PULSES NEWSLETTER

Indian Institute of Pulses Research, Kanpur

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CONTENTS

Focussed Research Project on *Kabuli* Chickpea

Considering the consumer preference and premier price of large seeded (>50g/100 seeds) *kabuli* chickpea, the Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India has sanctioned a contract research project on "Development of extra large seeded *kabuli* chickpea varieties for crop diversification" with a total outlay of Rs. 129.60 lakh under ISOPOM to develop *kabuli* chickpea varieties having high yield potential and large seeds (>50 g/100 seeds). The IIPR is the lead centre. Other cooperating centres are ICRISAT, Patancheru; IARI, New Delhi; PAU, Ludhiana; MPAU, Rahuri and seven testing centres, besides off-season nursery at UAS, Dharwad.

The launch meeting of the project was held on April 28, 2006 at IIPR, Kanpur. While inaugurating the meeting, Dr. Masood Ali, Director, IIPR mentioned that India imports about 0.5 million tonnes of chickpea every year from Mexico, Australia, Canada, Syria and Turkey. He called upon the collaborating scientists to make their best efforts to develop extra large seeded *kabuli* chickpea varieties (50-60g/100-seed wt.) which are free from problems associated with imported *kabuli* varieties such as long duration and susceptibility to common diseases like *Fusarium* wilt.

Various collaborators presented the status of *kabuli* chickpea cultivation in different states. Later, technical programme for current season was finalized. Among various collaborators, Dr. S. K. Chaturvedi (IIPR), Dr. P. M. Gaur (ICRISAT), Dr. J.S. Sandhu (PAU), Dr. L.B. Mhase (MPAU) and Dr. Jitendra Kumar (IARI) were present during the meeting. Other Co-PIs and scientists from IIPR including Dr. J.D.S. Panwar, Dr. B.B. Singh, Dr. Vishwadhar and Dr. N.B. Singh also attended the Meet.

IMC Re-constituted

The Institute Management Committee has been re-constituted. Dr. Masood Ali, Director, IIPR is the Chairman and other members are Director of Agriculture, U.P.; Director of Agriculture, M.P.; Dr. R.P. Katiyar, CSA UA & T, Kanpur; Dr. R.P. Dua, NBPGR, New Delhi; Dr. S.N. Sinha, IARI Regional Station, Karnal; Dr.D.L.N.Rao, IISS, Bhopal; Finance and Accounts Officer, IISR, Lucknow; Mr. Ramesh Dubey, Mumbai; Mr. Subhash Baburao Patil, Nanded (MS) and Administrative Officer, IIPR, Member Secretary.

The first meeting of the re-constituted IMC was held on June 30, 2006 at the Institute. Drs. Masood Ali, R.P. Dua, R.P. Katiyar, S.N. Sinha, Mr. Ramesh Dubey, Mr. Subhash Baburao Patil and Mr. Rajendra Singh were present in the meeting. All the Heads of the Divisions/Sections and Project Coordinators presented the highlights of achievements made during the past four months. The Committee reviewed different research and development activities carried out during the period and appreciated the overall activities and achievements of the Institute.

XXII INSTITUTE MANAGEMENT COMMITTEE MEETING
JUNE 30, 2006

QRT Constituted

To review the research accomplishments and developmental activities of IIPR and AICRP on Chickpea, Pigeonpea, MULLaRP and Arid Legumes during the period 2001-05, the ICAR has constituted Quinquennial Review Team under the chairmanship of Dr. R.B. Deshmukh, Vice-Chancellor, Mahatma Phule Agricultural University, Rahuri (M.S.). Dr. V.P. Singh, Ex. Director Research, CCS HAU, Hisar; Dr. S.V. Hegde, Ex. Professor, UAS, Bangalore; Dr. Janardhan Singh, Dean, IAS, BHU, Varanasi; Dr. M.V. Reddy, Ex. Principal Scientist, RARS (ANGRAU), Lam (A.P.) and Dr. J.D.S. Panwar, HoD, CPBM, IIPR, Kanpur are other members of the QRT.

ICAR – ICRISAT Meeting Held

ICAR-ICRISAT meeting was held on May 24-25, 2006 at New Delhi to review the progress made in the collaborative programmes during 2002–05 and strengthen the future collaboration in the mandate crops. Director General, ICAR, Dr. Mangala Rai and Director General, ICRISAT, Dr. William D. Dar chaired the sessions. The progress made under the partnership projects during the period under review had been highly rewarding in terms of identification of promising chickpea lines for various traits, development of chickpea varieties and CMS system in pigeonpea with good number of high yielding experimental hybrids and collection of wilt pathogens from different regions. Three new areas of research have been identified for future collaboration between ICAR and ICRISAT such as, development of cold tolerant and short duration chickpea varieties for North India, development of short duration varieties of chickpea having tolerance to drought, *Helicoverpa* and high temperature for Central and South India, and heterosis breeding in pigeonpea.

Announcement

Summer School
on
Crop Diversification through Pulses for Sustainable Crop Production

Duration **: August 10–30, 2006**

Organizer **: Indian Institute of Pulses Research, Kanpur**

Research Highlights

New Varieties of Pulse Crops Identified

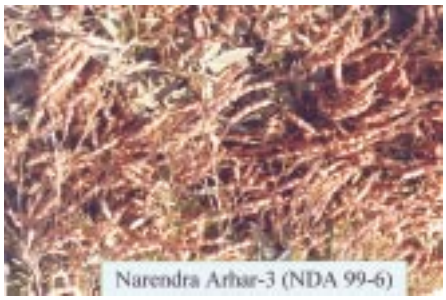
Following varieties of different pulse crops were identified during Annual Group Meet on *kharif* pulses held at Coimbatore on May 2–4, 2006:

WBU 109: Urdbean variety developed at PORS, Berhampore (WB) from the cross Pant U 26 x B 76. It gives an average yield of 1200 kg/ha and has about 28% yield superiority over the check. It is tolerant to MYMV and resistant to cercospora leaf spot and leaf crinkle virus. It has been identified for spring cultivation in eastern U.P., Bihar, Jharkhand, West Bengal and Assam.

HFP 9907 B: Green seeded fieldpea variety developed at CCS HAU, Haryana from the cross Rachna x Bonneville. It gives an average yield of 2105 kg/ha with 11% yield superiority over the best check. It is resistant to powdery mildew, root rot and root knot nematodes and tolerant to rust. The variety has been identified for cultivation in western U.P., Punjab, Haryana, Delhi, Uttaranchal and Rajasthan.

Pusa 2002-2: Pigeonpea variety developed at IARI, New Delhi from the cross Sel. 90310 x H 88-45 and identified for cultivation in Punjab, Haryana, Rajasthan, Delhi, western U.P. and Uttaranchal. Its average yield is 1671 kg/ha. Apart from yield superiority, it has an additional advantage of five days early maturity than the check variety Pusa 992.

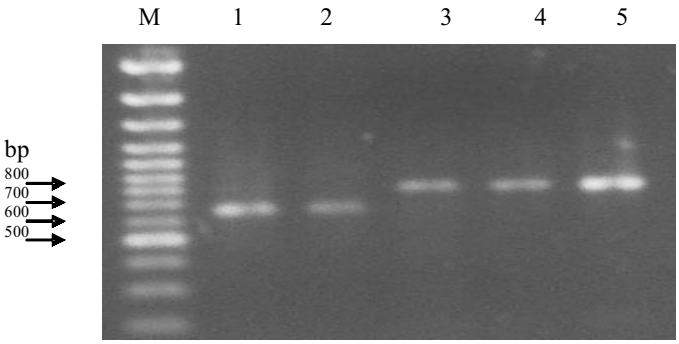
NDA 99-6 : Pigeonpea variety developed at NDUA & T, Faizabad from the cross ICP 8862 x ICP 11204. It has erect and semi



compact plant with profuse branching. This variety is resistant to SMD and Alternaria blight and moderately resistant to wilt and root knot nematode. It has been identified for pre-*rabi* sowing in Assam, Bihar, Jharkhand, eastern U.P. and West Bengal.

Cloning of Novel Insect Resistance Genes at IIPR

The gram pod borer (*Helicoverpa armigera*) causes heavy yield loss to pulses production in the country. Chemical methods to control the pest are neither ecologically sustainable nor economically viable. Therefore, search for plant derived genes in addition to *Bt* genes is a major goal for development of transgenics for sustainable control of this pest. Genes encoding inhibitors of insect mid gut proteases (PI genes) are the potential candidate genes for this purpose. Genomic DNA from two varieties each of eight different pulse crops was amplified using synthetic PI primers. These primers were synthesized based on the sequences available in publicly available Gene Bank database. This resulted in identification of six PCR clones which represent putative protease inhibitor genes. The amplified fragments are now being cloned into expression vectors and will be used for transformation of chickpea and pigeonpea.



Lanes M: Marker DNA, 1- lentil (IPL 81), 2- lentil (DPL 15), 3- Urdbean (DPU 88-31), 4- Mungbean (Pant Mung 1), 5- Mungbean (TAP 7)

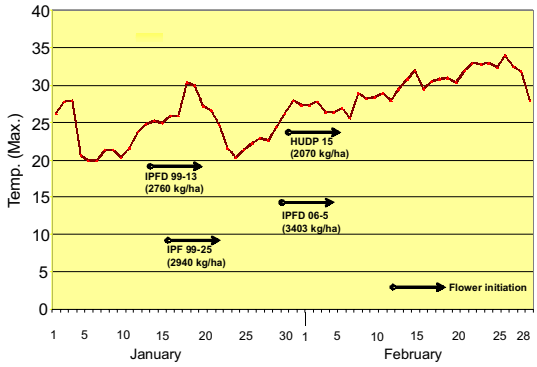
Amplification of protease inhibitor genes in pulse crops

Subhojit Datta and N P Singh

High Temperature Injury in Fieldpea

Daily maximum temperature above 25^0 C is considered as the threshold level for heat stress in cool season pulse crops, as it affects seed yield by reducing flowering, fertilization and seed formation. Fieldpea is sensitive to heat at the bloom stage. A brief exposure to high temperature during flowering causes heavy loss due to flower drop and pod abortion and during seed filling, it can reduce seed set, seed weight and accelerate senescence, resulting in reduced seed yield.

During the past few years, an abrupt rise in temperature has been observed in the months of January and February in North India, which led to poor yield in the ruling pea variety HUDP 15. It was observed that high temperature (> 25^{0}C) coincided with the onset of reproductive phase of HUDP 15. It affected not only total biomass, but also reduced pod setting by 30%, seeds per pod by 41% and seed weight by 36% and as a result, the overall productivity reduced drastically (48%). Preliminary screening of breeding lines at IIPR revealed wide variation in pod setting at high temperature. An advanced breeding line, IPFD 06-5 showed tolerance to high temperature at reproductive stage and gave an yield of 3403 kg/ha as against 2070 kg/ha in HUDP 15 during *rabi* 2005-06.



Effect of high temperature on yield of fieldpea genotypes (2006)

G.P. Dixit

Fusarium Wilt Resistant Chickpea Donors Identified

Among various biotic constraints, chickpea wilt caused by *Fusarium oxysporum* f sp. *ciceri* is the most important and wide-spread disease. Application of fungicides in soil to control this disease is uneconomic, difficult and time consuming. The most feasible and economic option is to control the disease through exploitation of host plant resistance (HPR). Keeping this in view, IIPR initiated systematic breeding programme to incorporate wilt resistance in high yielding agronomic backgrounds. As a result, 22 advanced breeding lines *viz.,* IPC 97-29, -2000-52, -2000-14, -2000-18, -2004-1, -2004-2, -2004-3, -2004-4, -2004-8, -2004-11, -2004-15, -2004-16, -2004-21, -2004-34, -2004-35, -2004-37, -2004-43, -2004-46, -2004-52, -2004-62, -2004-63 and IPC 2004-74 have been developed. In multilocation screening in wilt sick plots four elite lines *viz*., IPC 2000-52, -2000-14, -2000-18 and IPC 97-29 exhibited stable resistance against *Fusarium* wilt and have showed <10% plant mortality. These four lines have shown resistance in wilt sick plot at IIPR consecutively for four years, whereas other 18 IPC lines exhibited stable wilt resistance consecutively for two years. Therefore, lines *viz.,* IPC 2000-52, -2000-14, -2000-18 and IPC 97-29 can be utilized as donor parents to develop high yielding wilt resistant chickpea varieties.

S.K. Chaturvedi and S.N. Gurha

Survival of *Rhizobium* on Fungicide Treated Seeds

An experiment was conducted on urdbean to understand the compatibility of different fungicides *viz.,* Carbendazim and Thiram with *Rhizobium*. *In vitro* studies revealed that *Rhizobium* strain Urid 10B was compatible with fungicides up to 2000 ppm, which is higher than recommended concentration (1000 ppm *a.i.*). Survival of *Rhizobium* on urdbean seeds showed decline in rhizobial population with time of storage after seed inoculation. This decline in population was more steep in fungicide treated seeds than control. Therefore, fungicide treated seeds inoculated with *Rhizobium* should be sown within 8 hours of treatment to improve their performance.

K. Swarnlakshmi and M. Singh

SRC Meeting Held

Staff Research Council (SRC) meeting of the Institute was held on May 17-22, 2006 under the chairmanship of Dr. Masood Ali, Director, IIPR. Project Coordinators, Heads of Divisions and scientists participated in the meeting to review the progress of various research projects and finalize technical programmes for the next year. The Chairman in his opening remarks, apprised the house about development of research infrastructure, externally funded projects awarded to IIPR and major research accomplishments.

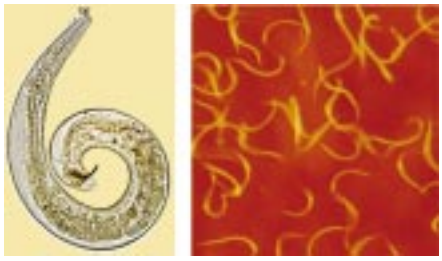
Research highlights of different projects were presented by respective Principal Investigators. Five new projects on different aspects *viz.*, water use efficiency in pulses production, mineral nutrition of major pulses, improvement in *dal* recovery, development of suitable plant type in short duration pigeonpea and socio-economic impact assessment of farmers' participatory research and extension programme on pulses in Bundelkhand region were approved. In addition, one synopsis for Ph.D. programme on inheritance and tagging of gene(s) resistant to *Fusarium* wilt in pigeonpea was also approved.

The Chairman in his concluding remarks called upon the scientists to focus on development of high yielding varieties and emphasized upon the need for appropriate production and protection technologies for increasing pulses productivity.

Compatibility of Entomopathogenic Nematodes with Pesticides

Studies on the effect of insecticides (Endosulphan and Monocrotophos), fungicide (Mancozeb), weedicide (Pendimethalin) and botanical (Neemarin) on the activity and infectivity of infective juvenile of *Steinernema seemae* were carried out under laboratory condition. The aqueous suspensions of the pesticides were prepared as per the recommended doses for field application and used along with control (exposed to distilled water). The population of infective juveniles of *S. seemae* was reared on final instar larvae of *Galleria mellonella.* Hundred infective juveniles (IJs) were transferred into petriplates containing 1 ml of each concentration of pesticide solution at room temperature. Treatments were replicated three times. The mobility and mortality of IJs were observed after exposure to different pesticide treatments for 72 h under Leica DMW stereoscopic microscope.

Two commercially available insecticide tested *viz.*, endosulphan and monocrotophos were found most promising as 60% of the infective juveniles were active. As regard with pendimethalin, 78% EPN retained their activity. In case of botanical



(A) (B)

(A). Steinernema seemae healthy
(B). EPN juveniles showing tolerance to insecticides

Neemarin, the EPN showed 66% activity. These results indicated that insecticides, weedicide or botanical are compatible with EPN to a large extent, hence EPN can be used as a component in IPM modules for *H. armigera* and other lepidopteran borer complex of pulses.

S. S. Ali, Rashid Pervez, R. Ahmad and M. A. Hussain

Group Meet on *Kharif Pulses*

The Annual Group Meet of All India Coordinated Research Project on Pigeonpea and MULLaRP (*kharif* pulses) was held at TNAU, Coimbatore on May 2-4, 2006. Dr. Ramaswamy, Vice Chancellor, TNAU, in his inaugural address stressed that there is a lot of scope for generating low cost technologies in the area of sowing method, conservation of moisture, integrated pest management, *etc.,* to reduce the yield gap. He stressed upon the adequate supply of quality seeds and standardization of seed production technology for hybrids.

Dr. Masood Ali, Director, IIPR, in his address mentioned that during the last ten years, productivity of pigeonpea has declined by 100 kg/ha and that of urdbean and mungbean by 30-40

kg/ha. This decline is due to sudden climatic changes in the country. He suggested that research programmes need to be geared up on extremities of weather like drought, temperature, excess moisture, *etc*. He informed that a target of 20 million tonnes of pulses production has been set up by the end of XI Plan, for which efficient management practices will have to be popularized.

Dr. B.B.Singh, Project Coordinator (MULLaRP) and Dr. N.D. Majumder, Project Coordinator (Pigeonpea) focussed on some researchable issues like broadening of genetic base, development of high yielding and multiple disease resistant varieties and refinement of production technology for different cropping seasons. Later, the results of *kharif* 2005 were discussed and the technical programme for *kharif* 2006 was finalized.

Farmers' Day Organized

The Institute organized Farmers' Day on May 30, 2006. A large number of farmers from Kanpur Nagar, Kanpur Dehat, Unnao and Hamirpur districts participated in the programme. Dr. R. P. Katiyar, Director Research, CSAUA&T was the Chief Guest. Dr. Masood Ali, Director, IIPR addressed the farmers and urged them to incorporate short duration pulses like mungbean and urdbean in spring/summer season to enrich the soil health. He cautioned the farmers about the ill effects of continuous mono-cropping in cereal based cropping systems. Pulse based crop rotations increase crop yield and improve soil health. Dr. Katiyar stressed on the importance of pulses in the human diet and crop diversification. A Farmer – Scientist interaction was also organised on the occasion. Scientists from different disciplines informed farmers about the improved varieties of pulses (mainly mungbean and urdbean) and improved production, protection and post- harvest technologies. Farmers visited field demonstrations, where improved technologies were demonstrated. IIPR *Dal* Mill was demonstrated

to the farmers, which they found as very efficient and effective in processing pulse grain to *dal*. The process of ridge making by Ridge Planter was also demonstrated. Farmers' friendly extension literature on pulses production and protection technologies was distributed among the farmers.

Group Meet on Late Pigeonpea

Group Meet on long duration pigeonpea was held at IIPR, Kanpur on June 19, 2006. About 35 participants representing six AICRP (Pigeonpea) centres *viz.*, BHU, Varanasi; RAU, Dholi; CSAUA&T, Kanpur and Belatal; NDUA&T, Faizabad and IIPR, Kanpur participated in the meeting.

Dr. Masood Ali, Director, IIPR in his introductory remarks expressed his concern on low yield and susceptibility to diseases of the newly released varieties. He emphasized that balanced fertilization should be resorted for good yield. Efforts should be made to maintain optimum plant population which is often a problem in pigeonpea. Dr. N.D. Majumder, P.C. (Pigeonpea) gave a brief resume of the research achievements of the last year. Research results of the previous year were reviewed in the meeting and the technical programme for the coming season was finalized. IVT (Late) trial was formulated with 16 entries. Ten entries were promoted from IVT to AVT1 (Late) based as yield superiority and resistance to biotic stresses. IVT (Pre-*rabi*) trial was formulated with 9 entries along with three checks and one entry was promoted from IVT to AVT 1 (Pre-*rabi*).

नूतन प्रजातियाँ

डब्लू.बी.यू. 109 : उर्द की इस नई प्रजाति की औसत उपज 1200 कि.ग्रा./हे. है जो मानक प्रजातियों की उपज से 28 प्रतिशत अधिक है। पीत चितेरी विषाणु रोग के प्रति सहनशील तथा सर्कोसपोरा पत्र बुंदकी और पर्ण व्यकुंचन विषाणु रोधी यह प्रजाति पूर्वी उत्तर प्रदेश, बिहार, झारखण्ड, पश्चिम बंगाल तथा आसाम में बसन्त ऋतु हेतु चिन्हित की गई है।

एच. एफ. पी. 9907 बी : हरे दानों वाली मटर की इस प्रजाति की औसत उपज 2105 कि.ग्रा./हे. है जो मानक प्रजातियों की उपज से 11 प्रतिशत अधिक है। चूर्णी कवक, मूल विगलन व जड़ गांठ सूत्रकृमि के प्रति अवरोधी व रतुआ सहनशील यह प्रजाति पश्चिमी उत्तर प्रदेश, पंजाब, हरियाणा, दिल्ली, उत्तरांचल व राजस्थान हेतु चिन्हित की गई है।

पूसा 2002-2 : अरहर की इस प्रजाति की औसत उपज 1671 कि.ग्रा./हे. है। उत्पादकता में श्रेष्ठ होने के साथ-साथ इस प्रजाति में मानक प्रजाति पूसा 992 की तुलना में पकने में 5 दिन का कम समय लेना अतिरिक्त गुण है। यह प्रजाति पंजाब, हरियाणा, राजस्थान, दिल्ली, पश्चिमी उत्तर प्रदेश व उत्तरांचल हेतु चिन्हित की गई है।

एन.डी.ए. 99-6 : अरहर की यह नई प्रजाति सीधे पादप प्रकार एवं अधिक शाखाओं के गुण वाली है। यह प्रजाति बांझ रोग तथा आल्टरनेरिया पत्र बुंदकी रोगरोधी तथा उकठा व जड़ गाँठ सूत्रकृमि के विरुद्ध मध्यम स्तर की अवरोधी है। सितम्बर के प्रथम पखवाड़े में बुवाई हेतु उपयुक्त यह प्रजाति आसाम, बिहार, झारखण्ड, पूर्वी उत्तर प्रदेश तथा पश्चिमी बंगाल हेतु चिन्हित की गई है।

कृषक दिवस मनाया गया

संस्थान में 30 मई 2006 को कृषक दिवस आयोजित किया गया। इस कार्यक्रम में कानपुर नगर, कानपुर देहात, उन्नाव व हमीरपुर जिलों के किसानों ने बड़ी संख्या में भाग लिया। डा.आर.पी. कटियार, निदेशक (शोध), चन्द्रशेखर आजाद कृषि एवं प्रौद्योगिकी विश्वविद्यालय, कानपुर कार्यक्रम के मुख्य अतिथि थे। डा. मसऊद अली, निदेशक ने कृषकों का आह्वान करते हुए मृदा के स्वास्थ्य में सुधार हेतु बसन्त/ग्रीष्म ऋतु में मूंग व उर्द जैसी शीघ्र पकने वाली दलहनी फसलों को फसल चक्र में सम्मिलित करने को कहा। उन्होंने कृषकों को धान्य आधारित फसल चक्र में एक फसल को लगातार उगाते रहने के दुष्परिणामों से सावधान रहने को कहा। डा. अली ने बताया कि दलहन आधारित फसल प्रणाली से फसलों की अधिक उपज के साथ मृदा की गुणवत्ता पर अनुकूल प्रभाव पड़ता है। डा. कटियार ने आहार में दलहनों की महत्ता तथा फसल विविधीकरण पर जोर दिया। इस अवसर पर वैज्ञानिकों ने दलहनों की उन्नतशील प्रजातियों (मुख्यतः मूंग व उर्द) तथा वैज्ञानिक प्रबधंन, सुरक्षा तथा कटाई उपरान्त तकनीक के बारे में कृषकों को जानकारी दी। कृषकों को आई. आई. पी. आर. दाल मिल भी प्रदर्शित की गई जिसको उन्होंने दलहन के प्रसंस्करण करके दाल बनाने के लिए अत्यन्त प्रभावी पाया। रिज प्लांटर द्वारा मेड़ बनाने की प्रक्रिया भी उनको दिखाई गई। दलहन उत्पादन व सुरक्षा तकनीक पर संस्थान द्वारा प्रकाशित कृषकोपयोगी साहित्य भी कृषकों को वितरित किया गया।

दलहनी फसलों के लिए उठी हुई शैय्या पर बुवाई की तकनीकी

बारानी दशाओं में उगाई जाने वाली दलहनी फसलों की उत्पादकता में वृद्धि हेतु संसाधन संरक्षण तकनीक का विकास अत्यन्त महत्वपूर्ण है। रबी 2005-06 में संस्थान में चना और मसूर की उठी हुई शैय्या पर बुवाई करने का मूल्यांकन किया गया। इससे जड़ तंत्र तथा उपज को बढ़ाने वाले अन्य कारकों में वृद्धि के कारण मसूर की उत्पादकता में 19.6% की वृद्धि हुई। इस प्रणाली में समतल शैय्या की तुलना में जल की आवश्यकता में 23.9% की कमी हुई। चना में भी उठी हुई शैय्या पर बुवाई करने से जल उपयोग कुशलता में वृद्धि हुई, सिंचाई की आवश्यकता में 25% की कमी आई तथा उत्पादकता भी समतल शैय्या पर बुवाई के बराबर ही रही। इस प्रकार, उठी हुई शैय्याओं पर दलहनी फसलों की बुवाई संसाधन संरक्षण की कुशल तकनीक सिद्ध होती है।

Personnel

A. Promotions

Name	Promoted to	w.e.f.
Shri Anil Saxena	AAO	31.5.06
Shri Lallan Yadav	T 7/8	31.2.05
Shri T.N. Tiwari	T 7/8	31.2.05
Shri Desh Raj	T 7/8	1.7.05
Shri M.R. Tripathi	T 7/8	1.7.05

- Mr. P.S. Syal, Asstt. Administrative Officer of this Institute has been promoted as Administrative Officer. He was relieved from IIPR on 20.5.06 to join at IARI, New Delhi.
- Dr. J.G. Varshney, Principal Scientist of this Institute has been selected as Director, NRCWS, Jabalpur. He was relieved from IIPR on 8.5.06 to join to the new position.

B. Transfers

Name	Post	From	To	w.e.f.
Dr. R.K. Nigam	Pr. Scientist	VPKAS, Almora	IIPR, Kanpur	5.6.06

C. Retirements

Name	Post held	Date of retirement
Shri Gauri Shanker	Adm. Officer	31.5.06
Smt. Maharana	SSG II	30.6.06
Shri Ram Prasad	SSG I	30.6.06

Director's Desk

Dear Readers,

Retrospection of the pulse production during the first four years of the X Plan (13.34 million tonnes) shows that no significant improvement has been witnessed over the IX Plan (13.15 million tonnes) primarily due to abiotic stresses such as drought and abrupt change in temperature. If this trend continues, the demand supply gap for pulses would be insurmountable in the near future unless corrective steps are taken immediately.

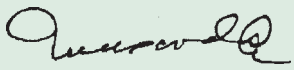
The projected requirement of pulses by the terminal year of XI Plan is estimated at 20 million tonnes, which is almost 44% higher than the present production of 13.92 million tonnes. Three-pronged strategy *i.e.*, improving productivity, avoiding post-harvest losses and expanding area under pulses needs to be adopted during the XI Plan for increasing pulse production. The productivity needs to be raised to 800 kg per ha and about 2.5 million ha additional area has to be brought under pulses through diversification of the existing cropping systems.

A conservative estimate of the average farm yield advantage of improved technology is about 30% in pulses. Therefore, we need to popularize the improved technologies already generated in the past among farmers through aggressive transfer of technologies. Shortage of quality seeds of improved varieties, which is the major constraint to pulses productivity, has to receive priority. Recognizing this, a Mega project on seed production has already been launched in the country. Efficient management of rainwater and appropriate crop management practices to enhance water use efficiency should be of our prime concern as abrupt climatic changes have threatened the successful harvest of pulse crops more often in the recent year than in the past.

The crop diversification scheme should emphasize the need to include pulses in new cropping systems, which are more consistent with the existing resources. There is potential for expanding pulse cultivation in irrigated and rainfed regions. For example, 9.7 m ha area under rice-wheat system offers great scope for introduction of pulses like mungbean as catch crop in the states of Punjab, Haryana, Uttar Pradesh and Bihar besides popularizing new cropping systems like pigeonpea-wheat, and rice-chickpea/lentil/fieldpea. Similarly, rice fallows of eastern India (Bihar and West Bengal) and coastal regions of Andhra Pradesh, Tamil Nadu and Orissa can efficiently be utilized by growing lentil, urdbean and mungbean. There is a scope to grow pulses in inter-row space of crops like sugarcane, pearl millets, and sorghum.

Pulses suffer heavy yield losses due to inefficient post-harvest practices. There are about 5500 medium and large size conventional *dal* mills with average *dal* recovery of 72% whereas establishment of modern *dal* mills of the same capacity have shown 83% *dal* recovery. Modernization of *dal* mill is thus expected to avoid losses to the extent of 0.90 million tonnes from the total processed 9.0 million tonnes of pulses. Similarly, pulses suffer substantial losses in the storage, which can be avoided by safe storage methods and structures. It is estimated that 0.45 million tonnes of losses on account of poor storage facilities can be avoided by safe storage.

Focussed research programmes on CMS based hybrids in pigeonpea, transgenics against *Helicoverpa* pod borer in chickpea and pigeonpea, multiple stress resistant varieties with efficient plant types, resource conservation technologies and bio-intensive IPM modules initiated during the X Plan are expected to start delivering the dividends in terms of higher yields in farmers' fields during the next Plan. The research programmes will further be consolidated and focussed on CMS based hybrids, efficient plant types having tolerance to abiotic stresses like temperature extremities, drought, salinity, *etc.*, pyramiding of genes/QTLs through molecular markers, and transgenics for unsolved yield constraints. The National Agricultural Innovative Project (NAIP), which has already been commissioned, will certainly prove a milestone in this direction.



(Masood Ali)

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