From the Director’s Desk

The potato is an ideal host to a large number of soil- and tuber-borne diseases. Since the same tubers, which are catered predominantly in a raw state to the consumers, are also used as seeds, these diseases play havoc in economic and sustainable potato production. Pesticides are used, I would say often injudiciously, to control these diseases, but emerging issues of food and environmental safety are making their uses more and more challenging against strong public debates. Even if these issues are yet to occupy the centre stage in our country, the public have become practically hysterical over these issues in developed, especially European countries and North America. Therefore, environment-friendly management of soil- and tuber-borne diseases of potato is a challenging task to the scientists in our country, if we are to sell our produce, tubers as well as seeds, in the international markets in this era of trade liberalization and globalization. The thematic article of this issue of the CPRI News Letter has, therefore, rightly dealt with various aspects of environment-friendly management of soil- and tuber-borne diseases in potato. It is indeed assuring that our scientists have succeeded in developing alternative methods, including bio-control agents, for controlling diverse soil- and tuber-borne diseases. Of various methods, the simple cost-effective boric acid formulation needs worth mentioning, as it is increasingly getting popular with our farming community. In this context, I would like to point out that nanotechnology is an emerging filed for future disease and pest management. Nanotechnology devices for “Smart Field Systems” to detect, locate, report and apply pesticides as and when needed, and “Smart Delivery Systems” to deliver insecticides and pesticides in a spatially targeted and self-regulated manner hold the key to successful environment-friendly management of soil- and tuber-borne diseases. In addition, there is an enormous opportunity for “Nanoparticle pesticides”, which can be easily taken up by plants and can also be programmed to be time-released. The multinationals like Monsanto, Syngenta and BASF are already in the process of developing pesticides enclosed in nanocapsules or made up of nanoparticles. Research in this direction will be highly rewarding for potato disease and pest management in the long run.

<table>
<thead>
<tr>
<th>ISSUE HIGHLIGHTS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>From Director’s Desk</td>
<td>1</td>
</tr>
<tr>
<td>Minister’s Visit</td>
<td>2</td>
</tr>
<tr>
<td>Research Highlights</td>
<td>2</td>
</tr>
<tr>
<td>Training &amp; Technology Transfer</td>
<td>5</td>
</tr>
<tr>
<td>Important Meetings</td>
<td>8</td>
</tr>
<tr>
<td>Invited lectures &amp; Visitors</td>
<td>11</td>
</tr>
<tr>
<td>Awards and Honours</td>
<td>13</td>
</tr>
<tr>
<td>Potato Facts</td>
<td>13</td>
</tr>
<tr>
<td>Human Resource</td>
<td>14</td>
</tr>
<tr>
<td>Future Activities</td>
<td>14</td>
</tr>
<tr>
<td>Article on Potato</td>
<td>14</td>
</tr>
<tr>
<td>News in Hindi</td>
<td>19</td>
</tr>
</tbody>
</table>
Minister of State Visits
CPRS, Gwalior

Hon'ble Minister of State for Agriculture and Food Supply, Govt. of India, New Delhi, Dr. Akhilesh Pratap Singh visited CPRS, Gwalior on 09.05.2006. He was formally welcomed by the scientists of the station Drs. AK Somani, SP Singh, Birbal and Vinod Kumar and was informed about the various activities of the station including its mandate to him and he shall not be selling the produce in mandi for table purpose at least for next 3-4 years.

During visit to the Station, Minister offered few suggestions like increasing production of breeder seed, more seed should be given to farmers and station scientists should have more interactions with them, development of laboratories and other infrastructural facilities.

Research Highlights

Transgenic potato for eco-friendly management of late blight

Potato late blight caused by the oomycete fungus Phytophthora infestans is the most dreaded disease of potato causing an annual loss of approximately US$ 3 billion worldwide. In India itself, management of late blight through host resistance would save around US$ 250-350 million annually. Moreover, heavy dose of fungicides (Metalaxyl and Mancozeb) is sprayed on potato crop to save it from this devastating disease thus creating serious environmental hazard. Development of potato cultivars with durable late blight resistance is, therefore, a major objective of the Institute. The diploid potato species, S. bulbocastanum from Mexico and Guatemala, known for its high level of late blight resistance for decades, could not be utilized to transfer the resistance into cultivated tetraploid varieties by classical breeding because of differences in ploidy and endosperm balance number (EBN). Recently, the $R$ gene responsible for race non-specific, broad-spectrum resistance in $S$. bulbocastanum has been cloned at the University of Wisconsin, Madison, USA. Transgenic lines of the potato cultivar Katahdin expressing this gene ($RB$) defended the onslaught of late blight at the Toluca valley of Mexico, the center of origin of $P$. infestans.

Late blight response of RB-transgenic Katahdin (left) and non-transgenic control (centre) with and without (right) inoculation of $P$. infestans.

The Institute is running a collaboration project with Agricultural Biotechnology Support Project II (Cornell University, USA) for utilization of the RB gene in development of late blight resistant potato varieties. Indian Council of Agricultural Research signed a Material Transfer Agreement (MTA) with the Wisconsin Alumni Research Foundation (WARF) in July 2005 for utilizing the RB gene in development of late blight resistant variety. Central Potato Research Institute, Shimla received RB-transgenic lines of Katahdin as well as the RB gene construct from the University of Wisconsin in the month of August-September 2005. Research work to utilize this valuable technology is now going at full swing at CPRI, Shimla. Scientists from India, USA, Indonesia and Bangladesh regularly engage into teleconferencing to share their experiences and achievements on fortnightly basis.
Multiplication of in-vitro planting material of potato (micro-tubers)

Potato is an important crop grown worldwide and is generally grown from seed tubers. Therefore disease free seed of potato plays important role in maintaining yield potential of potato cultivars. Successive multiplications of seed tubers in field carries the risk of infection and build up of various bacterial, fungal, nematode and viral pathogens. Hence, ideally, seed tuber multiplication is restricted to areas which are free from virus spreading insect vectors. Even in such areas, viral and fungal infection has to be prevented by repeated pesticide and insecticide sprays and adopting standard agronomic practices. Conventional seed production is totally dependent upon elite tubers. To obtain economic yields, it is desirable to replace seed stock of the farmers after every three years. For the purpose, micro-tubers developed through meristem tip culture under controlled conditions are multiplied on a large scale under net house for maintaining desirable health standards.

Production of micro-tuber

Meristem tip culture technique is used in the development of micro-tubers under aseptic conditions. For virus elimination from systematically infected potato cultivars, apical meristems (0.1-0.2 mm in size) are removed from terminal bud and cultured in a suitable medium for plant regeneration. This tissue, termed as “mericlon” is tested against virus with ELISA. When a potato clone is made free of viruses through meristem culture, it is rapidly multiplied by shoot cutting under aseptic conditions. Disease free micro-propagated plants are either directly transplanted in field for production of mini-tubers or are grown in laboratory under controlled conditions to provide micro-tubers. Micro-tubers are miniature tubers (average weight 100-200mg) produced in a suitable medium. These are produced in flask or in special culture boxes and are harvested after protracted period of
incubation. Before harvesting, the micro-tubers are greened under light for minimizing storage loss due to shrinkage and drying. These small dormant tubers are particularly convenient for handling, storage and distribution, and may be used for large scale mechanized planting in field.

Production of mini-tubers under net house

Sprouted micro-tubers are planted in the nursery beds under aphid proof net house at 10 x 30 cm on a mixture of FYM, soil and sand in the ratio of 1: 1: 1. Earthing up is done when plant height reaches 20-25 cm and N is applied at 50kg/ha. Micro-tuber crop is allowed to mature in the nursery beds and harvesting of mini-tubers is done at the end of crop season. The resultant mini-tubers are cold stored for field planting during next season.

Steps for production of mini-tubers in first field multiplication

- Fine tilth is required for proper emergence.
- Ratio of soil: sand: FYM (1:1:1) is maintained before soil solarization.
- Soil solarization for 4 weeks (15th May to 15th June) is carried out.
- Pre-sowing irrigation is done 3-4 days before planting.
- Raised beds having provision for side irrigation are prepared.
- Alternate day irrigation is provided by watering can for the first fortnight. After that, weekly irrigation interval is followed.
- Micro-tuber need to be placed more than 3-4 cm below soil level.

- After planting the micro-tubers are properly covered with soil.
- Earthing up is done at 40-45 days @ 50 kg/ha nitrogen when plants reach 20-25 cm height.
- After 60 days, composite samples of leaf is tested with ELISA.
- Spacing of 30 x 10 cm inter and intra row is followed.
- Three different inspections are carried out to rogue out off type and infected plants.
- Mini-tubers so produced are multiplied next year in second field condition.
- Produce of 2nd field multiplication is called Breeder’s seed.

Merits of In-vitro planting materials

- Micro-tubers are free from viruses (PVX, S, Y, A and M), soil and tuber borne diseases, bacterial and fungal infections
- Multiplication is faster than conventional method
- Saves storage space for seed
- Maintains yield potential of potato cultivars
- Technique is used to maintain healthy seed stocks of newly developed cultivars
- Seed rate per unit area is less
- Easy transportation owing to less volume

-RK Singh, Jyotsana Sharma, GS Kang and Sarjeet Singh

Recent potato varieties released by the Central Potato Research Institute

CFRI has developed six new potato varieties for cultivation in different agro-ecological zones. The Central Sub-committee on Crop Standard Notification and Release of Varieties for Horticultural Crops, Ministry of Agriculture, Govt. of India, New Delhi has recommended these varieties. The description of these varieties is as follows:

Kufri Arun: It is a medium maturing variety producing medium size, oval, red tubers with medium deep eyes and creamy flesh. The variety is field resistant to late blight. Kufri Arun is suitable for cultivation in plains of Uttar Pradesh, Punjab, Haryana and Bihar.
size, round-oval, white tubers with fleet to medium deep eyes and light yellow flesh. The variety is resistant to late blight and early blight. It is recommended for cultivation in Haryana, Rajasthan, Punjab, Uttar Pradesh and Maharashtra.

**Kufri Surya:** It is an early maturing variety producing medium to large size, oblong, white tubers with shallow eyes and pale yellow flesh. It is a heat tolerant variety and is field resistant to hopper burn. This variety also possesses some resistance to mite damage and late blight. It has been recommended for cultivation in Karnataka, Punjab and western Uttar Pradesh.

**Kufri Shailja:** It is a medium maturing variety and has been recommended for cultivation in Himachal Pradesh, Uttarakhand, Meghalaya and Nigiris hills in Tamil Nadu. It possesses high level of field resistance to late blight both in foliage and tubers. The tubers are white, round-oval and of medium size with shallow eyes and pale yellow flesh. The variety has better keeping quality than Kufri Ginraj, which is also recommended for cultivation in hills.

**Kufri Himalini:** This variety has been recommended for cultivation in Himachal Pradesh, Uttarakhand, Meghalaya and Nigiris hills in Tamil Nadu. It is a medium maturing variety and produces oval-oblong, white tubers of medium size with shallow eyes and pale yellow flesh. It possesses field resistance to late blight in foliage and moderate resistance in tubers.

**Kufri Chipsona-3:** This is a processing variety suitable for preparation of chips because of its high tuber dry matter, low reducing sugar and negligible glycoalkaloid content. This medium maturing variety has round-oval white tubers of medium size with shallow eyes. The variety also possesses field resistance to late blight. It is suitable for cultivation in Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal and Madhya Pradesh.

-Vinay Bhardwaj, Jai Gopal, SK Pandey, P Manivel and SK Kaushik

**Training & Technology Transfer**

**Kisan Mela at Shillong**

Central Potato Research Station (CPRS) Shillong, Meghalaya, one of the regional stations of Central Potato Research Institute (CPRI), Shimla (Himachal Pradesh) organized two days Kisan Mela on 26-27th April, 2006, under the aegis of Mini-Mission-I on the Integrated Development of Horticulture in
North Eastern region of India, Sikkim, Himachal Pradesh, J & K and Uttarakhand. The theme of the Kisan Mela was “Towards improving potato productivity in north eastern (NE) states. It is apt to mention here that potato crop occupies significant space in the rural agrarian economy and dietary regime of the people of NE region. The poor potato productivity of the region (about 10 t/ha as against the national average of 19 t/ha) is a matter of concern for all the potential stakeholders working for potato R & D in this region. The above facts also supported the genesis of the Kisan Mela wherein potato farmers from various states of this region and representatives from processing industries, seed industries, fertilizer companies and voluntary organizations shared the common platform.

In the presidential remarks, Dr. B.P. Singh, Joint Director, CPRI Campus, Modipuram stated the significance of CPRS, Shillong in the effort of generation and dissemination of technologies for production, protection and post harvest handling of potato among the farmers of this region. He specifically highlighted reasons for the location of this station, which was established in the year 1959 in the erstwhile Assam state. Dr. KM Bujarbarua, Director, ICAR, Research Complex for NEH Region, Barapani (Umiam), Meghalaya and Shri Oris Lyngdoh, Headman of the locality also addressed the gathering of the farmers and delegates.

Fertilizer companies like MECOFED, Shillong; IFFCO, Guwahati unit and IPL, Guwahati also displayed their products. The representatives from financial and other supporting institutions like NABARD, Shillong region; Meghalaya co-operatives Apex Bank Ltd., Shillong and AFEDA, Guwahati deliberated their schemes and other provisions for the potato farmers of this region in the parallel session. Similarly, there was deliberation by a reputed NGO like Rural Resources and Training Centre (RRTC), Umran (Meghalaya), who focused on the organic agriculture for better sustainability in this region. The state department of horticulture, Govt. of Meghalaya also displayed their products and production technologies.

Besides, there were stalls and exhibits by private enterprises like Stanley Roy Construction, Shillong; Anderson Bio-tech Pvt., Ltd., Shillong; Bethany society, Shillong and St. Peter Convent, West Khasi Hills, Meghalaya. State Marketing Board and Directorate of Marketing Intelligence (DMI), Govt. of India also displayed their live-in marketing portal in this Kisan Mela and explained to the interested groups of farmers about the best possible use of such web based portal.

In the technical session of this Mela, resource persons from CPRI, Shimla namely Drs. PH Singh, KR Dhiman, JS Minhas and NK Pandey deliberated upon different aspect of scientific potato cultivation including high yielding potato varieties, TPS technologies, management of various diseases and insect pests and storage of potatoes. Prior to that, Dr. BP Singh, Joint Director, CPRIC, Modipuram
presented the overall scenario of potato research and development in India vis-à-vis North Eastern region. In the same technical session, Dr. M.S. Kadian from CIP, South West and Central Asia, New Delhi shared with the audience about their effort for potato development in this region with particular focus on dissemination of TPS technology.

The other attractions of this Kisan Mela were live and standing crop of various potato varieties and a comprehensive stall of CPRS, Shillong depicting the entire aspects of potato technologies. Farmers took immense interest in these features. Scientists of this station coordinated the practical demonstration on scientific method of fertilizer application and potato planting. Further, a panel of scientists also evaluated all the stalls and best three stalls were given the award and certificate of merit. The best stall award was bagged by the District Horticulture Office, Department of Horticulture, Govt. of Meghalaya. The second and third best stall award was adjudged to Kislay Food and Snacks, Guwahati (Assam) and jointly to Department of Marketing and Directorate of Marketing Intelligence (DMI), Govt. of India, respectively.

Farmers meet at Palampur
A potato farmers and scientists meet was organized at Rice and Wheat Research Station, Malan near Palampur, HP on 10.03.2006. Around 400 potato farmers of the neighboring areas participated in this meet, which was organized by HPKV, Palampur and its station with the support of State Department of Agriculture and KVK.

Various scientists including Drs. VK Chandla and Brajesh Singh of CPRI delivered their talk on aspects related to potato production, protection and post harvest management. This belt of the region is known for quality production of processing grade potatoes and therefore, the major emphasis was given on potato production for processing purpose.

Potato Exhibition in Uttarkashi

The Himalayan Action Research Center (HARC), an NGO working in Uttaranchal organized Rawain Farmers’ Fair on January 8-9, 2006 at Nausaan, Uttarkashi. They invited CPRI scientists for organizing Potato Workshop in the fair. The Himalayan Action Research Center is involved in promoting agriculture and rural agri-business in fruits and vegetables. Two of its extension officers were trained by CPRI in the Model Training Course organised in August, 2005 at Shimla. After that a linkage has been developed with HARC and this workshop was a part of follow-up activities of the training. Accordingly, Drs. KR Dhiman, NK Pandey, Anil Kumar and Sh. Rakesh Kumar of CPRI attended this workshop and put up an exhibition stall in the fair. The scientists delivered lecture on potato and discussed different issues with the farmers of the area, which is by and large backward in terms of technology adoption. The farmers were ignorant about the improved techniques of potato cultivation. The major problems of the farmers were non-availability of healthy seed and marketing of the produce.

Training of Level-I experts of Kisan Call Center
The Kisan Call Center (KCC) for Himachal Pradesh is working since May 2005 at Chandigarh to answer the queries of farmers pertaining to agriculture. The Level-I experts based at Chandigarh answer the queries. If they are not able to answer the queries, the phone call is directed to Level-II experts. CPRI, Shimla has been identified as one of the Level-II expert center for potato in Himachal Pradesh and the Directorate of Wheat Development, Ministry of Agriculture, Govt. of India is the nodal agency for HP. The Directorate organises one-day training course every month for the Level-I experts of KCC. On January 31, 2006 a training course was organized at CPRI, Shimla in which the Level-I experts were trained with respect to potato production, storage and plant protection practices by CPRI, Shimla scientists.

Live Phone-in Programme on Doordarshan
The Shimla Doordarshan has started live phone-in programme of ‘Krishi
Darshan’ in collaboration with various organizations concerned with agricultural development. The programmes of various organizations are discussed in the monthly meetings and are telecasted every Monday and Thursday as per schedule. In this programme burning issues related to crop, animal husbandry, fishery, etc. are discussed by the expert and the viewers (farmers) can ask questions from the expert by dialling the phone number announced just before the start of the programme. Drs. SK Pandey, MC Sood and NK Pandey participated in the programme during the month of January 2006 to discuss various aspects of potato production. Dr. Sarjeet Singh participated in this programme on 16-3-2006, Dr. S S Lal on 8-5-2006 and Drs. PH Singh and VK Chandla on 15-6-06.

Exhibition in Krishi Expo-2006

CPRl campus, Modipuram put up potato exhibition stall in the Krishi Expo-2006 held during March 8-12, 2006 at Pragati Maidan, New Delhi that was organized by Ministry of Agriculture, Govt. of India. Various potato varieties for ware and processing purposes were displayed in the stall and two new varieties, viz. Kufri Surya and Kufri Chipsona-3 were also displayed for publicity.

Training programmes of NHRDF at Patna

A one-day farmers training programme on potato cultivation & seed production was organized at Patna on 20-03-2006. A group of 50 farmer's of district Sasaram, Bihar participated in the programme. Drs. RP Rai and Barsati Lal of CPRS, Patna imparted this training programme, which was sponsored by NHRDF, Patna.

Another one-day training programme on “Scientific Potato Cultivation and Seed production” was organized at CPRS, Patna on 27.04.2006. A group of 100 farmers (40 female and 60 male) of district Hazaribagh, Jharkhand, sponsored by NHRDF Patna participated in the programme. Drs. RP Rai, SN Singh, B. Frasad, Manoj Kumar and Barsati Lal delivered lectures and imparted training to this group on latest technologies of potato cultivation.

Participation in Krishak Goshti

Scientists of CPRS, Patna participated and arranged exhibits in farmers fair and Krishak Goshti organized by IIVR, Varanasi on 7.01.2006 at Motihari (W. Champaran), Bihar.

Jubilee year (1957 to 2006) on 7.04.2006 at Central Potato Research Station, Mutorai. About 35 lead farmers of the Nilgiris and Coonoor districts attended the function. The programme was well covered by the Media and All India Radio.

Inauguration of Golden Jubilee Year

Mr. C. Vijayarajkumar, IAS, Collector, Nilgiris presided over the inaugural function while Mr. R. Karpoorasundarapandian, IAS, Special Commissioner, Horticulture and Plantation crops, Chennai was the chief guest. The function was followed by Golden Jubilee year tree planting by the dignitaries in front of the building.

Dr. KS Krishna Prasad, in his welcome address explained about the establishment, activities and future thrust of Central Potato Research Station. He stressed the need of involvement of State Government in improving seed production and its distribution of farmers.
Sh. Vijayrajkumar, IAS, Collector of Nilgiris in his presidential address, appreciated the work of the station and its achievements. He urged the Scientist to develop disease resistant high yielding varieties. He offered to release funds for the purpose of training local farmers and field staff in Co-ordination with Hill Area Development Programme.

Sh. Jatak Chiru, IAS, Project Director, Hill Area Development Programme in his address termed it as a landmark function and told that the popularity and demand of potato is increasing day by day. He requested the scientisis to develop good farming techniques to grow potato.

After that three progressive farmers (Mr. Krishna Kumar, Mr. Palanisamy and Mr. Nanjan) talked about the importance of potato crop in vegetable cultivation, role of Central Potato Research Station in improving the productivity of potato in this area, performance of potato varieties released by Central Potato Research Station in this area, etc. They requested that seed production should be increased by growing potato in the State Government farms and farmers fields under the guidance and supervision of Central Potato Research Station to supply the needs to more farmers. They also requested local district administration to intervene in marketing and auction sale of their produce, as there are no facilities available for the same in the Nilgiris.

Mr. Rajkumar from MYRADA (an NGO) stressed that CPRS, Ooty should concentrate on providing good quality seed, education the farmers and on post harvest technology.

Dr. Nayum, Head, IARI Regional Station, Wellington gave suggestions for improvisation of tissue culture techniques for faster multiplication of seed. Dr. Durairaj, UPASI emphasized on the need for utilization of damaged and left over potatoes in the village level processing for value addition to the crop.

The function ended with tree planting by dignitaries at CPRS, Ooty and the first planting of potato for this year in the field.

**Mini Mission-I meeting held**

The Annual meeting of MM-I was organized by Nodal Officer, CPRI, Shimla at Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan on 4th and 5th January 2006. The Govt. of India was represented by Dr. Shiva Ram Reddy, Deputy Commissioner, Horticulture. All PI’s of different institutions involved in implementation and monitoring were present. Dr. D.S. Thakur, Vice Chancellor, CSK HPKV Palampur and Dr. Jagmohan Singh Chauhan, Vice Chancellor of Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan chaired different sessions. The inaugural function was attended by Directors of Research, Extension and Heads of departments / institutions located in the state. The PI’s/Co-PI’s of the ongoing projects presented the progress report of the first year and the newly approved projects under Mini-Mission–I. Dr. SK Pandey, Director cum Nodal Officer highlighted the importance of Horticulture in Indian economy and explained the main aims of Mini-mission. He said that the development of hilly region in mission mode to foster the rapid growth of the region and to improve socioeconomic status of all hilly farmers in Himachal Pradesh is the main aim of the mission. Annual progress report of 21 ongoing projects was presented in the meeting and the progress was considered satisfactory. The Nodal officer congratulated the PIs and the institutions that exceeded the physical targets fixed for the 1st year. The VC’s of the two universities also expressed their happiness in accepting challenges of achieving the physical targets. They also suggested that the crops which are economically important should be prioritized and the planting material be produced accordingly. The utilization of funds was slow due to procedural delays but all PIs assured to utilize the funds by 31st March 2006. In all, 28 newly approved project proposals covering the objectives of MM-I received from 4 institutions located in the state were presented and suggestions were given so that the MM-I is able to follow clear cut road map and other details.

**CPRI participated in sports meet**

CPRI participated in ICAR Inter-Institutional Sports meet (North Zone) held at NDRI, Karnal between 7th to 10th March 2006 and won the overall runner up trophy.
The major achievements include:

- Mrs. Shyamlata Begta was adjudged the Best Women Athlete.
- CPRI won the Trophy for Table Tennis (Men). The players were: Dr. Vinay Bhardwaj, Sh. CM Bist, Sh. Gurjeet Singh, Sh. Roshan Lal and Dr. NK Pandey.
- Runner up trophy in Volleyball shooting event.
- Mrs. Shyam Lata Begta got Gold Medals in Discuss Throw, Jevellian Throw and Shot Put Throw. She also got bronze medal in long Jump.
- Mrs. Tarvinder Kocchar got Gold Medals in 100 mt race, 200 mt race and Long Jump and Bronze Medal in High Jump.
- CPRI won the TT (Women Doubles event) and received the Gold Medal – The players were Mrs. Shyam Lata & Mrs. Poonam Sood.
- Sh. Vijay Kumar won the Silver Medals in Long Jump (men) and Shot put throw (men).

**Participation of CPRI Scientists in RAU, Pusa programme**

A team of potato scientists namely, Drs. RP Rai, RS Marwaha, Manoj Kumar and SK Singh lead by Dr. SK Pandey, Director, CPRI, visited RAU campus at Pusa (Distt. Samastipur) and participated in seminar on “Promoting entrepreneurship in potato by farm and household women”. The above seminar was held during 29th to 31st January, 2006. Dr. SK Pandey delivered a lecture on “Potato development in the country” and promised to extend full support to the university for all kind of research know-how. He also proposed the technical work plan to the university authority as how to proceed with the cultivation of processing potato varieties and its utilization by local women to saturate important towns like Munzaafpur and Samastipur with products like chips, lachhas, etc.

The team of potato scientists visited a large number of potato fields. The Director gave suggestions for using healthy seed of popular varieties from CFRSS, Patna for multiplication and then further distribution to local growers. Dr. RP Rai delivered a talk on “Potato scenario in Bihar” and suggested improvements in the potato productivity by switching over to new potato varieties like Kufri Ashoka and Kufri Pukhraj. He also offered to spare breeder seed of these two varieties to the university for multiplication programme. Dr. RS Marwaha presented a full view of processed products of potato. He elaborated on the methodology involved in processing of different products. He also offered technical help in training RAU staff at CPRS, Jalandhar.

As an extension of the above programme Agri-expo was also held at RAU, Pusa for a period of four days w.e.f. 2nd to 5th March, 2006. Drs. RP Rai, S Kumar, Manoj Kumar and B Lal participated in the above programme and arranged an exhibition displaying live samples of fifteen varieties and other display materials. Forty kg of Kufri Chipsona-2 was also provided to RAU for chip making and its popularization.

**Workshop on Electron Microscopy**

Division of Plant Protection, CPRI, Shimla participated in the organization of 26th Workshops on Electron Microscopy organized by Sophisticated Analytical Instrumentation Facility (SAIF), Punjab University, Chandigarh between April 26-May 3, 2006. Trainees of the workshop had a full day lecture-cum-training in Electron Microscopy and Immuno-Electron Microscopy for plant virus diagnosis.

**Participation in Expert working group**

Dr. ID Garg, Head, Division of Plant Protection, CPRI, Shimla participated as expert in the Expert Working Group constituted by International Plant Protection Convention (IPPC), FAO, Rome to frame guidelines for the movement of micropropagated material and minitubers of potato in International trade between September 12-16, 2005 at Edingburgh (Scotland).
Invited lectures & Visitors

DDG visits CPRS, Patna

Dr. G. Kalloo, DDG, Horticulture, ICAR, New Delhi visited CPRS, Patna on 29th and 30th December 2005. During the visit he interacted with the scientists of the station and supervised the on-going research work of the station. He suggested improvements in the present activities of seed production and infrastructural facilities for laboratories, office and fields.

DG CIP visits CPRI

Dr. Pamela Anderson, Director General, International Potato Centre, Lima Peru visited CPRI, Shimla on 22nd February, 2006. She was accompanied by Dr. Sarath Ilangantileke, Regional Director, CIP from New Delhi office. During her visit she was shown the facilities available at the institute. She also discussed the various activities of the institute and the possibilities of mutual cooperation. During her meeting with the Heads of Divisions of the Institute she evinced keen interest on the work on inducing late blight resistance through incorporation of RB gene in Kufri Bahar and Kufri Jyoti in collaboration with Wisconsin University. She also briefed the scientists of CPRI about the work being carried out in this regard at CIP.

Another area of mutual interest was the introduction of cold chipping gene into processing varieties to avoid enhancement of sugars during cold storage of potatoes. She informed us that CIP is also working on this aspect and discussed the possibilities of exchange of expertise. She showed keen interest in the work on traditional methods of potato storage. She wanted to know about the places in India where farmers are practicing heap and pit methods of potato storage, the maximum storage period and total storage losses. She was informed that storage of potatoes in heap is popular throughout India and potatoes can be stored on-farm, in heaps for 90-110 days with total storage losses of less than 10%.

Dr. Pamela was also eager to know about the IPM schedule adopted by CPRI for control of PTM. She suggested introduction of eco-friendly component using Granulosis Virus, etc.

She also addressed the Scientist's meet of CPRI. She informed that under the new funding policies of the international funding agencies, more funds are being given to address the health, poverty alleviation and nutrition of regions with high population densities. Thus, in the near future CIP is going to expand its activities in Africa and India and especially so in North East India where the problems are more acute.

CIP Scientists visit CPRI

Ms Guruswamy, GIS Specialist, International Potato Centre, Lima, Peru visited CPRI, Shimla between 18th to 19th January 2006 to appraise herself of the work being carried out at CPRI, Shimla on use of Remote Sensing and GIS for potato acreage estimation in the Indo Gangetic Plains. The methodology of acreage estimation was explained to her in detail, viz., criteria for selection of study area i.e. States and districts, procedure and periods for ground truth (GT) data collection in different states. The study is being carried out in five major potato growing states of India i.e. Punjab, Haryana, UP, Bihar and West Bengal. These five states account for about 75% of potato acreage and 85% of potato production in the country. Complete enumeration is done for Punjab and Haryana states, while for other states cluster based approach is adopted. The ground truth data (GT) is collected during the active growth phase of the potato in different states. GT data is also collected for the other crops, which are in active growth phase during the period and likely to interfere with the signatures of potato crop. These crops include sugarcane and wheat in Punjab and Haryana, sugarcane, mustard and wheat in UP, mustard, sugarcane and maize in Bihar and rice and mustard in West Bengal. During 2001-02 to 2003-04 crop seasons,
Agriculture, H.P.); training of 1-2 PTM scientists in India or CIP, Lima under sponsored programmes, on-farm trial against PTM with farmers participation in Kangra valley and testing of GV, Bt formulations in talc powder after ascertaining LD 50 dose of these bio-pesticides in fields and stores.

Dr. Jonathan Snape, Commercial Director, SCRI delivered a talk on “Overview of research being done at SCRI and possible areas of collaboration” during his visit in the Institute on 17.03.2006.

Mr. Alok Sharma from TLS Pvt Ltd. gave a talk on “Introduction about EJ server: Its functions and facilities for online library searching” on 15.05.2006.

Activities of ATIC

Scientists, teaching staff, students and farmers from different parts of the country visit CPRI for acquaintance with potato research and for purchase of CPRI publications. A total of 16 scientists/ teaching staff, 146 students of UG and PG and 106 farmers visited the Institute at Shimla during the year. The visitors saw a film on potato and the institute museum. They were also acquainted with the mandate and R & D activities of the Institute through lectures, delivered by the social scientists. Technical bulletins worth Rs. 10,970/- were sold to the visitors through ATIC during January to May 2006. Besides, a number of extension bulletins were also supplied free of cost to the visiting farmers, students and extension officers.

Scientist meet at CPRI, Shimla

Scientist meet is the regular activity of the Institute, where on Friday, scientists, technical workers and research associates meet to discuss and deliberate on latest and emerging R & D issues. Following lectures were delivered and discussed in the last 6 months.
CPRI NEWSLETTER

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Topic</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>SJ Gawande</td>
<td>Advances in molecular based diagnostics</td>
<td>13.01.2006</td>
</tr>
<tr>
<td>PM Govindakrishnan</td>
<td>Developing models and decision support systems and their role in standardizing agro-techniques</td>
<td>27.01.2006</td>
</tr>
<tr>
<td>ID Garg</td>
<td>Guidelines for micropropagated material and minitubers of potato in the International trade</td>
<td>03.02.2006</td>
</tr>
<tr>
<td>MK Jatav</td>
<td>Liming of acid soils for crop production</td>
<td>10.02.2006</td>
</tr>
<tr>
<td>Priyanka Koundal</td>
<td>Molecular aspects of virus transmission by plasmophorids, aphids, thrips and white flies</td>
<td>10.03.2006</td>
</tr>
<tr>
<td>Nimisha Kaushal</td>
<td>Contributions of TMV investigation in plant biology</td>
<td>24.03.2006</td>
</tr>
<tr>
<td>P Manivel</td>
<td>Breeding for processing-where do we stand</td>
<td>31.03.2006</td>
</tr>
<tr>
<td>Anil Kumar</td>
<td>Information and communication technologies for rural development</td>
<td>21.04.2006</td>
</tr>
<tr>
<td>Neelam</td>
<td>Genetic engineering of chloroplast genome of higher plants</td>
<td>28.04.2006</td>
</tr>
<tr>
<td>Arun Pandit</td>
<td>Contract farming: Pros and cons</td>
<td>04.05.2006</td>
</tr>
<tr>
<td>Shashi Rawat</td>
<td>GIS and developing spatial decision support system with special reference to agro-ecological zoning</td>
<td>19.05.2006</td>
</tr>
<tr>
<td>RK Rana</td>
<td>Future trading in commodities implications for potato</td>
<td>26.05.2006</td>
</tr>
<tr>
<td>Sandhya Agarwal</td>
<td>An introduction to DNA microarray technology</td>
<td>2.06.2006</td>
</tr>
</tbody>
</table>

of potato cultivation for the first time in the autumn season in Afghanistan.

Drs. SK Pandey, Director and P Manivel, Sr. Scientist (Plant breeding) of the Institute have been enrolled as the Life Members of National Academy of Sciences (M.N.A.Sc), Allahabad, India from May 2006. They will be receiving the bi-monthly Journal “National Academy of Science letters” and “Proceedings of the National Academy of Science, India: Section B- Biological Science” free of cost.

Potato Facts

Frozen French fries will be produced in India

Exporters to India’s fast-growing market aim to super-size their offerings, which include potato products. McCain Foods Ltd. has been sending frozen potato products to India since 1998, but years earlier the company began planting test patches of potatoes around the country.

Gujarat province produced the best potatoes for processing, and later this year a frozen French fry and potato specialty plant is expected to open there, eventually employing 100 to 125 people. Not many people know that potatoes are a staple in India, Mr. Bird, Vice President of McCain Foods Ltd. says. The new plant will produce French fries, but McCain also plans to develop and make frozen versions of traditional Indian potato-based foods. Mr. Bird says these local products will eventually be the company’s biggest sellers.

Source: Global Potato News

Awards & Honours

Dr. Jai Gopal, Principal Scientist was awarded the prestigious ‘Invitation Fellowship’ by the Japan Society for Promotion of Science for 10 months to work as Visiting Professor at Faculty of Agriculture, Hokkaido University, Sapporo, Japan. He returned to India in May 2006 after availing fellowship. He worked in Japan on “In-vitro selection for drought tolerance” in the laboratory of Prof. Kazuto Iwama.

Dr. Mohinder Singh Kadian an Agronomist with the International Potato Center (CIP), has been honored as a “Scientist of the CGIAR-Peace and potatoes” for working two years as one of the principal players of the consultative Group for International Agricultural Research (CGIAR) who’s efforts were to rehabilitate the farming economy of Afghanistan. Dr. Kadian assisted in introducing Afghanist fresh supplies of certified seed and provided training to local agricultural technicians and farmers on multiplication and maintenance of quality seed at the farm-level and introduction

Working of CIP scientist at Afghanistan

JUNE - 2006
Promotions

<table>
<thead>
<tr>
<th>Name</th>
<th>Scientific</th>
<th>From</th>
<th>To</th>
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<tbody>
<tr>
<td>Dr. D Pattanayak</td>
<td>Scientist (SS)</td>
<td>Dr. D Pattanayak</td>
<td>Sr. Scientist</td>
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<td>Dr. NR Kumar</td>
<td>Scientist (SS)</td>
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<tr>
<td>Dr. P Kumar</td>
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<td>Scientist (SG)</td>
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<td>Dr. VP Chimote</td>
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Administrative

<table>
<thead>
<tr>
<th>Name</th>
<th>Administrative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smt. Heera Verma</td>
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<td>Sh. IS Negi</td>
<td>Asst. AAO</td>
</tr>
<tr>
<td>Smt. Bindra Gupta</td>
<td>UDC</td>
</tr>
<tr>
<td>Smt. Chandni Bhagia</td>
<td>Jr. Clerk</td>
</tr>
<tr>
<td>Sh. RS Mehta</td>
<td>Financial Graduation</td>
</tr>
</tbody>
</table>

Transfers

<table>
<thead>
<tr>
<th>Name</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Jyotsana Sharma</td>
<td>CPRS, Jalandhar</td>
<td>NRCP, Sholapur</td>
</tr>
<tr>
<td>Sh. SK Dey, T-5</td>
<td>CPRI, Shimla</td>
<td>ICAR, New Delhi</td>
</tr>
</tbody>
</table>

Retirements

<table>
<thead>
<tr>
<th>Name</th>
<th>Post</th>
<th>Retired on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. DS Singh</td>
<td>Sr. Scientist</td>
<td>31.01.2006</td>
</tr>
<tr>
<td>Sh. M Janardhan</td>
<td>T-5</td>
<td>01.03.2006</td>
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<tr>
<td>Sh. Pampoo Ram</td>
<td>SS Gr.III</td>
<td>05.01.2006</td>
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<td>Sh. Jagdish Rai</td>
<td>SS Gr.II</td>
<td>31.01.2006</td>
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<tr>
<td>Smt. Daivathya</td>
<td>SS Gr.I</td>
<td>31.01.2006</td>
</tr>
<tr>
<td>Sh. Dinu Ram</td>
<td>SS Gr. IV</td>
<td>28.02.2006</td>
</tr>
<tr>
<td>Sh. TA Subramaniam</td>
<td>SS Gr. III</td>
<td>28.02.2005</td>
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<tr>
<td>Sh. Seebu Ram</td>
<td>Tech. Off.</td>
<td>31.05.2006</td>
</tr>
</tbody>
</table>

**Vimal Oil and Food to enter snack zone**

Vimal Oil and Foods is getting ready to enter the fast-growing national snack foods market under the umbrella brand of Vimal. The MD of the company, Jayesh Patel, said their main focus would be on branded potato chips as it accounts for 65% share of the snack foods market. It will also offer other products like fried, extruded, filled and unfilled snacks as well as wet fried snacks. We will be the first company in India to introduce wet fried snacks claimed Patel. The organized snack foods market is estimated to be worth Rs. 10,000 crore plus and is growing at the rate of 30-35% per annum, said Patel. He feels that the market is big enough for new players. Vimal Oil is going to invest Rs. 42 crore in this project. In the first phase we will launch our snack foods in western and northern India. Thereafter, we will spread to other regions said Patel.

**Source: Economic Times of India**

**Call for new research into acrylamide in Korea**

French fries and potato chips available in South Korea are higher in the carcinogenic chemical acrylamide than previously thought, said an environmental group. The group told the Korea Times that the quantity of acrylamide in one 114g bag of McDonald's fries was equivalent to the WHO-recommended amount in 580 liters of water. WHO recommends no more than 0.5 mcg of acrylamide per litre of drinking water.

**Source: AP Foodtechnology**
soil. Diseases such as black scurf and common scab (Figs. 1a & b) make potato tubers ugly in appearance thereby reduce their market value whereas diseases such as soft rot and dry rots (Figs. 2 & 3) affect the produce directly causing economic losses. Russet scab, which closely resembles common scab disease in appearance is an emerging problem in potato production and is not controlled by seed treatment with boric acid or organomercurials (Fig. 4).

Treatment with organomercurials which are universal poisons and hazardous to human health and environment. With growing concern about quality of potato, human health and environment use of such hazardous chemicals is greatly discouraged. Organomercurials have already been banned in most of the developed countries. Use of organomercurials poisons the environment due to their non-degradation in the soil beside, the workers are also put to risk of mercury poisoning. Thus there is a great need to find safe and eco-friendly alternatives to manage the soil and tuber borne diseases. Management of soil and tuber borne diseases of potato without use of pesticides is a great challenge that requires identification of suitable alternative environment friendly control measures.

Safe alternatives to pesticides

Research work carried out at CPRI has revealed that such diseases can successfully be managed in an environment friendly manner by practicing soil solarization, seed treatment with safe chemicals, use of bio-control agents and suitable cultural practices. An integrated approach involving one or more of these methods can greatly reduce our dependence on pesticides and improve quality of the produce.

Soil solarization

Solar energy - a natural gift to mankind – is available in plenty in tropical and subtropical plains of our country. Antimicrobial properties of solar radiation had been realized by ancient Aryans as is evident from a sacred hymn from Atharvaveda "Ut Suryo Div Eti Puro Rakshansi Njurvan" (6.32.1) which means rising Sun destroys numerous germs causing diseases. Solar energy can successfully be trapped and targeted to clean the sick soil infested with pests and disease causing organisms by use of transparent polyethylene mulching (Fig. 5). It is an effective, simple, physical and non-hazardous method to control a variety of soil borne pathogens, pests and weeds.

Fig. 5. Soil solarization by polyethylene mulching

Best period and method

Soil solarization is best carried out during period of high temperature and intense solar radiation, which in Indian plains are available during May - June. Experiments carried out in north-western plains have revealed that third week of May to second week of June is the best period for soil solarization when there is maximum elevation in soil temperature. The maximum temperatures recorded during this period in solarized plots at 5cm depth were between 45 to 61°C, which were 5 to 14°C higher than the un-mulched plots. Light irrigation given 48 h prior to mulching with polyethylene sheet traps heated water vapors below the sheet and increases thermal conductivity in the soil. It also increases sensitivity of resting structure of most of the soil borne pathogens and pests to heat and thus adds to the efficacy of soil solarization. The heat under the
sheets is retained in soil for much longer time causing an effective control of the soil-borne pathogens.

**Disease control**

Soil solarization kills sclerotia of *Rhizoctonia solani* upto 5cm and *Sclerotium rolfsii* upto 15cm depth and results in clean produce with very low disease incidence. Soil solarization is distinctly superior to summer ploughing which is conventionally followed to control soil borne pathogens (Fig. 6). Russet Scab of potato has emerged as a major problem in seed potato production. Measures such as seed treatment with boric acid or organomercurials, which control common scab, do not control russet scab but soil solarization is a very effective method for control of russet scab (Fig. 7).

For easy application, roll the polyethylene sheet over a pipe and unfold it in the field.

Apply the sheet during less windy period of the day and keep it close to ground.

Open about 4 inches deep furrows in field at 2.5 m apart for laying out sheet 3m in width. The distance between the furrows can be changed according to the width of the sheet available.

Insert two edges of the polyethylene sheets about 3 inches deep in the furrow, bury the edges in soil and open the upper layer of sheet like page of a book. Align another sheet with free edge of the sheet now opened and repeat the process of burying the two edges and opening the new sheet till the required area is covered with the polyethylene sheets.

Compact all free edges of the sheet with the soil around them so as to prevent escape of soil moisture and heated air from inside the area thus mulched.

Place a few small (half to one kg capacity) plastic bags filled with soil as weights over the sheet where required to prevent flapping and tearing of polyethylene sheet by wind. The smooth edges of the bags do not cause tearing of the sheet.

Avoid entry into plots covered with polyethylene to the extent possible. If entry is necessary such as for sealing the leaks etc. prefer to enter bare feet or with smooth soled shoes to prevent tearing. Holes appearing in the polyethylene sheet if any can be scaled with rubber solution adhesive.

After the solarization period (4 to 6 weeks) remove the sheet.

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**Additional benefits**

In addition to the control of soil borne pathogens, soil solarization also brings about a remarkable reduction (up to 98.5%) in weed population. It increases mineralization in top layer of soil, bringing about up to 35.5% increase in nitrate nitrogen and up to 26.4% increase in available potassium up to 15 cm depth. Mineralization of soil caused by soil solarization thus helps in cutting down fertilizer requirement of potato crop. This could be a reason that yield equal or more to full dose of fertilizers (NPK 240:100:150) is observed in solarized soil applied with only 3/4th dose of NPK (Fig. 8).

![Fig. 6. Control of potato diseases by soil solarization](image)

![Fig. 7. Produce from soil solarized plots (right) and unsoarized plots (left)](image)

**Package to be followed for soil solarization**

- Carry out soil solarization during period of high temperature and intense solar radiation. A period of four weeks from mid May to mid June is quite effective in north western plains.
- Provide a light irrigation (around 50mm) to the field 48 hr before solarization. Thereafter, cultivate and level the field thoroughly before laying polyethylene sheet.
- To prevent tearing of polyethylene sheet level the field thoroughly so as to minimize any protrusions due to clods, stubble and stones.
- Use clear, transparent linear low density polyethylene (LLDPE) sheet 25 to 100um thick, about 3 m in width without any joints.
carefully from one end to another. If intact this may be used for another time, if torn dispose it off as scrap.

- To maintain disease free conditions in the solarized plot do not allow water to flow from contaminated area to the solarized plots and also do not plant infected or untreated seed in the solarized plots.

Increased mineralization results in a significant increase (15 to 25 per cent) in potato tuber yield. The beneficial effects of soil solarization persist even to the subsequent year. It is the only soil-friendly method of reclaiming the pest-infested patches in a fields used for seed potato production. The treatment is highly beneficial and cost effective in potato crop grown for seed purposes. For every rupee spent a benefit of up to four times was recorded when the seed crop was grown after solarization in previously sick plots.

Safe Chemicals

Efforts to find substitutes to hazardous organomercurials (Methoxy Ethyl Mercuric Chloride - MEMC) have resulted in identification of some safe and effective chemicals such as acetic acid, zinc sulphate and boric acid.

Boric acid: Boric acid not only controls black scurf (Rhizoctonia solani) but also common scab (Streptomyces scabies), dry rots (Fusarium spp.) and soft rots (Erwinia spp.). Spraying or dipping of seed tubers in 3 per cent solution has been recommended for the control of these diseases. Boric acid is safe and as effective as organomercurials in control of tuber diseases (Fig. 9). Treatment given strictly before cold storage is safe to tubers and more effective than the treatment carried out after cold storage. Further work carried out to economize on the use of boric acid has revealed that spray application of 3% boric acid was economical and as effective as the dip treatment. Spray treatment can be carried out effectively using a manual sprayer or seed treatment device (Figs.10 & 11). Spray application is also much cheaper than the dip treatment as less amount of chemical is required for the treatment. The cost of good quality (laboratory grade 99.5% pure) boric acid comes to around Rs.110/kg (Rs. 5500/ per 50kg). Average cost of chemical required to treat one quintal of seed by boric acid through spray is around Rs. 5.0 as against Rs. 12.0 with the organomercurials. Boric acid seed treatment has now completely replaced the use of hazardous organomercurials at all CPRF farms and is becoming popular with the farmers.

Package for boric acid seed treatment for control of the tuber-borne diseases

- Seed potato tubers should be treated after harvest but before cold storage. Tubers should be properly cured, freed from bruises and dirt. If required wash the tubers in water and dry in shade before the treatment.

- To treat one quintal of seed potato by spray method prepare 3% boric acid by dissolving 45g of pure boric acid (laboratory grade 99.5% pure) in 1.5 liter of water. (total quantity of the chemical required for the seed to be treated should be worked out accordingly).

- To prepare the boric acid solution put the chemical in small quantity of warm water. Stir till it is fully dissolved and the solution becomes colourless. Now mix this solution with additional amount of water (at normal temperature) and make the required volume.

- Spread the seed tubers in a single layer over clean cemented floor or over a plastic sheet.

- Spray the boric acid solution on the seed tubers so as to cover entire surface of the tubers. For this, turn the tubers after first spray and repeat the spray till whole surface of the tubers is wet with the solution.
Quick dip treatment (dip and remove immediately) with boric acid is equally effective. The same solution can be used up to 30 dips. However, cost in dip treatment will be almost double than the spray method since only half of the solution is used effectively by dip method. Dip treatment will also create problem of disposal of unused solution.

Allow the treated tubers to dry completely in shade before filling these in gunny bags. Mark the bags with red ink as “Treated”.

Do not treat sprouted or chitted tubers as this may damage the sprouts and delay emergence.

Biocontrol

Biocontrol of plant pathogens using naturally occurring antagonistic microorganisms is a safe and eco-friendly alternative to the use of chemicals. It has a great potential in control of soil and tuber borne diseases especially in organic farming. Efforts to identify beneficial natural microorganisms at CPRI have resulted in development of two ready to use bioformulations of *Trichoderma viride* (10^7 c.f.u./g) effective against black scurf and *Bacillus subtilis* strain B5 (10^10 c.f.u./g) effective against bacterial wilt. These bioformulation have been evaluated as seed tuber treatment in several field trials at different locations and found effective under field conditions (Figs. 12 & 13). Treatment with B5 also results in an increase in potato yield.

![Graph showing the control of bacterial wilt by *Bacillus subtilis* (B5)](image)

**Fig. 13. Control of bacterial wilt by *Bacillus subtilis* (B5)**

Prepare 0.25% solution of B5 by dissolving 100g of the formulation in 40 l of water. Dip 80 kg of potato in the solution for 20 minutes. Treat a second lot of 80kg in the same solution.

Plant the treated tubers on the same day or at the most the next day of the treatment with the bioformulations.

The tubers to be treated with the bioformulations should not be treated with pesticides.

**Cultural practices**

Cultural practices which deprive the pathogens from their natural host or reduce their build up in the soil helps in disease control. Depending upon the problem prevailing in the regions following practices can be adopted.

**Alteration in dates of crop planting / harvesting**

- Delay in planting from October 10 to November 2 in north-western plains reduces russet scab of potato to one half.
- Advancing harvest of the crop from mid February to mid January significantly reduces black scurf disease in north-western plains.
- Harvesting the crop before February 15 when soil temperature does not cross 28°C results in a lower incidence of charcoal rot in Indo-Gangetic plains.

**Regulating soil moisture**

- Avoiding high soil moisture and heavy soils reduces incidence of russet scab
- Irrigation at four to seven day interval at tuber initiation reduces common scab.
Frequent irrigations to spring crop in Indo-Gangetic plains reduce charcoal rot.

Crop rotations
- Rotation of paddy–wheat–potato or onion-maize-potato controls common scab.
- Rotation of potato with maize or sun hemp reduces black scurf and charcoal rot.
- Rotation of potato with pea and wheat reduces powdery scab in high hills.

Soil amendments
- Soil amendments with neem or mustard cakes reduce black scurf.
- Soil amendment with groundnut cake reduces Fusarium wilt.
- Application of ammonium sulphate lowers soil pH and suppresses common scab.

Proper handling of produce
- Avoiding bruises by careful handling of potato tubers minimizes dry and soft rots.

Integrated Approach
Since most pathogens causing seed and soil borne diseases survive both in soil and on tubers, any single method of treatment is less likely to be effective for the complete control. An integrated schedule for disease management would be an ideal approach.
- Incorporation of wheat crop residue as soil amendment together with summer irrigation followed by soil solarization reduces black scurf more effectively than a single method.
- A combination of soil solarization together with seed treatment with Trichoderma viride or 3 per cent boric acid controls black scurf in infested fields much better than the individual treatments.

Following some of the above eco-friendly strategies we can save our environment and grow potato free of pesticides for which there is a growing demand both in the national and international market.

- RK Arora
मुख्य अधिकारियों के नाम संस्थान के निदेशक और अधिकारकर्म के नाम उल्लेख किये गए हैं।

उर्दू शब्दों के लिए हिंदी अनुवाद का संचालन किया गया है।

कृषक दिवस एवं कृषि प्रदर्शनी

जवाहर लाल नेहरू कृषि विभाग न्यूयोर्क, जबलपुर के अन्तर्गत कृषि विभाग केंद्र मुरुणा में दिसम्बर 08 फरवरी 2006 को कृषक दिवस एवं कृषि प्रदर्शनी का आयोजन समाप्त हुआ। यह केन्द्र में केंद्रीय आयुक्त अनुसंधान केंद्र, चिकित्सार्थ से लेकर प्रदर्शनी में आयुक्त की विभिन्न किस्मों एवं ऊपर नहीं ग्रामीण द्वारा आयुक्त को उन्नत तकनीकों एवं संसाधन के द्वारा प्रकाशित साहित्य की किताबों के लिए व्यापार के माध्यम से प्रदर्शन किया गया। यह कृषि दिवस में चिकित्सार्थ केंद्र के डॉ. डी. ऐ.चे. अरुण, जेन, राम, चिकित्सा और आयुक्त दर्शन से आयुक्त की विभिन्न किस्मों, प्रजाज्ञान आयुक्त दर्शन तकनीकी एवं संसाधन के द्वारा प्रकाशित साहित्यकी की आवश्यकता को पूरा करने के लिए व्यापार के माध्यम से प्रदर्शन किया गया।

प्रदर्शनी एवं कृषि मेला

केंद्रीय कृषि मंत्रालय, भारत सरकार और छत्तीसगढ़ राज्य सरकार के संयुक्त तत्त्वेत्व में चिकित्सा क्षेत्र की प्रदर्शनी एवं कृषि मेला दिसम्बर 13 फरवरी 2006 से 17 फरवरी 2006 का आयोजन इंडिया गांव कृषि विश्वविद्यालय, रायपुर में समाप्त हुआ। यह मेले में केंद्रीय आयुक्त अनुसंधान केंद्र, चिकित्सा द्वारा प्रदर्शनी में, आयुक्त की विभिन्न किस्मों एवं ऊपर नहीं एवं संसाधन के द्वारा प्रकाशित साहित्य की किताबों के लिए व्यापार के माध्यम से प्रदर्शन किया गया।

आयुक्त व्यक्तियों अनुयाय द्वारा, फूल थंडियों स्ट्रूशियों लाए।