

Dated: 24.03.2015

Sub.- Project on “Generation advancement and development of new genotypes through pre breeding in Lentil and Kabuli Chickpea” funded under NFSM- Monitoring Report regarding.

Reference: F. No. CPS 5-13/2013-NFSM Dated 20th Feb. 2015.

The NFSM-funded ICAR-ICARDA collaborative research programme envisages pre-breeding and genetic enhancement in breeding yield barriers in kabuli chickpea and Lentil. The project was initiated from 2010-11 (Rabi Season). The other cooperating centres for hybridization involving accessions of wild species and land races are ICARDA, IIPR, IARI and RAK College of Agriculture.

Administrative Approval for Rs.314.21 Lakh vide DAC's letter No. CPS 5-25/20009-NFSM, dated 25th August, 2010 for the first Phase (2010-11 and 2011-12) and Rs. 296.59 Lakh vide letter No.CPS 5-13/2013-NFSM, dated 04.10.2013 for the second phase (2013-14 to 2016-17) has so far been issued.

To monitor the pre-breeding project on the above cited subject, undersigned visited R.A.K. College of Agriculture, Sehore (M.P.), the project site, on 16th March 2015. Dr. A.H. Rizvi, Project Manager, ICARDA, New Delhi, Dr. Ashok Saxena, Project In-charge and Dr. R.P. Singh, In-charge MULLaRP, Dr. M.Yasin, Chickpea Breeder and Dr. Sandeep Sharma, Chickpea Entomologist, also accompanied the visit.

2. A presentation on the brief rationale of the project and outcome of the objectives and work-plan during Phase-I (2010-11 to 2012-13) and Phase –II (2013-14 to 2016-17) was made by the Project Team. Dr. (Mrs.) S. B. Tambi, Dean, R.A.K. College of Agriculture, Sehore and the Team of the Scientists, associated with the project, were present during the deliberations.

3. The presentation/meeting was followed by the field visit of the nurseries.

4. PHASE-I (2010-11 to 2012-13)

Objectives:

- i. Identification of appropriate germplasm of lentil from ICARDA gene bank (landraces & wild species) and from Indian sources for resistance to keys biotic and abiotic stresses in addition to yield attributing traits.
- ii. Synthesis of new gene pool through recombination breeding with higher frequency of useful genes using exotic landraces and wild progenitor species of Near-East origin and Indian cultivars/germplasm.

- iii. Selection of useful recombinants in the target environments for their further utilization in crop improvement programs.
- iv. Development of high yielding varieties through multi-location testing for adaptation to various cropping systems in major agro-ecological zones.
- v. Human resource development for enhanced utilization of plant genetic resources and adoption of frontier technologies in crop improvement.

The Year-wise work plan submitted by ICARDA and approved by the DAC is as follows:

Year	Work Plan
1st year (2010-2011)	<ul style="list-style-type: none"> i. Introduction of germplasm from ICARDA to India and from India to ICARDA. ii. Evaluation and seed increase of germplasm by NBPGR and IIPR, and by ICARDA. iii. Identification of parents based on disease and drought resistance, phenological adaptation, seed traits, plant architecture, etc. iv. Genotyping of elite parents v. Preparation of scientific reports, annual coordination meeting. vi. Recruitment of personnel mentioned in the project document and establishment of lab/field facilities.
2nd Year (2011-2012)	<ul style="list-style-type: none"> i. Acquisition of new germplasm, their evaluation and selection of promising parents. ii. Minimum 50 cross combinations to be carried out each in India and at ICARDA in various combinations. iii. Growing F₁'s to confirm hybridity and generation advancement to F₂ in summer nursery in Lahaul Sphiti in India and in Lebanon for ICARDA. iv. Genotyping of newly selected parents. v. Preparation of scientific reports.
3rd Year (2012-2013)	<ul style="list-style-type: none"> i. Introduction, evaluation and selection of desirable parents from landraces and wilds. ii. At least 50 crosses will be commissioned in India and 50 crosses at ICARDA with newly identified parents. iii. Growing F₃ populations in main season and F₂ & F₄ in summer nurseries. iv. Genotyping of parents. v. Preparation of research reports.

5. PHASE-II (2013-14 to 2016-17)

Objectives:

1. Development of high yielding and farmers' preferred varieties with broad genetic base for adaptation to various cropping system in major lentil growing areas.
2. Selection of useful recombinants developed during last three years activities in target environments for their utilization in crop improvement programs.
3. Synthesis of new gene pool through recombination and mutation breeding with higher frequency of useful genes using exotic landraces and wild progenitor species of Near-East origin and Indian cultivars/germplasm.
4. Identification of appropriate germplasm of lentil from ICARDA gene bank (landraces & wild species) and from Indian sources for resistance to key biotic and abiotic stresses in adaptation to yield attributing traits.
5. Human resource development for enhanced utilization of plant genetic resources and adoption of frontier technologies in crop improvement.

Year	Work Plan
1 st Year (2013-14)	<ol style="list-style-type: none">i. Introduction of new batch of materials, evaluation and selection.ii. Making crosses with selected parents.iii. Raising F₁s and advanced to F₂ in summer nursery from crosses in third year.iv. Growing F₃ populations and advanced to F₄ generation from 2nd year crosses.v. Part of F₄ seeds from each crosses (to sent materials to India from ICARDA for evaluation under Indian condition.vi. Single plant selection to be performed in F₄ and F₅ families will be developed with increased seed amount in summer nurseries.vii. Preparation of research articles.
2 nd Year (2014-15)	<ol style="list-style-type: none">i. Hybridization.ii. Raising F₁ and F₂ in summer nursery.iii. Generation advancement to F₄ using summer nursery.iv. Dispatch of part of F₄ segregating populations from ICARDA to India.v. Single plant selection in F₄ population and development of F₅ families.vi. Testing of F₆ lines in various zones and in disease hot-spots in India. Promising lines will be advanced to F₇ and seed increase will be done in summer nursery for replicated preliminary yield trials. The fixed lines developed at ICARDA will be shared with India through special/international nursery.vii. Final reporting and publication of research articles.

3 rd year (2015-16)	<ul style="list-style-type: none"> i. Hybridization ii. Confirmation of hybridity and generation advancement at main season and using summer season (F2/F3/F4) iii. Genotyping of the F5/F6 populations, desirable mutants with the molecular markers (eg. SSR). iv. F5/F6 seeds from each cross will be sent to India from ICARDA for evaluation under Indian condition. v. Selection of desirable transgressive segregants with combination of desirable traits. vi. Testing of genetically fixed lines in multi-location for yield performance and stability in representative areas. vii. Preparation of scientific reports/research articles/annual report.
4 th Year (2016-17)	<ul style="list-style-type: none"> i. Hybridization ii. Hybridity confirmation and generation advancement of previous years crosses. iii. Genotyping of F6 populations, desirable mutants and fixed lines with new genes/alleles. viii. Testing of advanced generations for direct use as cultivars, and for further uses in breeding programme. ix. A few promising lines will be further evaluated for release as varieties, used for hybridization program. x. At the final stage, farmers will be involved in the varietal selection process in the target environments. xi. The cycles of breeding program will continue to construct new genotypes. xii. Final reporting and publication of research articles.

OBSERVATIONS/SUGGESTIONS

1. The field visits/interactions have revealed that the project is moving in right direction. The Land races (Germplasm) of lentil and accessions of wild lentil were procured from ICARDA via NBPGR to India. The lentil land races evaluated for morphological and yield traits and their seed have been multiplied for further evaluation and screening against moisture stress, heat tolerance, seed size, biomass and earliness for advancement of new genotypes. The parents with desired traits on disease and drought resistance, phenological adaptation, seed traits and plant architecture etc have been identified.
2. Genotyping of elite parents is continued.
3. More than 50 cross combinations have been carried out at various location and these are going on.

4. To confirm hybridity and generation advancement from F_1 to F_2 , summer nurseries have been planted in Lahual Sphiti (India) and in Lebanon (ICARDA). Similarly growing F_3 populations in main season and F_2 and F_4 in summer nurseries, as undertaken during Phase –I, is continued during the Phase-II i.e. 2013-14 to 2016-17.
5. The second Phase of the project has completed two years from 2013-14 to 2014-15, is also proceeding in accordance to set objectives except that of human resource development for further utilization of plant genetic resources and adoption of frontier technologies in crop improvement.
6. Landraces from different origin of countries (400 no.) is maintained well and evaluation of these for particular traits like early maturity, high yield, bold seed size, high biomass and wilt resistance is under study.
7. Out of 400 landraces 35,29,7 and 24 lines are being selected and multiplied for bold seed size, high yield, wilt resistant and early maturity respectively.
8. Crosses being attempted to incorporate gene of interest from donor parents' for eg. High yield, bold seed size, wilt resistant and high temperature tolerance.
9. Generations (F_1 , F_2 , F_3 , F_4 and F_5) are being advanced to next level.
10. Selection for early maturity, heat tolerance, high yield, bold seed size and high biomass were made from nurseries/landraces by ICARDA and different populations generated under the project.
11. Experience / information has revealed that the prevailing varieties JL 3 and IPL 316 in state of Madhya Pradesh and Chhatisgarh has a very little share as far as the SSR is concern.
12. The market rate of lentil in major mandies at the time of harvest i.e. Rs. 4300 to Rs. 4800 are much higher than MSP of lentil (Rs. 3075) while it is lower in case of chickpea. Thus the crop has much potential in terms of productivity and income. Non-descript varieties/farm saved seed is being used by farmers.
