



PULSES



Newsletter

ICAR-Indian Institute of Pulses Research, Kanpur

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Annual Group Meet on MULLaRP Pulses and AINP on Arid Legumes Organized

The Annual Group Meet of AICRP on MULLaRP and AINP on Arid Legumes was held at Sardar Krushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat during April 28-30, 2018 to review the progress of research and finalize the technical programme for 2018-19. About 150 delegates from cooperating centres, SAUs and State departments of Agriculture participated in the meet. Dr. P.K. Chakrabarty, Assistant Director General (PP&B; O&P), ICAR, New Delhi was the Chief Guest during the inaugural function. While inaugurating the meet, he emphasized that centres should take innovative programmes and advised that each centre should specialize itself in some specific objective of national importance. He

also desired that efficacy trials on newer chemicals for control of pathogens, pests and weeds should be



taken up with caution as the information generated will be useful in the process of extending label claims for pulses. Dr. Sanjeev Gupta, Project Coordinator (MULLaRP), while presenting the significant findings of the project, focused on the progress made to

speed up the breeding process by generating breeding material with the use of trait specific donors, advancing the generations by using off-season facilities, shuttle breeding and sharing of breeding materials for rapid varietal development programme. Some centres were also identified as breeding hubs in each zone during the meet. He also highlighted the progress made in identification of post-emergence herbicides and specific recommendations for *Kharif* pulses. After thorough discussion, the technical programme for 2018-19 was finalized for each discipline. One variety each of Urdbean (PU 10-23) and Horsegram (BSP 15-1) were identified for release and notification.

Annual Group Meet on Pigeonpea organized

The 23rd Annual Group Meet of All India Coordinated Research Project on Pigeonpea was organized on May 19-21, 2018 at Professor Jayashankar Telangana State Agriculture University, Rajendranagar, Hyderabad. About 125 delegates from cooperating centres of SAU's and ICAR Institutes attended this group meet. In Inaugural Session,

Dr. V. Praveen Rao, Hon'ble Vice-Chancellor, PJTSAU, Hyderabad; Dr. R. Jagadeeshwar, Director of Research, PJTSAU; Dr. N.P. Singh, Director, ICAR-IIPR, Kanpur; Dr. I.P. Singh, Project Coordinator (Pigeonpea) and other dignitaries were present.

Dr. V. Praveen Rao was chief guest, of the inaugural session while Dr. N.P. Singh chaired it. While giving welcome remarks, Dr. R. Jagadeeshwar highlighted the dietary importance of pigeonpea in Telangana as well as in the country. Following this, Dr. I.P. Singh, presented a brief account on annual progress of AICRP, Pigeonpea for 2017-18. He informed that favourable weather conditions persisted during the crop season across the country except in a few states like Gujarat which received heavy rainfall and witnessed crop loss. Emergence of disease and insect pest like yellow mosaic, bristle beetle and



CONTENTS

● Research Highlights	3
● प्रौद्योगिकी हस्तांतरण	5
● Personnel	7
● Director's Desk	8

dry root rot was observed during the period. Several entries were promoted to the next level of evaluation. He further informed that more than 285 crosses were made among the five maturity groups of pigeonpea. Intercropping of soybean and pigeonpea in 6:1 ratio performed better, however, it did not offer any significant yield advantage in comparison to 4:1 ratio.

This was followed by introductory remarks of Dr. N.P. Singh wherein he appreciated the sincere efforts of scientific community, besides, favourable government policies which collectively resulted in record production of pulses during 2016-18 and break the long-existing yield plateau in pulses. At the same time, he stressed upon the challenge of sustaining the yield gains in order to achieve self-sufficiency in the face of dramatic climate change. He emphasized that in view of the increasing demand, there is considerable scope for expanding research and development activities in various areas. In addition, he also briefed the house about the other important government schemes

including rationalized Minimum Support Price (MSP) and increase in import duty for pulses to sustain domestic pulse production, are needed for intensifying the pre-breeding efforts to broaden genetic base of pigeonpea and other pulses. He desired that a few centres should be developed as the National Standard Screening Centres for different diseases and other few as pre-breeding centres.

Dr. Singh informed that regulatory approval was obtained for conducting confined field trials on transgenic chickpea and pigeonpea. He suggested that the current scenario demands for photo-thermo insensitive pulse crops and genotypes which are amenable to mechanical harvesting. Dr. Singh suggested not to release any variety that shows susceptibility to wilt or SMD.

Dr. Praveen Rao appreciated the rigorous efforts of pulses research community that have been reflected in the form of record pulses production. At the same time, he also raised concern regarding the scarcity of resources for future R&D in the country. He emphasized upon the necessity to

reorient the breeding programme swing to global needs. Breeding programmes need to align changing food habits as well as value addition in agricultural products, matching technologies in artificial intelligence and gene editing. Dr. Rao suggested to deploy modern crop genomic tools for addressing specific problems that otherwise it will be difficult to address through conventional methods. Dr. N.K. Singh, National Professor, B.P. Pal Chair and Director, NRCPB presented an overview on significance of draft pigeonpea genome sequence in pigeonpea improvement which was followed by the lectures of Dr. M.K. Singh and Dr. P.K. Panda on status of *Rabi* pigeonpea in Chhattisgarh and Odisha. Three more lectures delivered by different speakers including Dr. Navneet Kumar on status of area, production and productivity of pulses in 2017-18; Dr. Abhishek Rathore on Digitilization of agricultural research data and Dr. Anupama Hingane on status of super early pigeonpea in ICRISAT, Patancheru. In the technical sessions, programmes of various disciplines were discussed and finalized.

Foreign Deputations

7th International Food Legume Research Conference

7th International Food Legume Research Conference (VII-IFLRC) was held at Marrakech, Morocco during May 6-8, 2018. The Conference was organized by the IFLRC International

Steering Committee in local collaboration with ICARDA, Rabat, Morocco and INRA, Rabat, Morocco. About 300 delegates from different organizations and countries attended

this conference. In this conference, 24 keynote lectures, 41 oral presentations, 72 oral presentations in workshops on different legume crops and big data analytics and more than 100 poster



presentations were made. The Scientific program of ICP-2016 had three-day program comprising 10 sessions. and one plenary session under various scientific themes including global pulse scenario, global health, nutrition and gender, innovations in pulses genomics, pulses and natural resources management, pulse genetic resources, opportunities for enhancing pulse production, innovation in pulse breeding, innovation in productivity management, innovation in biotic and abiotic stress management. Three

keynote presentations were made in plenary session, while concurrent sessions included two keynote lectures followed by oral presentation from eminent scientists. A group of Indian scientists serving national and international organizations participated in this conference and made oral and poster presentations in different sessions. Drs. Sanjeev Gupta, G.P. Dixit, S.K. Chaturvedi, C.S. Preharaj, Meenal Rathore, Uma Sah and Debjyoti Sen Gupta from IIPR, Kanpur were deputed to the conference. Dr.

Sanjeev Gupta made a presentation on "Indian perspective of lentil and lathyrus research in India". He also co-chaired a session on "Germplasm and Genetic Enhancement". Dr. S.K. Chaturvedi made a presentation on "Herbicide tolerance in chickpea while Dr. G.P. Dixit made presentation on "Chickpea Breeding in India". The progress made in pulses production in India has been applauded. A global road map has been made to make nutrition secure world by increasing production and productivity in good legumes.

Annual Review and Planning Workshop of "Tropical Legumes-III Project"

Dr. N.P. Singh, Director, ICAR-IIPR; Dr. S.K. Chaturvedi and Dr. Uma Sah visited Kampala, Uganda during April 4-6, 2018 to attend annual review and planning workshop of "Tropical Legumes-III project". The meeting was attended by collaborating partners from



seven countries including India. The visiting team shared the progress of the work under the TL-III project in India in the workshop. The team also participated in discussion on upgradation of data collection tools and also finalization of work plan for 2018-19 under the project.

IIPR Scientists visited Myanmar

Dr. N.P. Singh, Director and Dr. Aditya Pratap, Principal Scientist, Crop Improvement Division visited Nay Pyi Taw, Myanmar between May 02-04, 2018 to attend the Annual Review Meeting of the ACIAR-funded project on 'Establishing International Mungbean Improvement Network'. The meeting was also attended by the partners from Australia, Myanmar, Taiwan and Bangladesh. The



progress of the project during last one year and the technical programme to be followed during the ensuing year were discussed besides the impact pathways, communication channels, inter project linkages and scope of mungbean expansion in Sub-Saharan Africa. A field visit to the farms of Department of Agriculture at Yezin and Tatfone was also organized.

Research Highlights

In vitro multiple shooting in grasspea using embryonic axis explants

In vitro multiple shoot induction was attained in grasspea mature decapitated embryo axis (cv. Pusa 24). For this, explants were inoculated in

different concentrations of BAP (0 mg/L, 1 mg/L, 2 mg/L, 3 mg/L and 4 mg/L and 5 mg/L BAP). Multiple shoot induction was observed after 15 days

of inoculation in different concentrations of BAP. A single long shoot arises when inoculated in a MS (Murashige and Skoog, 1962) media

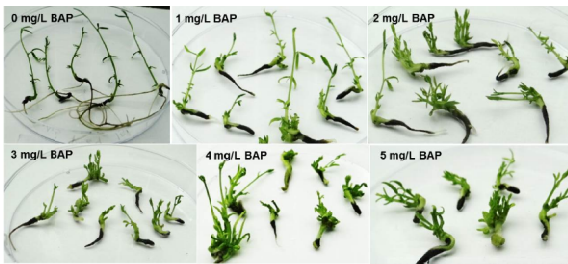


Fig.: Multiple shoot induction in grasspea under the influence of different concentration of BAP

without any BAP whereas multiple shoots arise when MS medium was

supplemented with different concentration of BAP (Fig. 1). 1 mg/L and 2 mg/L BAP induces relatively fewer shoots but most of the induced shoots were elongated and easily separable. Shoot bud induction increases as the concentration of BAP increases from 1 mg/L BAP to 4 mg/L BAP. Increasing BAP concentration

from 4 mg/L BAP to 5 mg/L BAP did not increase the shoot number. This suggests that 4 mg/L BAP could be used effectively for induction of multiple shooting in grasspea. After shoot bud induction, no further BAP is required and the shoot buds could be easily elongated in basal MS media.

Neetu Singh Kushwah, Alok Das,
Archana Singh, Meenal Rathore
and N.P. Singh

Toxicology of Phosphine: A fumigant for management of pulse beetle species

An experiment was conducted to ascertain the phosphine gas toxicity on developmental stages of different pulse beetle (*Callosobruchus chinensis* L.; *C. maculatus* F. and *C. analis* F.). The target insect stages were exposed to different doses of phosphine gas at different periods i.e. eggs and adults for 24 hr and grub and pupae for 7 days. Initial range finding test results illustrated doses ranged between 0.05-1.00 mg/L caused 20-80% mortality, which were further used to determine LC_{50} values.

Irrespective of species, the adult stage was the most susceptible (0.11-0.148 mg/L) compared to the grub (0.52-

0.564 mg/L) and pupal (0.543-0.573 mg/L) stages. Considering LC_{50} values, high toxicity of phosphine gas was observed on *C. chinensis* followed by *C. analis* and *C. maculatus* species. Nature of exposure might have attributed wide range of susceptibility between the stages of the pulse beetle, where adults and eggs expose directly to phosphine unlike grubs and pupae.



Revanasidda, Chitra Srivastava,
Kiran Gandhi, B., Sanjay Bandi
and Krishna Kumar

Flanking sequence identification using TAIL-PCR

Characterization of transgenic chickpea and pigeonpea lines in terms of knowing the site of transgene integration is an important aspect in event characterization and for regulatory approval. Thermal Asymmetric Interlaced PCR (TAIL-PCR) is a simple and powerful tool for the identification of DNA fragments adjacent or flanking to known sequence (transgene), in which a set of nested sequence specific primers together with a shorter arbitrary degenerate (AD)

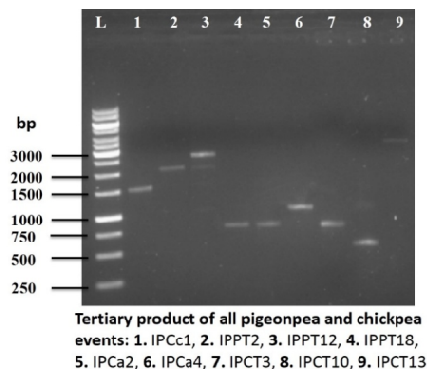


Fig.: Yield performance of transgenic chickpea lines vis-a-vis non transgenic (control) in pigeonpea

primers were used to amplify fragments at the site of integration. Using the strategy, targets could be amplified in transgenic chickpea and pigeonpea events harbouring single locus integration, confirmed by Southern blot hybridization. Identification of target sites in genome shall help in designing event specific PCR and also identify zygosity status of the transgenic lines.

Alok Das, Neetu Singh Kushwah,
Jamal Ansari and N.P. Singh

Efficacy of various priming agents on mungbean cultivars

A pot experiment with four priming levels (control, tap water, KNO_3 (0.2%) and GA_3 100 ppm), three mungbean varieties (Virat, Samrat and Meha) and two moisture levels (normal and drought) was conducted at IIPR Farm, Kanpur. Observations on seed quality parameters including germination %, seedling length and dry weight, field emergence, vigour I & II, crop efficiency parameters, yield attributes and yield were recorded. It was observed that seed priming of mungbean varieties with KNO_3 (0.2%) and GA_3 (100 ppm) for 06 h significantly enhanced the

germination, seedling vigour, stomatal conductance, photosynthetic rate, transpiration rate, pigment



Fig.: Photographs showing response of seed priming with KNO_3 (0.2%) and GA_3 (100 ppm) in mungbean variety Samrat respectively

composition, yield attributes and yield in all the varieties evaluated under normal as well as drought conditions. Variety Samrat performed better than Virat and Meha in respect of almost all the characters studied. Germination enzymes viz. alpha amylase and protease also increased their activities considerably in response to KNO_3 (0.2%) and GA_3 (100 ppm) priming in the varieties evaluated when compared with unprimed control.

T.N. Tiwari and Shivam Patel

Yield performance of transgenic chickpea lines vis a vis non transgenic (control) in confined field trial

Yield and other agronomic traits of transgenic lines are very important parameters to be considered before selecting a potential line for transgenic breeding programme. Five transgenic chickpea events (*Cicer arietinum* L.) harbouring *Bt* gene (*cry1Ac* and

cry1Aabc) sown in confined field conditions were compared to non-transgenic counterpart (control). Yield data were recorded in triplicate with respect to yield per plant (n = 10). Statistically, no significant difference were observed in the transgenic lines

compared to control (cv. DCP 92-3) ($p > 0.05$).

Alok Das, Alok Shukla,
Jamal Ansari, Poonam Chaturvedi,
Biswajit Mondol, Meenal Rathore,
Malkhan Singh and N.P. Singh

प्रौद्योगिकी हस्तांतरण

Field Day and Farmer-Scientist interaction meeting on Summer Mungbean organized

The institute organized a Field Day and Farmer-Scientist interaction meeting on summer mungbean at Allipur Bahera village of Fatehpur on 26th May, 2018 under 'Frontline Demonstrations Programme' for popularizing summer mungbean technology in the area for enhancing income of the farmers. Hon'ble State Minister of Agriculture, Govt. of U.P. Sh. Ranvendra Pratap Singh was the chief guest. He appreciated the mungbean variety IPM 02-3 for good



production and early maturity. The programme was attended by >300 farmers from different villages of Fatehpur district. Dr. N.P. Singh, Director, IIPR was present on this occasion. Dr. Rajesh Kumar, Nodal Officer, FLD briefed about the programme. Scientists of IIPR, Kanpur viz., Dr. C.S. Praharaj, Dr. Aditya Pratap, Dr. Naimuddin and Dr. G.K. Sujyanand interacted with the farmers and provided knowledge about cultivation of summer mungbean for additional income and employment generation.

Farmer societies towards strengthening pulse seed system

With an objective of enhancing availability of quality seed of improved pulse varieties and encouraging entrepreneurship development, six registered societies of partner farmers from project area in Kanpur Dehat, Banda, Hamirpur and Chitrakoot were mobilised for seed production of pulses under various extension-oriented projects.

During *rabi* 2017-18, farmers societies of Hamirpur (1 no.), Banda (1 no.), Chitrakoot (2 nos.), Kanpur Dehat (2 no.) were capacitated for seed production of improved varieties of chickpea and fieldpea. 34 ha area was registered for seed production of recommended chickpea varieties (*Desi*: RVG 202, JG 16, JG 14, *Kabuli*:

Shubhra, Ujjawal) and fieldpea varieties (Prakash, Aman and IPFD 10-12). To facilitate seed production programme, sessions were organized on seed production technologies in seven capacity enhancement programmes organised during the crop period. The

Table: Details of seed production by partner seed societies in project villages

Variety	Category of seed	District	Quantity (kg)	Gross return (₹)
Crop: Chickpea				
Ujjawal	F/s*	Chitrakoot, Kanpur Dehat and Hamirpur	13430	831502
Shubhra	F/s	Hamirpur	5448	337514
JG 16	TL	Kanpur Dehat and Banda	4500	207900
JG 14	F/s	Banda	970	44814
RVG 203	F/s	Hamirpur	712	32894
Total			25060	1454624
Crop: Fieldpea				
Aman	F/s	Kanpur Dehat	4170	157966
IPFD 10-12	TL		5665	214137
Prakash	F/s		2421	91514
Total			12256	463617

*F/s : Foundation seed; TL : Truthfully labelled seed

assisted rogging of off-type plants from seed production plots were carried out in the project villages. Farmers' societies were also supported for building-up linkages with Uttar Pradesh Seed Certification Agency for seed production. These societies contributed towards strengthening the formal seed system by quality seed production (foundation /TL seed) of fieldpea (122.5 q) and chickpea (250.6 q) and earned gross income of ₹ 4,63,617 and ₹ 14,54,624, respectively.

The farmers registered groups, therefore, could be harnessed for contributing towards strengthening the formal pulse seed system by way of suitable interventions in terms of linkage support, seed delivery and needed capacity enhancement.

*Uma Sah, S.K. Chaturvedi,
P.K. Katiyar, N. Kumar, Sujayanad
and R.K. Mishra*

Field Day-cum-Farmer-Scientist interaction meeting organized

IIPR, Kanpur organized Field Day-cum-Farmer-Scientist interaction meeting on Mungbean, Maize and Vegetables during summer at Karchalpur village in Fatehpur district of Uttar Pradesh on 2nd June, 2018

under Farmer FIRST programme. The programme was inaugurated by Dr. N.P. Singh, Director, Indian Institute of Pulses Research, Kanpur. He visited mungbean fields and interacted with the farmers. He also inaugurated the

exhibition organized on this occasion in which farmers displayed their produce related to wheat, chickpea, vegetables, poultry and goats. He appreciated the efforts made by the Farmer FIRST team. Dr. Rajesh Kumar, PI, Farmers FIRST project briefed about the project. The Scientists of IIPR, Kanpur, Dr. Aditya Pratap, Dr. Narendra Kumar, Dr. R.K. Mishra and Er. Manmohan Dev interacted with the farmers and provided technical know-how about cultivation of mungbean, maize and vegetables for additional income and employment generation.



Poultry Chicks for income and employment under Farmer FIRST project

Under farmer FIRST Project, 2100 poultry chicks were distributed to the poor and landless farmers of Karchalpur, Kharauli and Mirai village of Devmai block, Fatehpur district of

Uttar Pradesh. It is noteworthy that the poor and landless farmers are getting employment through rearing of poultry chicks as additional source of income as after 5-6 months, they will earn by

selling of eggs at higher price than the broiler eggs ranging between ₹ 10-15 per egg. It will also provide nutritional security to the families of the farmers.



Trainings Conducted

A training programme on Pulses Production Technology was organized



on June 21-25, 2018, which was sponsored by SIMA Rehmankheda, Lucknow (U.P.) Thirty four participants took part from Kanpur Nagar, Kanpur

संस्थान में मनाया गया अन्तर्राष्ट्रीय योग दिवस

अन्तर्राष्ट्रीय योग दिवस 21 जून, 2018 को भारतीय दलहन अनुसंधान संस्थान के प्रांगण में बड़े उत्साह के साथ मनाया गया। प्रातः 6:00 बजे आयोजित इस योग कार्यक्रम में संस्थान के वैज्ञानिक, तकनीकी व प्रशासनिक वर्ग के कर्मचारियों ने भाग लिया। इस अवसर पर संस्थान के कार्यवाहक निदेशक, डॉ. आई.पी. सिंह ने जीवन में योग के महत्व पर प्रकाश डाला। उन्होंने कहा कि आज के इस प्रदूषित वातावरण में योग को जीवन में अपनाकर ही स्वस्थ रहा जा सकता है और तनावमुक्त जीवन जिया जा सकता है। योग क्रियाएं आयुष मंत्रालय के प्रोटोकाल के अनुरूप संस्थान के प्रधान वैज्ञानिक, डॉ. बन्सा सिंह ने पूर्ण करवाई। उन्होंने यह भी बताया कि विभिन्न आसनों का नियमित



अभ्यास करके विभिन्न रोगों से मुक्ति पाई जा सकती है। इस अवसर पर संस्थान के वरिष्ठ पदाधिकारी, परियोजना समन्वयक, डॉ. संजीव गुप्ता; विभागाध्यक्ष डॉ. कृष्ण कुमार, डॉ. राजेश कुमार, डॉ. सी.एस. प्रहराज; वरिष्ठ प्रशासनिक अधिकारी श्री कुमार विवेक; वित एवं लेखाधिकारी श्री डी.के. अग्निहोत्री भी मौजूद थे।

Promotion

Sl	Name	Promoted to	w.e.f.
1.	Sh. Rakesh	STO	04.01.2017
2.	Sh. Kanhaiya Lal	TO	13.10.2016
3.	Sh. Krishna Pal	STA	31.01.2017
4.	Sh. Promeet Dias	UDC	17.04.2018
5.	Sh. Samar Singh	LDC	18.04.2018
6.	Sh. Mohd. Shabbir	LDC	18.04.2018

Personnel

Transfer/Deputation

Sl	Name	Designation	From	To	Date
1	Dr. Ummed Singh	Sr. Scientist (Agronomy)	IIPR, Kanpur	College of Agriculture, Agriculture University, Jodhpur (Raj.)	27.04.2018

Retirement

Sl	Name	Post held	Date of retirement
1.	Sh. Chhotey Lal	Sr. Technician	30-06-2018

Obituary

Dr. Purushottam, Senior Scientist, Division of Social Science left for heavenly abode on June 29, 2018. May the departed soul rest in Peace.

Dehat, Etawah, Farrukhabad and Auraiya districts of U.P. in this training programme.

Fifty farmers from Karchalpur, Kharauli and Mirai village of Fatehpur district attended the live telecast of the address of Hon'ble Prime Minister, Sh. Narendra Modi Ji. Through this programme, the farmers learned that small enterprises in a group approach can be established in the village for income and employment generation.

Fellowship Awarded



Dr P.K. Katiyar, Principal Scientist, Division of Crop Improvement received an International Fellowship (KOP- NFP fellowship) under Netherland Fellowship Programme and attended a course on, "Integrated Seed Sector Development" at Wageningen Centre for Development and Innovation (WCID), Wageningen University and Research, Wageningen, Netherland during 14th May to 1st June 2018.

Award



Dr. Shalu Thakur, has been awarded the prestigious 'Department of Science & Technology-Innovation in Science Pursuit for Inspired Research (DST-INSPIRE) Faculty' Award 2017. She has joined Division of Plant Biotechnology, ICAR-Indian Institute of Pulses Research, Kanpur.

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Director's Desk

Dear Readers,

The pulses production this year is likely to cross 24 million tonnes (mt), taking India closer to achieving self-sufficiency in the production of the protein-rich food crop. Undoubtedly, India's record harvest during past two successive years is a matter of great satisfaction, however, there is no guarantee that in the years ahead we would continue to plant large acreages and harvest equally good crops. We have seen volatile and unsteady pulses cultivation in the past. After stagnating at 14-15 mt till 2009-10, pulses production showed a quantum leap in the following two years to 18-19 mt and now production increased further to 24 mt. It is better to remain cognisant of the fact that Indian agriculture is fragile and vulnerable. Global warming and climate change are beginning to take a toll. However, we must also consider that this 24 mt of production of pulses is in the raw form and consumption demand is also for split pulse or *dal*. Also one needs to arrive at the marketable surplus after taking into account the quantity retained for sowing and then consider milling yields or milling losses. Considering that pulses are among the most economical vegetable protein, we need to maximise their consumption in the form of *dal* to ensure nutrition security. Per capita availability of 20 kg/year would translate to 24 mt of *dal*, equivalent to 28-30 mt of raw pulses. Indeed, we are far from reaching that production level. The chickpea is the major contributor of total pulses production, however, the consumption of chickpea in the raw or *dal* form is very little ranging from 15 to 20% of total production and rest is transformed into value-added processed products leading to increase in the market price and often these products are out of reach for the common people who actually need protein from pulses. Similarly, peas, lentils, urd and number of arid legumes are being consumed as various kinds of snacks and *namkeens*. The value addition of many such commodity crops has undoubtedly many advantages and the approach is commercially viable but

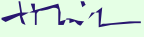
value-added products often limit access to poor man. For example, in potato chips industry, cost of packaging and production of 200 g chips is many times higher than the actual cost of same amount of raw potato, as a result, though very popular snacks, this product is not affordable to common people below poverty line.



In the light of above discussion to eradicate protein-malnutrition, our primary aim should be convert as much pulses as *dal* and in this strategy, *arhar* may play a crucial role as this pulse is predominantly consumed as *dal* or *sambhar* in majority of Indian dishes. State-wise preferences also hold important consideration for pulse production in India. Lentils and fieldpea are quite heavily used as *dal* in West Bengal, Orissa and North-East India while *chana dal*, mung whole grain and rajmash are taken in Punjab, J&K, Rajasthan and Haryana. But how to keep a balance between total pulses converted into value-added products as per consumer demand and at the same time, adequate amount of raw pulses made available for poor man as *dal*. What are those mechanisms to produce surplus amount of pulses under shrinking natural resources? Minimizing post-harvest storage losses, improving milling efficiency for higher *dal* recovery, development of milling compatible varieties with less gum content and re-use of pulses by-products for cheaper nutri-rich food commodities for common people, are some of the opportunities ahead for making the country truly self-reliant in pulses.

Processing losses are considerable (between 15-20%) and

increased pulse production can not help until these losses are reduced. According to various estimates, total post-harvest losses are 25-30%. One estimate puts the milling losses at 1.5-2.0 million tonnes valued at ₹ 1,500-2,000 crore. There is a sizeable quantitative and qualitative loss of blackgram, during different post-harvest operations like threshing, winnowing, transportation and storage. Due to improper and inefficient methods of storage, about 10 per cent loss is estimated during storage. Around 80% of storage losses are due to store grain pests, rodents and micro-organisms. As the husk form, 10-16% of grains, a theoretical *dal* yield of 84-90% should be attained. The present *high* milling losses can be attributed to the fact that the unit operations differ according to the crop and *varieties* and also the degree of maturity and threshing of *pulse* crops with some degree of variations in the grain *recovery*. Pigeonpea is considered to be the *toughest-to-mill* among all pulse crops. Certain pulses like pigeonpea, urdbean, mungbean, and horsegram pose great difficulty in dehusking, while pulses like chickpea, peas, lentil and *khesari* are relatively easy to dehusk. This difference in dehusking behaviour can be attributed to the characteristic of husk that adheres the cotyledons so tightly that poses difficulty in its removal during milling. Higher degree of attachment causes heavy milling loss in the form of broken and powder. Therefore, loosening of husk prior to milling through various treatments is an essential prerequisite. The maximum *dal* recovery in case of pigeonpea has been reported to be about 75%. This has become a researchable issue how it can be enhanced through mechanical modifications of *dal* mills, chemical treatment or breeding tools. Apart from this, as most of the pulses husk are very rich in essential fibres and minerals, these can be used in promoting nutraceutical industry for the benefits of mankind or as cattle feed by innovative approaches of food technologies.


(N. P. Singh)

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