5353 Deliverable: Evaluation of segregating populations for inheritance studies

1. Activity: Development of F1s for recombination breeding in lentil and chickpea

Title	**:**	Development of F1s for recombination breeding
Objectives	**:**	Generate new recombinants with desirable traits for different target regions.
Activities	**:**	Continued.
Observations to be taken	**:**	Seedling stem color, Days to flowering, Days to maturity, Stem hairiness Presence of tendril
Number of crosses	**:**	**Lentil:** 277 single crosses for earliness, tolerance to heat and drought, resistance to wilt, rust, Ascochyta blight, Stemphylium blight, and quality traits **Chickpea:** 153 crosses for combining desired traits were effected
Key outcome	**:**	**Lentil:** 179 single crosses were successful and advanced in Summer season at Terbol (**Attachment: MEL-F03**). Based on parental traits, only 35 F1s carried forward for further evaluation as F2 populations in Winter season. At Marchouch, Only 4 crosses were successful. **Chickpea:** All 153 crosses with at least 25 seeds harvested successfully (**Attachment: MEL-F04**). In order to widen the genetic base, multi-parent crosses generated to accumulate minor genes/QTLs in desired agronomic backgrounds. This will help release variability for various traits and understand the inheritance.

2. Activity: Generation advancement of Segregating populations in lentil and kabuli chickpea

Title	**:**	Generation advancement of various segregating populations
Objectives	**:**	To advance F_2, F_3, and F_4 generations , and make selection of single plants and uniform single plant progenies in F_5, F_6 and F_7 generations
Activities	**:**	Continue
Expected outcomes	**:**	High yielding elite lines with extra earliness, disease resistance and high micro-nutrient components
Observations to be taken	**:**	Phenological traits, seed size and seed color
Materials and methods	**:**	• 27 F2, 146 F3, and 56 F4 populations (**Attachment: MEL-F05, MEL-F06**) • 301 progenies from seven crosses in F_4 generation, 3,097 progenies from 107 crosses in F_5 generation, 266 progenies from 14 crosses in F_6 generation and 2,745 progenies from 113 crosses in F_7 generation along with the check variety, Bakria for evaluation. • In chickpea, 320 F1s, 208 F2 bulks, 54 F3SSD, 198 F4 SSD(X011), 110 F4 SSD(X012), 2032 F7 progenies, 1719 fixed lines evaluated.
Key outcome	**:**	• 27 F_2 populations advanced as F_3 bulk. A significant variability for various morpho-physiological traits observed. F3 bulks planted in Terbol and Marchouch for generation advancement following bulk-pedigree method. • 367 F5 selections with earliness, non-shattering, seed size, cotyledon colour, seed coat colour and high biomass selected and 350 F_4 single plant selections advanced to the summer nursery. • 430 single plant progenies with special traits selected from F4 populations.

		• Total 646 single plant progenies from 5 F_3 crosses (DPL-58 × LWL-7, ILWL-425 × DPL-62, ILWL-366 × DPL-58, DPL-58 × ILWL-248, DPL-62 × ILWL-189) and 450 plant progenies • In chickpea, 49 early maturing lines identified for further evaluation.

3. Activity: Application of TiLLING approach for lentil improvement

Title	**:**	TiLLING approach to elucidate gene function in mutant population
Objectives	**:**	To iIdentify novel mutants for the introduction of novel allelic variation for extra earliness, herbicide tolerance and machine harvestability
Activities	**:**	New
Observations	**:**	Morphological traits, Phenological traits, Yield and yield components
Materials and methods	**:**	Lentil mutant populations were generated for two varieties namely ILL4605 and ILL5883 with three doses of gamma rays including 50Gy, 100Gy and 150Gy.
Key outcome	**:**	A total of 2774 single plant selections and 6140 SSD carried forward at M1 generation of ILL 4605. For ILL5883, 285 single plant selections and 8758 SSD made at M_1 generation. Interesting morphological mutants identified. (Plate1). A  B  C  D  E   **Plate 1.** Chlorophyll mutants and mutants (A, B) with three flowers per peduncle (C,D) and stunted growth (E) and large tendrils (F) identified in ILL 4605 M_1 population.

4. Activity: Generation advancement of lentil chickpea RIL population

Title	**:**	Development of recombinant inbred lines (RIL) populations
Objectives	**:**	To study linkage and association mapping to establish trait-marker relationship
Activities	**:**	Continued
Observations to be taken	**:**	Phenological traits
Populations	**:**	30 RIL population at F_2 generation in Marchouch, 33 RIL population at F_3, F_4 and F_5 generation in Terbol following SSD Planted Magic 1600 S.plant; F5 RILs (FW3) 126 acc.; F5 RILs (DR4) 134 acc.; F5 RILs (AB7) 55 accc.; F4 RILs (Salt2) 150 S.plant; F4 RILs (CT2) 150 S.plant, F5 RILs (AB7)120 S.plant; F5 RILs (DR4) 48 S.plant; F5 RILs (FW3) 50 S.plant
Key outcome	**:**	All population are advanced for one more generation through SSD method. 12 RIL populations at F6 Generation advanced for final RILS construction **(Attachment: MEL-F10**) In chickpea following populations are advanced : Magic 1600 S.plant; F5 RILs (FW3) 126 acc.; F5 RILs (DR4) 134 acc.; F5 RILs (AB7) 55 accc.; F4 RILs (Salt2) 150 S.plant; F4 RILs (CT2) 150 S.plant, F5 RILs (AB7)120 S.plant; F5 RILs (DR4) 48 S.plant; F5 RILs (FW3) 50 S.plant