

Proceedings of the Second Annual Meeting on NFSM-funded projects jointly implemented by DAC, ICAR and ICARDA

Date: 23-24 May 2012

Venue: NAAS lecture Hall, NASC Complex, Pusa.

The Annual Workshop on DAC-ICAR-ICARDA collaborative projects (i) *Pre-breeding and genetic enhancement in breaking yield barriers in lentil and kabuli chickpea* (ii) *Enhancing lentil production for food, nutritional security and improved rural livelihoods* (iii) *Enhancing grasspea production for safe human food, animal feed, and sustainable rice-based production systems in India* under NFSM-Pulses was held during 23-24 May 2012 at NAAS Lecture Hall, NASC Complex, Pusa, New Delhi-12. Senior Policy makers, scientists, NGO staff and RA/SRF associated with these projects participated in the deliberations. The two-day workshop deliberations were divided into different sessions: Inaugural Session; Technical Session-I; Technical Session-II Technical session-III and Plenary Session.

A. Inaugural Session

A two-day meeting in New Delhi, during 23-24 May, allowed scientists and policy makers to review progress on three Govt. of India's National Food Security Mission funded projects and to develop plans for next season. The delegates comprised of scientists/extensionists/NGO staff and some of India's most senior agricultural policy makers: Dr.Gurbachan Singh, Chairman, Agricultural Scientist Recruitment Board and Ex-Agriculture Commissioner, DAC (**Chief Guest**); Dr. D.P Malik, Additional Commissioner (Crops), Ministry of Agriculture; Prof. R. B. Singh, President, National Academy of Agricultural Sciences (**President**); Dr. N. Nadarajan, Director, Indian Institute of Pulses Research ; Dr. R.S. Paroda, Chairman, Farmer's Commission (Haryana) and Chairman Trust for Advancement of Agricultural Sciences; Dr. B.B Singh, Assistant Director General, Oilseed and Pulses, ICAR; Dr Shankar Lal, Consultant, NFSM; ICARDA was represented by Dr Michael Baum, Director, BIGM (**Guest of Honour**); Dr S K Agrawal, lentil Breeder; Dr H Alauddin, Biotechnologist and Dr Ashutosh Sarker and his team, South Asia & China Regional Program, New Delhi.

Dr Ashutosh Sarker gave a presentation on details of the projects: overall implementation, outcome of the project. In Chairman's remarks, Dr G. Singh mentioned that he was involved in designing and approval of the projects. He expressed his satisfaction on outcome of the projects, and suggested to implement the projects in a bigger way in new areas. Last year India witnessed a record production of >18 m t, which to be maintained and even should look for higher production in the coming days. Quality seeds of improved varieties to be more available to farmers. Dr R B Singh stressed upon increased pulses production in the country for nutritional security, and in this endeavour, these projects have great importance. More concerted efforts are warranted at the field level with involvement of all partners. The attempt to widen the genetic base is very important in the context of climate change and to combat new stresses . On behalf of ICARDA Management, Dr M. Baum extended all support to Indian programs for research and development, as India is a key partner of ICARDA. Dr N. Nadarajan emphasized on IIPR's commitments on increased pulses production in India and support to activities in these projects and look forward to expand these activities in future.

B. Technical Session I: Pre-Breeding and Genetic Enhancement (Lentil and Chickpea)

Chairman : **Prof. (Dr) R B Singh**, President, NAAS, New Delhi
Dr Balram Sharma, Ex-Head, Division of Genetics, IARI, New Delhi
Co-chairman : **Dr Michael Baum**, Director, BIGM, ICARDA, Syria
Rapporteurs : **Dr Aqeel H. Rizvi**, ICARDA-SACRP, New Delhi
Dr Mohar Singh, NBPGR, New Delhi

Session started with remarks of Honourable Chairman Prof. (Dr) R B Singh who stated that the Pre-breeding program is really a very useful area of research for widening the genetic base of cultivated lentil and chickpea using introgression of wild relatives, since these are reservoirs of useful genes/alleles. He also mentioned that the management of genetic variation is an equally important as the creation of genetic variation in the cultivated backgrounds. He emphasised upon the need of accelerated plant breeding using traditional and modern techniques judiciously. During the session seven presentations were made.

Dr S K Agrawal, ICARDA, Syria presented the progress of pre-breeding research under the project at ICARDA, Syria on lentil and chickpea.

- A complete set of 574 accessions representing six wild lentil species and subspecies provided to NBPGR, segregation populations of F₁ (33), F₂ (8), F₃ (6) and F₄ (2) generations were developed.
- Crossing programmes involved parents from South Asia and WANA regions operating at ICARDA. Crosses were undertaken between cultivated and wild lentil, also F₃ populations of these crosses will be shared with Indian partners in 2012.
- Screening of the Chickpea accessions for the Ascochyta blight (6 RILs, 1596 bulk lines, 296 new lines from Australia and Pakistan), Heat (288 germplasm), drought (1025 germplasms); and salt tolerance screening resulted in the eight accessions identified as salt tolerant and for QTL analysis of salt tolerance three F₃ population have been selected.
- For the *Fusarium* wilt resistance in chickpea, genotyping of 163 RILs derived from the cross between FLIP 97-7 (resistant) and ILC-482 (susceptible) is underway.
- Twelve lines were found resistant for combined resistance of Ascochyta blight and *Fusarium* wilt, and will be shipped to India.
- The Chairman emphasized that India should not ask for the same set of wild germplasm each year to ICARDA instead it should be maintained and conserved.
- Dr Arjun Lal, Head Germplasm Exchange Division, NBPGR suggested to test the *Fusarium* wilt along with root knot nematode.

Several pre-breeding and introgression programmes initiated by ICARDA in lentil and chickpea with various objectives were highlighted in the presentation. It was also discussed that Bio-fortification experiment should be done in collaboration with biochemist to test and break antagonistic effects. The Chairman suggested that Phenomics and Genomics should come together and tested under different environments. The crossed materials developed at ICARDA to be sent to India.

Dr S K Chaturvedi, IIPR imparted that the acquisition of germplasm of chickpea and lentil have been made from ICARDA

- Wild species and land races received from ICARDA and have been grown for seed increase for supply to various locations.
- All the chickpea landraces evaluated for the agro-morphological characters.
- Six new interspecific crosses using 5 wild species and three using landraces were made. Old crosses were advanced and true F₁ plants identified using molecular marker.
- Screening of wild species against heat stress has been done. Landraces were screened for Ascochyta blight at hotspot in Dhalakuanand 11 were selected as tolerant.
- Selections were made from the breeding material/landraces supplied from ICARDA for early, tall and erect lines for further evaluation and utilizing in hybridization for crop improvement programmes.

It was pointed out by members that drought tolerance has not yet been properly characterised therefore, totality of component traits will have to be considered while scoring for drought tolerance in plant breeding programmes. Dr Michael Baum, Director, BIGM, suggested that time management should always be considered while designing any experiment and cross check the work done with same set of varieties/wild species/landraces with different participating centers for not duplicating the work.

In lentil, wild species and land races have been received from ICARDA.

- Thirty cross combinations with wild species and Mediterranean types were made.
- Generation advancement of the old crosses and F₂ seeds were harvested.
- Five plants for earliness were selected from pre-breeding nurseries.
- Evaluation for heat tolerance has been done and tolerant and resistant genotypes were selected.
- Molecular characterization of parental lines has been done using SSR markers.

Chairman suggested for integrating genomics information in future crop improvement programmes. Dr Balram Sharma advocated the work done at IIPR for herbicide tolerance on chickpea and suggested to screen the all available lentil germplasm with the same technique.

Dr H K Dikshit from IARI presented the progress of work on lentil.

- Mediterranean land races from ICARDA were evaluated and 14 crosses were made using these landraces.
- Fresh crosses were made using ICARDA material having characters like bold seeded, early, biofortified, rust resistant and good plant type.
- F₂ population raised and seeds harvest to advance the generation.
- Molecular characterization of parental lines has been done using new microsatellite markers developed by the group.
- Estimations of iron (Fe) and zinc (Zn) have been done in 100 genotypes of lentil and eight promising ICARDA lines with high Fe (>70 mg/kg) and Zn (>60mg/kg) were selected.
- Collection from ICARDA comprising 273 accessions were screened for heat tolerance and 13 lines were identified including both exotic and indigenous lines. These will be evaluated at 3 locations next year.

Dr N Nadarajan suggested for the release proposal of these high Iron and Zinc content lines.

Dr C Bharadwaj presented research on chickpea breeding from IARI.

- He informed that 100 land races from ICARDA and 3 from MPKV, Rahuri have been evaluated for heat tolerance.
- Evaluation of land races for yield attributing traits, drought parameters and molecular characterization was carried out.
- Land races evaluated for stress parameters like Membrane Stability Index (MSI) and Relative Water Content (RWC), nine were found tolerant to drought.
- Wild species were also checked for the MSI and **three accessions** were found best which can act as a donor for abiotic stress.
- Twenty eight plant progeny from wild X cultivated crosses (F₂) were advanced and harvested (F₃).
- F₁s made during last year have been checked for hybridity with STMS markers.
- Seven new interspecific crosses were attempted. ICARDA nurseries have been evaluated for the seed weight and selections were made for the lines having 100 seed weight more than 50.

Dr Shiv Kumar asked about the right stage for RWC and MSI parameters, Dr Bharadwaj replied its flowering and pod initiation stage. Dr Sarker enquired about the wild accessions which possess short internode, more number of pods per peduncle, etc.

Dr R P Singh presented the progress of work on lentil at Rafi Ahmad Kidwai College of Agriculture, RVSKV, Sehore.

- 289 accessions were evaluated and recorded superiority in major traits like maturity, bold seed, high yield, wilt resistance, drought and heat tolerance.
- Nine lines were found high yielding and early maturing.
- Fresh crosses were made from the parents having bold seed, early and high yield characters.
- Ten *Fusarium* wilt entries were selected as a resistant from the ICARDA material.

Dr Sarker was interested to know about the constraints for reducing the yield. He told *Fusarium* wilt, late varieties and frost. Dr Sarker suggested that it is because of Management problem and lack of good varieties. He also suggested for maintaining the wilt sick plot with as many pathogen as possible. Dr B B Singh, ADG (Oilseed and pulses) emphasized that variety development strategy should be very stringent.

Dr P N Harer, Mahatma Phule Krishi Vidyapeeth, Rahuri, presented the research work done for kabuli chickpea under pre-breeding project.

- He informed that along with 94 wild accessions, 100 land races from ICARDA, Syria have been received.
- Seeds of wild accessions were multiplied.
- Standardization of media for ovulo-embryo culture technique is in progress.
- Hybridity for the last years crosses were confirmed with SSR markers.
- Fresh crosses were made with different accessions and wild races.
- Landraces were evaluated under normal season, screened for wilt resistance and heat tolerance.
- **Seven promising lines were recorded from normal season, six lines were identified as resistant to wilt and five for heat tolerance.**
- Evaluation and selection of progenies in F₄ and F₆ generation has been done, 7 and 18 progenies has been selected, respectively.

Dr S M S Tomar, Retired Plant Breeder, IARI suggested to test for the pollen sterility/fertility instead of hybridity.

Dr Mohar Singh presented the progress of work carried out at NBPGR.

- He described that 463 wild *Lens* and 86 wild *Cicer* accessions have been introduced from ICARDA.
- Ninety six accessions of wild *Cicer* species for *Ascochyta* blight and fifty five accessions of wild *Lens* species for rust and powdery mildew were screened under hot spot condition at Dhaulakuan, CSKHPKV. 2 lines resistant to powdery mildew, 3 lines resistant to rust in lentil; 5 lines resistant to *Ascochyta* blight in chickpea were selected as donor.
- Eighty six *Cicer* species were also screened for Botrytis Gray Mold (BGM) and root knot nematode. 3 wilds resistant to BGM and 4 lines resistant to root knot nematode were identified.
- Meiotic study of F₁s of lentil interspecific crosses has been conducted.
- Crosses in lentil and chickpea have been attempted between cultivated and wild species at Delhi and Sangla.
- Hybridity tested for inter/intra-specific crosses of lentil and chickpea both. Inheritance pattern for some morphological traits and cotyledon colour were also studied.

Dr Sarker suggested sharing wild accessions after multiplication at NBPGR. Dr N Nadarajan, Director, IIPR pointed out the duties for NBPGR is to share the material received from ICARDA for smooth running of program.

The house observed that good progress have been made in introduction of primitive landraces and wilds from ICARDA, seeds have been multiplied, evaluated for traits of interest (heat, drought tolerance, disease resistance, seed size, earliness). Chairman stressed on widening the genetic base of both the pulses as they had huge share in national pulse production and through such innovative research programmes we can bridge the gap in demand and supply of pulses through reducing the crop losses due to diseases and insect pests. He discussed the role pre-breeding as due to lack of marked variability for morphological, phenological and yield traits, resistance to biotic and abiotic stresses, asynchrony in flowering of Indian lentils and exotic germplasm limited very little progress has been achieved. Focussed traits and their characterization up to the molecular level is must for enhanced utilization of germplasm in crop improvement programmes. The reasons for low productivity in India should be thoroughly analysed to identify bottlenecks and for appropriate interventions. Field and laboratory work are to be judiciously combined to achieve better results. Following major recommendations emerged from the session.

Recommendations:

- 1. More emphasis should be given on climate resilient agriculture for which trait phenotyping and genotyping is an important area of research and use climate analogues for breeding and transgression.**
- 2. Pulse breeders should work together with biochemist and nutritionist, keeping in view the importance of nutrients available in pulses including wild relatives.**
- 3. Screening of germplasm for herbicide tolerance needs to be taken into an account as weeds are the major menace of pulses production.**
- 4. Efforts should continue to screen the germplasm (landraces/wilds) for biotic and abiotic stress related traits through reliable and standardized techniques for identifying potential donors.**
- 5. Germplasm received from ICARDA by NBPGR should be multiplied, characterized, conserved in National Gene Bank and shared with the partners. Feedback on germplasm distribution and utilization should be provided to ICARDA for its record.**

c. Technical Session-II (Lentil Enhancement)

Chairman: Dr. Shankar Lal, National Consultant (NFSM)

Co-Chairman: Dr. B.B Singh, ADG (OP),

Rapporteur: Dr. Shailesh Tripathi, IARI/**Dr. Atul Dogra**, ICARDA

Dr. R. Choudhary, ICARDA New Delhi presented the progress report on enhancing lentil production for food, nutritional security and improved livelihoods. Two districts Nalanda (Bihar) and Chandauli (Uttar Pradesh) were selected for technology interventions involving 203 farmers. Two varieties of lentil WBL-77 (Moitree) and IPL-81 (Noori) were selected by farmers for rice fallow conditions while KLS-218 performed very well in normal sown condition in Chandauli. PL-6 was most preferred variety both at Nalanda and Chandauli in all situations under FPVSTs. In both the districts, total 260.89 Qt. of foundation and certified seed and 428.6 Qt. TL were produced against the target of 200 Qt. On an average, improved variety has a yield advantage of 20% over the local variety, improved technology has a yield advantage of 34-48% over local technology and if both improved variety and improved technology are applied then it has synergistic effect on yield and the advantage of 31-87% over local variety can be obtained. Stemphylium blight was a major disease infesting the crop in Bihar, resistant varieties should be bred. Under capacity building, 17FFS, 20 field days/ workshop, 4 training on quality seed production and PHT and 1 travelling seminar was organised. One seed hub each at Chandauli and Nalanda was also established. Dr. Shankar Lal and Dr. B.B Singh expressed satisfaction at close interaction of farmers and Scientist under the project.

Dr. S.K. Singh, IIPR, Kanpur presented progress report for his centre. Two districts Fatehpur and Ballia were selected and PRA was conducted in both these districts. PL 6 emerged as best lentil variety with a net income of Rs. 36608 per ha, followed by NDL-1. Effect of trichoderma, rhizobium inoculation and their combined effect were also studied. Chairman of session advised for focusing more on Ballia and change the villages from Fatehpur to other areas. Two farmers association have been formed and registered as per norms. Promotion of formal seed system has been advocated through developing linkages with National Seed Corporation and U.P Seed certification agency. Soil testing was also done for 70 selected farmers from Ballia and Fatehpur.

Dr. I.A. Sheikh, AAU, Jorhat presented progress report for Assam. The project was implemented in Nagaon District of Assam. He informed that area under lentil is decreasing due to more adoption of summer rice after winter rice. He reported that there was an increase of 28-41 % in yield over the local varieties. Seed production was a major problem. Dr. Sarker suggested that we should make a clear recommendation that farmers should go for relay crop or pure crop, so policy should focus on this. Dr. Balram Sharma suggested that a village can be trusted with responsibility of seed production. Dr. Sarker said that increase in yield over local variety could be bifurcated into improved variety or improved technology.

Dr. Pawan Kumar, SPARK Patna presented the progress report for his centre. Farmers were not doing seed treatment and there is no use of rhizobium culture. Seed replacement rate was also very poor, 13% of farmers change their seed after 3-4 years and 87% of farmers change their seed after 5-6 years. Five varieties were taken for seed production and total seed production was 175qt. Farmers were not ready to sell their seed in market because of non-remunerative price.

Under normal sown condition HUL-57 was best fit whereas, under rice fallow Moitree was best. Stemphylium blight was a major disease infesting the crop in Bihar this year

Dr. A.K. Singh, RAU, Pusa presented progress report for Muzaffarpur District. HUL 15 was ranked as number one variety followed by Arun, KLS-218 and Moitree. 587.90 qtl seed was also produced.

Dr. M.P. Srivastava, presented progress for PORS Berhampur, this year inputs were provided to 141 farmers. Most of the farmers (88%) were have no knowledge of improved practices. Subrata and Moitree were found to be promising variety with yield of 1191 and 1163 kg/ha, respectively. Two registered seed retail outlets were opened by participatory farmers approach. 519qt. Seed have been produced at 10 project villages during *rabi* 2011-12

Dr. S. Gupta, MESADM, Kalyani presented progress report, lentil was mainly cultivated by the farmers as rainfed crop utilizing the residual moisture after harvest of Aman paddy. 227 farmers have been selected for demonstration and dissemination of improved technologies in Malda. Total 22qtl. of quality seed was produced and one seed hub was also established at village level.

In most of the places, substantial rice-fallows were taken under the project. Yield advantages due to variety only and due to improved production technology were emerged, substantial amount of quality seeds were produced, good number of capacity development activities were carried out. Appropriate varieties were selected by farmers for specific areas/regions which will be disseminated further. From all presentations it was observed that:

- ✓ **On an average, improved varieties gave an yield advantage of 20% over the local variety**
- ✓ **Improved technology alone showed a yield increase of 34-48%**
- ✓ **With both improved varieties and technologies together, an yield advantage of 31-87% was observed**
- ✓ **Stemphylium blight was a major disease infesting the crop in Bihar, and resistant varieties should be promoted.**
- ✓ **Seed replacement rate (SSR) is very low in pulses as a whole which need to be improved.**
- ✓ **Small storage earthen pots can be used by marginal famers for seed storage using neem leaves, so such farmers technology can be a learning lesson for pulse storage in other areas for economically poor farmers**
- ✓ **Major problems are poor quality seed, lack of storage facilities, timely availability of inputs, and poor knowledge about the management practices**
- ✓ **Newer area to be taken into project intervention in coming years and more area coverage with improved varieties need to be considered.**
- ✓ **Farmer-to farmer seed distribution pattern in action sites should be thoroughly studied to know sign of adoption by farmers**
- ✓ **Promotion of informal seed system for seed supply at village level, farmers should be registered with the societies so that they can replicate seed production model.**

C. Technical Session-III

Enhancing Grasspea Production for Safe Human Food, Animal Feed and Sustainable Rice-based Production Systems in India

Chairman : **Dr. D. P. Malik**, Addl. Commissioner (Crops), DAC
Co-Chairman : **Dr. Shiv Kumar**, ICARDA, Syria
Rapporteur : **Dr. Pooja Sah**, ICARDA-SACRP, New Delhi

During the session seven presentations were made. Collaborating partners from four important grasspea growing states where project envisages its activities (West Bengal, Bihar, Chhattisgarh and Uttar Pradesh). During 2011-12 a total of **83 villages** (**12** in Uttar Pradesh, **18** in Bihar, **49** in West Bengal and **4** in Chhattisgarh) across **12 districts** of **4 states** were covered and a total of **959 farmers** (**160** in Uttar Pradesh, **142** in Bihar, **34** in Chhattisgarh and **623** in West Bengal) were selected for infusion of technological intervention along with new improved low toxin grasspea varieties.

Participatory Rural Appraisal of selected villages revealed that the farmers were unaware about the importance of quality seeds of low ODAP grasspea varieties and wherever they had some knowledge about such varieties, there also the good quality seeds of such varieties were not available to them. Farmers have never practiced seed priming, seed treatment with fungicides and Rhizobium neither they have any knowledge about the improved package of practices for grasspea cultivation. Women's were also not aware about the physico-chemical detoxification strategies for removal of ODAP from grasspea seeds that people were cultivating traditionally.

It came out from the deliberation of presentation that the introduced low ODAP grasspea varieties in the project areas, namely Nirmal, Ratan, Prateek and Mahateora performed well in almost all the areas yielding >25 (upto 45%) higher than the traditionally grown high ODAP grasspea. In **Bihar** Ratan (25-46%), Nirmal (11-30%), Prateek ($>25\%$) and Mahateora ($>30\%$); in **Uttar Pradesh** Ratan (4%), Nirmal (40%) and Prateek ($>30\%$); in **Chhattisgarh** Mahateora (54-88%) and Prateek (45-84%) and in **West Bengal** Ratan (25-43%) and Nirmal (21-62%) were identified as superior low toxin grasspea varieties compared to traditionally cultivated high toxin low yielding grasspea with farmers practice.

In experiments pertaining to evaluation of effect of either variety or technological intervention as compared to the farmers variety and farmers practice it was observed that variety alone contributed significantly (**30-37% higher yields compared to locals**) as compared to the technological interventions (**13-40% higher compared to farmers practice**). That shows the importance of the variety is higher compared to technology and if these both can be clubbed then the farmers can realize nearly 35-50% higher yields compared to their local cultivars that they are cultivating by traditional means (farmers

Practice). **Dr. Ashim C. Sinha**, UBKV, Koch Behar; **Dr. Madan Srivastava**, PORS, Berhampore and **Dr. Raghunath Sadhukhan**, BCKV, Kalyani presented the activities and achievements under the project in West Bengal.

Dr. S. K. Nair from IGKV, Raipur presented the activities of the grasspea enhancement project in Chhattisgarh in three districts namely, Raipur, Durg and Bilaspur. Because of heavy pour of rains in the month of January during the peak flowering season of grasspea flower drop occurred in Chhattisgarh state, that resulted in realization of lower yields of grasspea as in most of the areas the crop has been utilized as fodder after flower drop. Awareness camps/trainings on detoxification methods were also conducted by project partners as a part of capacity building for farm women's.

Dr. A. K. Roy from IGFRI, Jhansi told the house that the tested grasspea germplasm and introduced varieties had very good feed quality as revealed through important feed quality parameters to be used as feed for animals.

Advanced low ODAP lines (**54**) and three advanced grasspea nurseries (GIYT-E/HB/LO-2012) were supplied from ICARDA, Syria for their evaluation in different agro-ecologies of grasspea growing areas.

Through undertaking farmer participatory varietal selection procedure improved grasspea varieties were selected for different states; in Uttar Pradesh and Bihar **Ratan** and **Nirmal**; in West Bengal **Nirmal** followed by **Ratan** and in Chhattisgarh **Mahateora** and **Prateek** were selected as farmer preferred low toxin varieties through FPVS. As an important objective of grasspea enhancement project; seed production of low ODAP grasspea varieties was undertaken in the target areas and a total of **1496.672 quintals** of quality seeds of low toxin grasspea varieties (**Nirmal: 716.40; Ratan: 480.07; Prateek: 268.90 and Mahateora: 31.25**) were produced as against the **target of 200 quintals** for the second year for the continuity of seed chain.

Efforts were also made for the capacity building; an important component of grasspea enhancement project in the grasspea growing regions, a number of farmers trainings on seed production, Post Harvest Technologies, seed processing (**18**), field days/workshop (**37**), travelling seminars (**3**) were conducted by ICARDA-SACRP and collaborating partners. Three leaflets and one booklet is also published for distribution among farmers for creating awareness about low toxin grasspea varieties along with physico-chemical detoxification strategies and improved package of practices. **5 village based seed hubs/enterprises** were established (two in West Bengal, two in Bihar and one in Uttar Pradesh) for promotion of farmer-to-farmer seed diffusion system (informal seed production and delivery system).

After the deliberation of presentation discussions were made on important aspects related to quality and purity of seeds, approach utilized for seed replacement with low toxin varieties, etc.

At the end of the session following recommendations were made:

- A. Quality seed production of low toxin varieties should be ensured as grasspea is often cross pollinated crop.**
- B. It was advised for providing the results in a clearer mode with respect to the area covered under the program, number of farmers selected, and nutritional information with respect to ODAP content of the seeds should always be accompanied and seed quality parameters should also be taken care of.**
- C. It was also emphasized to undertake some experiments on introduction of vermi- compost and bio fertilizers for improving the soil health.**
- D. Information on the seed diffusion pattern should be compiled from the farmers for tracking farmer to farmer seed transfer.**
- E. Dr. Shiv Kumar Agrawal recommended that proper isolation distance should be maintained for eliminating possibilities of cross pollination. And for this whole village should be adopted for inception of seed production program of low toxin grasspea varieties to avoid any possibilities of cross-pollination.**
- F. Scientists were urged for giving their key feedback for raising pulses production in the country.**

IV. Plenary Session

Chairman: Dr. R.S. Paroda, Chairman, Farmer's Commission (Haryana)

Co-Chairman: Dr. B.B Singh, ADG (OP), ICAR

Rapporteur: Dr. Shiv Kumar, ICARDA, Syria/**Dr. C. Bhardwaj**, IARI, New Delhi

Dr. R.S. Paroda, Chairman, Farmer's Commission, Govt. of Haryana, welcomed the participants and congratulate DAC, ICAR and ICARDA for organizing this Meeting. In his inaugural remarks, he spoke for an urgent need to peroxide nutrition security along with food security in which pulses play a major role. He appreciated this joint initiative comprised of development and research components, which is an example to work together for the betterment of farmers. He stressed that ICARDA should play and support NARS partners for lentil, kabuli chickpea and grasspea enhancement through germplasm exchange, technology dissemination and research development. He emphasised the need of right seed, right technology, and availability of other inputs at right time for increased productivity. Pulses will not only increase the rice-wheat system efficiency but maintain soil productivity too. The role of CGIAR in developing and supporting NARS system was appreciated by Dr. Raj Paroda.

Dr. Balram Sharma presented the recommendations of technical session I on Pre-breeding and genetic enhancement in lentil and chickpea. The concentrated efforts in pre-breeding were highlighted and the support of DAC and ICARDA was appreciated. The possibility of identifying new genes and new sources was indicated. The herbicide screening work, off-season facilities started were also summarized. The proceedings made by the rapporteur's for technical session I were readout. The need of NBPGR to play a pivotal role in supply of seed and also the use of this seed by indenters needs to be maintained. The need to use the herbicide resistant material in crossing programme, identification of genes responsible for this herbicide resistance should be taken on priority (**Action: All participating centres**). The recommendations were approved by participants.

Dr. R.S Paroda highlighted the requirement of bold seeded red lentil and its evaluation in good quality lab. Dr. A. Sarker said that India is the largest indenter of ICARA materials. The Chairman suggested the need to monitor the nurseries/materials being sent by ICARDA and feedback to be sent to ICARDA (**Action: IIPR, Kanpur and ICARDA**).

Dr. Shankar Lal presented the proceedings of technical session II on lentil enhancement. He emphasized the possibility of utilization of rice-fallows (11.2 mha) for lentil cultivation. In *uterasystem* only small seeded and early maturing varieties are more suitable, eastern part of the country should be selected for these trails. If both improved variety and improved technology are applied then it has synergistic effect on yield and the advantage of 31-87% over local variety can be obtained. So, both improved variety and technology are very important (**Action: All participatory centres**).

Dr. R.S Paroda indicated the need to identify early maturing varieties, large scale Front Line Demonstrations (FLD's) aggressive extension of production technology to farmers. The need for rolling plan was stressed particularly for pulses to enhance the Seed Replacement Rate (SRR). SRR for pulses was very-very less as compared to cereals (25-30%). A small working group to formulate the seed revolving plan was suggested by the Chairman (**Action: All participatory**

centres). An additional recommendation of buying farmers seed and a paper on seed production of ICARDA's mandated crops was also suggested(**Action: ICARDA).**

Farmers participatory programme become important in this mission. The need to identify progressive farmer, train them into seed production is required. Mini-kit distribution and buy back arrangement of particular seed is required. Farmers training and field school should be encouraged and farmers to be educated to use recommended packages and practices (**Action: All participatory centres).** Newer area to be taken into project intervention in coming years and more area coverage with improved varieties need to be considered.

Dr. D.P Malik, Additional Commissioner (crops) D.A.C read out the outcome of technical session on grass pea improvement. Low-ODAP materials were supplied by ICARDA which are evaluation in 6 location and results are awaited. Non-availability of seeds was the biggest problem in grasspea programme for the selected 4 varieties viz; Nirmal, Ratan, Prateek and Mahateora, which needs to be considered(**Action: All participatory centres).**

Chairman urged to strengthen the centres for evaluating grasspea collection of ICARDA for their "BOAA" content. The technique of removing toxin by boiling should be popularised (**Action: All participatory centres).** More dual-purpose germplasm and low neurotoxin lines are available with ICARDA which has been supplied to India.

The need to **popularize faba bean in India** was stressed and chairman requested ICARDA to play an active role. The high yield potential of faba bean, least cooking time was highlighted. The support of NFSM for enhancing food security was appreciated by Dr.B B Singh. Dr Malik stressed that effective programs will be further encouraged by DAC. The increase in breeder seed production was highlighted. However, its conversion to certified seed or foundation seed was a problem due to disparity between market price and procurement price. The starting of registration societies and seed production under the DAC-ICAR-ICARDA programme was lauded(**DAC and All participatory centres).**

Chairman, stressed the great role played by pre-breeding in improving varieties, duration, adaptabilities and insulating against pests. Chairman, appreciated the initiative made in these projects and partnerships between NARS, DAC and ICARDA. He also said that breeding programme requires to be strengthened particularly lentil in rice-fallow in eastern India. National programme should take lead in requesting collaborative programme in these lines

Management of dryland, supplemental irrigation, soil management requires to be addressed. Micro-nutrient management particularly in sulphur and zinc deficient soils would greatly increase pulse yields. Farmers to farmers spread of seed should be monitored and encouraged. The mission should be focussed and time bound targets to be successful.

Dr. Michael Baum, Director Biodiversity and Gene Management (BIGM), ICARDA affirmed ICARDA's support for any call by Indian programs.

Lastly, Dr.Raj Paroda, Dr B B Singh, Dr D P Malik, Dr B Sharma, Dr Shankar Lal, Ashutosh Sarker and participants acknowledged support from National Food Security Mission to carry out these three DAC-ICAR-ICARDA collaborative projects.