (52 km).

Allahabad

Allahabad is one of the holy cities of the Hindus. Located at the Sangam or the confluence of the sacred rivers. Ganga, Yamuna and the mythical Saraswati, it is the site of the famous Kumbh Mela that is held every twelve years. **Places of interest:** Sangam, the Fort, Anand Bhavan, Khushru Bagh, Allahabad Museum. **Access:** Allahabad is connected by air to Delhi and Patna and by rail and road to all the major cities in the vicinity-Varanasi (122 km), Patna (368 km), and Lucknow (237 km).

Varanasi

An ancient city, Varanasi (Kashi) is the holiest of pilgrimage places located on the River Ganga. The temples and ghats on the river and the unique character of the city make it a fascinating place to visit. **Places of interest:** The Ghats, Tulsi Manas, Durga and Bharatmata Temples, Vishwanath Temple, Ram Nagar Fort, Gyanvapi Mosque, Benares Hindu University. **Access:** Connected by air to Delhi, Agra, Khajuraho, Calcutta and Kathmandu. Linked by rail and road to all the major towns in the area- Agra (565 km), Allahabad (122 km), Delhi (765 km).

Heart of India

India's heartland, Madhya Pradesh is located on a hilly plateau. Its pleasant hills and valleys, the home of a variety of wildlife is "Kipling's India". Royal cities, splendid temples, fine wildlife sanctuaries and hill retreats, that are off the beaten track and still unspoilt, make Madhya Pradesh a fascinating destination.

Khajuraho

Extraordinary temples rise spire upon spire like a mirage in the middle of nowhere. Built by

the Chandela kings in the 10th century, just 22 of the original 85 temples still remain. Their tall spires are balanced with horizontal bands of the most dazzling profusion of carved figures, animals, trees, chariots- sculpted with unerring perfection. **Places of interest:** Kandariya Mahadev and the Lakshmana Temple, Chitragupta, Vishvanath, Chausth Yogini and Jain temples. **Access:** Linked by air to Delhi, Agra and Varanasi. Nearest rail heads are Jhansi (175 km), Satna (117 km) and Mahoba (65 km). Connected by road to Satna, Harpalpur, Jhansi and Gwalior.

In the Footsteps of Buddha

Two thousand five hundred years ago, the lord Buddha, abandoning his royal heritage, came to Bodhgaya, where he attained enlightenment. Follow in the path of this great Teacher and revive his gentle philosophy.

Sarnath

The tranquil Deer Park, where Buddha preached his first sermon, is just 10 km from Varanasi. In later times, the emperor Ashoka erected magnificent stupas and buildings at Sarnath, making it an important place of pilgrimage. Places of interest: Dhamukh Stupa, Ashoka Pillar, Chawkhandi Stupa, Mulagandha Kuti Vihar. Access: Linked by road to Varanasi. There are regular bus services and tourist buses going to Sarnath. ITDC cars and taxis can be hired at Varanasi.

Kushinagar

Kushinagar is where the Buddha breathed his last and achieved Mahaparinirvana. There are ruins here of many *stupas* as well as the *Chaityas* and *Viharas* that were built in later times. **Places of interest:** Nirvana Temple, Rambhar Stupa, Matha Kaur Shrine. **Access:** Kushinagar is connected by road to Gorakhpur (55 km). Gorakhpur, in turn, is linked by rail and air to Delhi, Calcutta, Lucknow and Varanasi.

Bodhgaya

Near the holy city of Gaya, the Buddha attained enlightenment The tree that had sheltered him came to be known as the Bodhi tree and the place Bodhgaya. Today Bodhgaya, an important place of pilgrimage, has a number of monasteries. **Places of interest:** The Bodhi Tree, Mahabodhi Temple, Monasteries, Magadh University. **Access:** Bodhgaya is just 16 km from Gaya which is well connected by rail and road to Calcutta (458 km) and Varanasi (220 km). The nearest airport is Patna.

Nalanda

A great centre of Buddhist learning, Nalanda came into being around the 5th century BC and was a flourishing university town with over ten thousand scholars and an extensive library. **Places of interest:** Sariputra Stupa, Nalanda Archaelogical Museum. **Access:** Connected by road to Patna (103 km), Rajgir and Bodhgaya (89km). The nearest rail head is Gaya and the nearest airport, Patna.

Rajgir

Rajgir 19 km from Nalanda is the ancient capital of the Magadha Empire. Lord Buddha often visited the monastery here to meditate and to preach. Rajgir is also a place sacred to the Jains, since

Lord Mahavira spent many years here. **Places of interest:** Gridhakuta Hill, the Vishwa Shanti Stupa. **Access:** Linked by road to Gaya and Nalanda. The nearest rail head is Gaya and the nearest airport is Patna (90 km).

Vaishali

Vaishali was one of the earliest republics in the world (6th century BC). It was here that Buddha preached his last sermon. Vaishali, birthplace of Lord Mahavira, is also sacred to the Jains. **Places of interst:** Ashoka Pillar, Stupas, Coronation Tank, Bawan Pokhar Temple, Chaumukhi Mahadeva. **Access:** Linked by road to Patna (55 km). The nearest rail heads are Muzzafarpur (36 km) and Hajipur (35 km). The nearest airport is Patna.

Sanchi

Located in the heart of India is Sanchi with some of the finest examples of Buddhist architecture in the country. **Places of interest:** The Great Stupa, the Ashoka Pilllar, the Gupta Temple. **Access:** Connected by road to Bhopal (68 km). The nearest rail head is Vidisha (10 km). The nearest airport is at Bhopal. Taxis ply from Bhopal.

An Orissan Odyssey

Orissa the ancient land of the Kalingas, lies along the eastern coast. Splendid temples embellished with intricate carvings are the main attractions of this delightfully rural state.

Bhubaneswar

The capital of Orissa, Bhubaneswar is an ancient city with a history that goes back 2200 years. It is also a city of temples and various shrines, built in the splendidly ornate style typical of this region. **Places of interest:** Lingaraja Temple, Parasurameswara Temple, Mukteswara Temple, Raja Rani Temple, Brahmeswar Temple. **Access:** Connected by air to Delhi, Calcutta, Hyderabad, Nagpur, Chennai, and Mumbai. Well connected by rail, Bhubneswar is on the National Highway linking Calcutta (480 km) to Chennai(1225 km).

Puri

Puri is one of India's holiest cities. The magnificent temple at Puri, dedicated to Vishnu or Jagannath, the Lord of the Universe and its famous chariot festival, the Rath Yatra, make it a popular place of pilgrimage. **Places of interest:** Jagannath Temple, Gundicha Mandir, Puri Beach. **Access:** The nearest airport is at Bhubneswar (62 km) to which it is linked by road. Puri is connected by rail to Calcutta, Chennai and Delhi.

Konark

The majestic Sun Temples rises dramatically out of the sand dunes at the beach at Konark. This amazing edifice built in the 13th century AD was conceived as a vehicle for Surya, the Sun God, for his celestial journey across the sky. **Access:** The nearest airport is Bhubneswar (65 km) and the nearest rail head is Puri (31 km). It is connected by road to Bhubneswar and Puri.

Western Perspectives

The western state of Maharashtra, located on the Deccan Plateau, is the land where the valiant

Marathas and their intrepid leader Shivaji once ruled. The dynamic city of Mumbai, Pune located in the cool of the plateau, the Mughal city of Aurangabad, the rock-cut-caves of Ajanta and Ellora and hill resorts like Mahabaleshwar and Matheran, form a circuit that is full of variety and interest

Mumbai

The financial capital of India, Mumbai is a major port and entry point- a dynamic city that is also the centre of arts and the film industry. **Places of interest:** Gateway of India; Elephanta Island; Prince of Wales Museum; Jehangir Art Gallery; Hanging Gardens; Kamala Nehru Park; Beaches at Juhu; Chowpatty; Gorai; Marve; Manori and Madh; St. Thomas Cathedral; Afghan Church; the Babulnath; Bhuleshwar and Mahalakshmi Temples; Jama Masjid; Mahim shrine; the tomb of Haji Ali; Kenheri Caves. **Access:** Mumbai is linked to all parts of the country and to most parts of the world by air. It is connected by road and rail to all the major towns.

Pune

Pune is a historic town upon the Deccan Plateau, in what was once the territory of Shivaji, the great Maratha ruler, whose hill forts dot the surrounding countryside. **Places of interest:** Raja Dinkar Kelkar Museum, Shanwarwada Palace, Agha Khan Palace, Pataleshwar Temple, Parvati Temple, Saras Baug. Around Pune: Simhagad (15 km), Shivneri (95 km), Raigad (126 km), Purander and Torna, Lonavala (70 km) and Khandala. **Access:** Daily flights connect Pune to Mumbai (192km). Linked by road and rail to Mumbai and most major cities.

The Deccan Saga

Located on the Deccan Plateau, the state of Andhra Pradesh has a rich cultural heritage. It was once a part of the Emperor Ashoka's empire and traces of its Buddhist past are still to be seen at places like Nagarjunakonda and Amarvati. Muslim domination after the 14th century added a veneer to its already interesting amalgam of cultures.

Hyderabad

Hyderabad, the capital of Andhra Pradesh, is a city that is over 400 years old. It is noted for its artistic and cultural heritage, delicious cuisine and splendid shopping. **Places of interest:** Charminar, Mecca Masjid, Salar Jung Museum, Archaelogical Museum, Zoological Gardens, Hussain Sagar Lake, Birla Mandir, Golconda Fort. **Access:** Hyderabad is linked by air, rail and road to most major cities in the country.

Tirupati

The beautiful temple of Lord Vendateswara, located in the cool of the Tirumalai Hills, close to the town of Tirupati, is an important place of pilgrimage. The temple- a masterpiece of Dravidian architecture has a glided *vimana* over the sanctum. At Tiruchanur (10 km) is the shrine to the goddess Alamelumanga, the consort of Lord Venkateswara. **Access:** Linked by air to

Chennai, Banglore and Vijaywada, it is connected by rail to a number of destinations. Tirupati is also well connected by road and easily accessible from Bangalore and Chennai.

The Scent of Sandalwood

The land of sandalwood and coffee- Karnataka is a state with a rich and colourful heritage. Splendid temples, gracious cities and wildlife sanctuaries, are facets of this relaxed state. Bangalore, its dynamic capital city is the start of a heady tour of the delights of this state.

Bangalore

The capital of Karnataka, Bangalore is a gracious spacious city, despite the fact that is a modern industrial and commercial centre. **Places of interest:** Vidhan Soudha, Attara Kacheri, Cubbon Park, Lal Bagh, Bangalore Palace, Bull Temple, Government Museum, Visveswaraya Industrial & Technological Museum, Ventkatappa Art Gallery, Aquarium, Jawaharlal Nehru Planetarium, Ulsoor Lane, etc. Around Bangalore: Bannerghatta National Park (22 km), Heearghatta (25 km), Janapada Loka (53 km), Nandi Hills (60 km). **Access:** Well connected by air, rail and road to the rest of country.

Mysore

The charming old capital of the Wodeyar rulers, Mysore is a city of stately places and gardens. Every year, around October/November, Mysore takes on a fairy-tale quality as the festival of Dussehra is celebrated. **Places of interest:** Mysore Palace, Lalitha Mahal Palace, Sir Jayachamarajendra Art Gallery, St. Philomena's Church, Mysore Zoo, Brindavan Gardens, Chaumundi Hills. Around Mysore: Srirangapatna (14 km), Ranganathittu Bird Sanctuary (18 km), Somnathpur (35 km), Bandipur National Park (80 km), Nagarhole National Park (96 km), Madikeri (124 km). **Access:** Connected by rail to Bangalore. Well linked by road to all the major towns in the area.

Saravanabelagola

At Sravanabelagola there is a huge statue of the Jain saint Gomateswara - 17 mt high. The largest monolithic statue in the world, it is visible even at a distance of 25 km. **Access:** Easily accessible by road from Hassan. The nearest rail head is Hassan.

Of Palms and Backwaters

Kerala, the lush coastal strip in the south west of India, is a land apart. This little green paradise is edged on the one side by the forested ranges of the Western Ghats and on the other side by the Arabian Sea. All along the coast are a network of backwaters, lagoons and canals - the life-line of the people who live along its banks.

Thiruvananthapuram

Set on a painteresque group of hills near the sea is Thiruvananthapuram, one of the loveliest cities in India. Though a bustling state capital, it manages to preserve its charm and in the quieter areas of the town are narrow roads and old world Kerala houses that white washed and tiled in red. While in Thiruvananthapuram, try to take in a performance of Kathakali, the traditional folk dance of Kerala. **Places of interest:** Padmanabha Swami Temple, Napier Museum, Sri Chitra Art Gallery, Botanical Gardens. Access: Well linked by air, rail and road.

The Blue Mountains

South India has fine hill stations located in the cool heights of the Western Ghats. The forested ranges that seem tinted with a delicate shade of blue are also known in parts as the Nilgiris or the blue mountains. Udhagamandalam, Kodiakanal and Yervaud, located on these southern ranges, have fine lakes, wooded trails, waterfalls, rock outcrops and splendid scenery, that make them delightful retreats from the heat of the plains.

Udhagamandalam

The lake, Botanical Gardens, Doddabetta Peak, Mukurti Peak, Pykara Dam, wenlonk Downs, Kalhatti Falls, Elk Hill. **Access:** The nearest airport is Coimbatore (100 km). Connected by rail to Chennai via Mettupalayam. A little hill train links Mettupalayam to Udhagamandalam. Connected by road to all the major towns in South India.

Kodaikanal

The prettiest hill station in South India, Kodaikanal is set around a star shaped lake. Green wooded hills, scenic walks and waterfalls, make it a beautiful summer retreat. **Places of interest:** The Lake, the Coaker's Walk, Pillar Rocks, Perumal Peak, Bear Shola, Silver Cascade and Fairy Falls. **Access:** The nearest airport is Madurai (125 km) and the nearest railhead Kodai Road (80 km). Kodaikanal is only approachable by road and is well connected to most major towns in the area.

Golden Beaches

Given the length of the Indian coastline, it is not difficult for the visitor to find his particular spot in the sun. There are marvellous unspoilt stretches of golden and sand along the east coast, spectacular beaches in Kerala and Karnataka.

Goa

Goa's hundred odd kilometres of coastline has some of the best beaches in the country and the finest beach resorts. **Places of interest:** Calangute, Candolim, Baga, Vagator, Anjuna and Charpora Beaches in North Goa, Bogmola, Colva, Benaulim, Betul and Palolem Beaches in South Goa. **Access:** Dabolim, the airport near Vasco da Gaam, is linked to Delhi, Mumbai, Kochi, Bangalore, Chennai and other major towns. Charter flights link Goa directly to Europe. Vasco da Gama is connected by rail to Delhi, Mumbai. Well linked by road.

Eastern Vistas

The North East is a general term for a group of fascinating states that include Assam, Sikkim, Manipur, Meghalaya, Nagaland, Arunachal Pradesh and Tripura, located in the Himalayan and sub-Himalayan ranges of this area. Superb natural scenery, colourful cultures and exceptional terrain for trekking, mountaineering and other adventure sports make them marvellous destinations for unusual holidays. Calcutta, the capital city of West Bengal, is the entry point to this region.

Calcutta

Starting as a small British settlement on the Hooghly about 300 years ago, Calcutta grew to

be the brilliant capital of British India and a centre of their commercial interests in the east. Calcutta is also known for its devotion to the arts. **Places of interest:** Botanical Gardens, Indian Museum, Fort william, the Octherlony Monument, Victoria Memorial, Raj Bhawan, St Pauls Cathedral, Town Hall, National Library, Birla Planetarium, Marble House. **Access:** Linked by air to major Indian cities and to a number of international destinations. Regular flights link it to the North East and the Andaman Islands. Well connected by rail and road.

Darjeeling

A popular hill station, picturesquely located on a ridge 2123 m high, Darjeeling is noted for its fine tea. It offers splendid views of the snow capped Himalayas and of the Kanchanjunga Peak. **Places of interest:** Tiger Hill, Senchal Lake, Ghoom Monastery, Dhirdham Temple, Himalayan Mountaineering Institute, Zoological Park and Botanical Gardens. Around Darjeeling: Takdah (26 km), Kurseong (32 km), Mirik (49 km) **Access:** The nearest airport is Bagdogra.

Gangtok

Sikkim, with its spectacular scenery, exotic orchids, Buddhist monasteries and mountain trails, is a splendid holiday destination and for trekking. Gangtok, its capit al, offers superb views of the Kanchenjunga range. **Places of interest:** Tsuk-La-Khang, Institute of Tibetology, Orchid Sanctury, Enchey Monastery. Around Gangtok: Rumtek Monastery (24 km). **Access:** Gangtok is only accessible by road. The nearest airport is Bagdogra (124 km). The nearest rail heads are Silliguri (111 km) of New Jalpaiguri (126 km).

Shillong

The capital of the state of Meghalaya, Shillong is a pretty hill town with lakes, grassy downs, pine scented hillsides, English cottages and a fine golf course. **Places of interest:** Ward Lake, Raj Bhawan, Botanical Gardens, Lady Hydari Park, Bishop and Beadon Falls, Elephant Falls, Cherrapunji, Mawphlang. **Access:** Nearest airport and railhead is Guwahati (100 km). Well connected by road to various parts of the state and to towns in Assam.

About Indian Agricultural Research Institute...

The Indian Agricultural Research Institute (IARI), popularly known as "Pusa Institute", was orginally established in 1905 as "Agricultural Research Institute" (ARI) at Pusa (Bihar). Institute was renamed as the "Imperial Agricultural Research Institute" in 1919. The Institute was shifted to the present site in New Delhi following a major earthquake at Pusa and formally inaugurated on November 7, 1936 by the then Viceroy of India, Marquis of Linlithgo. After independence, the Institute was renamed as "Indian Agricultural Research Institute (IARI) in 1947. In 1958, the Institute conferred the status of a 'deemed university' by the University Grants Commission. Since 1966, the Institute is functioning under the administrative control of the Indian Council of Agricultural Research (ICAR), a central autonomous body. In 1975,the ICAR appointed a Board of Management for the Institute with the Director IARI as its chairman.

The Institute is headed by the Director, who is the overall incharge of the activities concerning research, education, extension and administration. He is assisted by four Joint Directors i.e. J.D. (Research), Dean and J.D. (Education), J.D. (Extension) and J.D. (Administration). The research and educational activities of the Institute are carried out under the direct supervision of Project Directors and Heads of divisions/regional stations. The research, education and extension activities of the Institute are carried out through a network of 18 divisions, 4 multidisciplinary centres, 9 regional stations and 2 off-season nurseries located in different agro-climatic regions of the country. Besides 18 divisions, covering almost all disciplines of agricultural sciences, the four multidisciplinary centres include Nuclear Research Lab. and Water Technology Centre. Regional stations of IARI include Amartara Cottege, Shimla, Himachal Pradesh (horti-cultural technology), Katrain, H.P. (vegetable research and breeding), Tuti Kandi, Shimla, H.P. (wheat and barley breeding), Wellington, T.N. (wheat breeding), T.N. (rice) and Dharwad, Karnataka (pulses).

Aerial view of the Campus

The Campus

The present campus of the Institute is a self-contained sylvan complex spread over an area of 500 hectares. It is located about 8 km (5 miles) west of the New Delhi Railway Station, and about 16 km (10 miles) east of Indira Gandhi International Airport at Palam. The location stands at 28.08^0 N and 77.12^0 E, the height above mean sea level being 228.61 metres (750 feet).

The IARI Library

The IARI library is one of the largest agro-biological libraries in the world. It plays the de facto role of the National Agricultural Library of India. Its rare collections include Philosophical Transactions

of the Royal Society, London, Vol. 1, April 1665/66, the first ever published scientific journal in English and General History of plants, Norton 1597 (in original). At present, the library has over 6,00,000 publications, over 10,500 files of periodical and series title, besides a comprehensive collection of 750 secondary source journals, 1500 titles from 80 countries, cover-to-cover translated titles, newsletters, bulletins, etc. It maintains a retrospective bibliography on Indian Agriculture from 1944. The library is also a depository for publications of the World Bank, FAO, IDRC and CGIAR. The bio-informatic centre of the Institute caters to the application of information technology to life sciences. It acts as a computerised information base and has online access to international database through global network and E-mail.

IARI Library

Research Contribution

The Institute laid a strong research foundation during the pre-independence period. The Institute responded by developing a high yield technology in crops like wheat, maize, sorghum, pearl-millet, and later in rice, through enhancement of genetic potential for crop yields and evolving improved management practices to help demonstrate this potential in the farmers' fields.

The Institute reappraised the wheat improvement programme of the country in the early sixties. Dwarf genotypes responsive to fertilizer and irrigation were evaluated throughout the country. The dwarfing genes were incorporated with grain quality acceptable in India. This helped in extensive cultivation of new genotypes of wheat, which led to a phenomenal improvement in wheat production. Consequently, country could pride in proclaiming itself self sufficient in food grains. This was the beginning of "Green Revolution'. The then Prime Minister of India, Mrs. Indira Gandhi, released a postage stamp in 1968 to acknowledge the achievement of the Institute and scientific community.

Crop improvement programmes involving yield enhancement and resistance to disease and pests continue to remain the main focus of the Institute since its establishment. High yielding varieties of cereals, pulses, oleoiferous brassicas, vegetables, flowers, and fruits developed at this Institute are widely cultivated and have brought national and international recognition to the Institute. More recently, the Institute has sought to strengthen the genetic enhancement programme through emphasis in researches involving modern biology, particularly molecular biology, identification, isolation, cloning and characterization of genes controlling novel traits for resistance/tolerance to biotic and abiotic stresses are some of the major commitments of this programme. Techniques for generation of transgenic plants, gene mapping, doubled haploid through another culture and somatic

hybridization for specific cases of otherwise incompatible crosses, are among the technologies that the bio-technology centre of the Institute is pursuing to standardize. The crop improvement programme have responded to the national needs and priorities. It has, therefore undergone appropriate modifications from time to time. While pursuing these goals, the Institute has generated a wealth of knowledge that has contributed substantially to our understanding of the plant sciences, especially in the context of Indian scenario.

Potato Research at IARI

The foundation of potato research was laid down in the country at IARI in late forties by Dr. Yavalkar, Dr. Sharma and Dr. PN Arora. The first Ph.D. thesis on potato under supervision of Dr. Arora was submitted in 1950. Since then maximum number of the M.Sc./Ph.D. theses were submitted under the guidance of Dr. PN Arora. At the beginning of the programme, main emphasis was on fertilizer requirement and date of sowing. After release of new varieties such as Kufri Chandramukhi, Kufri Sinduri, Kufri Chamatkar and Kufri Alankar, the emphasis was given to fertilizer management, irrigation, plant geometry and inter-cropping. During late sixties and early seventies the short duration varieties of potato were fitted into the cropping systems such as maize-potato -onion-moong. Maximum benefit was realized with the cropping system by inclusion of potato in northern part of India.

–NN Singh,
Project Director,
Directorate of Maize Research,
IARI, New Delhi - 110 012.

The Special Cultural Programme : Kuchipudi Dance

NPL Auditorium, 9th December 1999 : 07.00 pm

This classical Indian dance takes its name after the village of Kuchipudi in Andhra Pradesh and is an embodiment of Telugu culture in its variety and richness. Originally known as *'Natya Mela'* (drama tradition), Kuchipudi evolved itself into the special classical dance from the Andhra Pradesh. During the 16th-17th century, the advent of Siddhendra Yogi brought glory and fame to Kuchipudi. By writing masterpiece ballets like *Bhamakalapam* and initiating the male members of the community into dance, he became a force of integration, a force that gave eternity to the Kuchipudi classical dance form. Based on the fundamentals of *Natyasastra*, it represents our ancient heritage.

The Kuchipudi dance - drama is performed in night-long events. One of the major characteristics was *Vachika Abhinaya* - where the actor has to speak and sing. *Pravesha daruvu* is another special feature in Kuchipudi. Daru means entry of a character. Each character, portraying a particular God, Goddess or demon, makes different entry.

The great Guru Vedantam Laxminarayana Sastri (1875 - 1957) introduced the concept of solo dancing by female artists. Thus, independent solo dance numbers gained immense popularity. From males impersonating females, to females even doing male roles - Kuchipudi has come a full circle. Kuchipudi has also imbibed *'Abhinaya'* number from the Andhra Nattuvamela traditions, introducing rich expression in various *varnams*, *padams*, javelis and excerpts from dance dramas. The wide range of *'Abhinaya'* representing numerous *'Bhavas'* (facial expressions) is the specialty of Kuchipudi dance. Its scintillating rhythm and fluid style captivate the sustained interest of audience all over the world.

About the Artists ...

Renowned Kuchipudi Maestro Jayaram and his wife Vanashree Rao are today known as outstanding artists of this style. Enriched by Rama Rao's choreography, which has extended the Kuchipudi Repertoire, their performances have served to highlight the flowering beauty of a style

characterized by grace and virtuosity. In perfect synchronization and harmonious balance, they represent the manly vigour '*Tandava*' and feminine charm '*Lasya*' in their duet presentations.

Jayrama Rao was trained in traditional *Guru-Shishya Parampara* in Siddhendra Kala Kshetram, Kuchipudi, since his childhood, under eminent Gurus like Late Shri Chinta Krishnamurty, Sri P.V.G.K. Sarma and Dr. Vempati Chinna Satyam of Madras.

Vanashree, his excellent dancing partner, is a postgraduate in political science from Lady Sri Ram College, Delhi University. While doing her M.Phil studies, she started her training under Guru Krishna Kumar and later continued under Shri Jayrama Rao. Within a very short span of time, she established herself as a sincere and dedicated practitioner of Kuchipudi. Later, she took training under Guru Dr. Vempati Chinna Satyam and Dr. Nataraja Rama Krishna.

Individually acclaimed performers, the couple started dancing together since 1978. His school Kuchipudi Dance Academy, is the pioneer institution in Delhi for teaching this style. Honoured by a large number of prestigious awards including the Sangeet Natak Academy Award or President's Award (1999) and *'Sammans'*, this couple has performed throughout the length and breadth of the country. They have represented India in over 40 countries in various prestigious national and international festivals.

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–Director, Agriculture, KOHIMA, Nagaland

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