

## 5352: Deliverable: Evaluation of germplasm for phenological variation

### Product line 6: Extra early varieties of chickpea and lentil

Development of extra-early varieties of chickpea and lentil offers opportunities for intensification and diversification of existing cropping systems. Some of the opportunities are legumes into new niches such as rice fallows in South Asia, two crops per season in Ethiopia, and spring planted legume crop in West Asia and North Africa. To achieve this goal, appropriate changes in phenology and plant type that can fit within the short-season windows available between major cereal crops are required. Under the Product Line 6, research activities were undertaken to develop improved varieties through trait discovery and deployment in appropriate agronomic background, and their large-scale adoption through demonstrations, training and farmers' participatory seed system.

#### 1. Activity: Evaluation of lentil germplasm

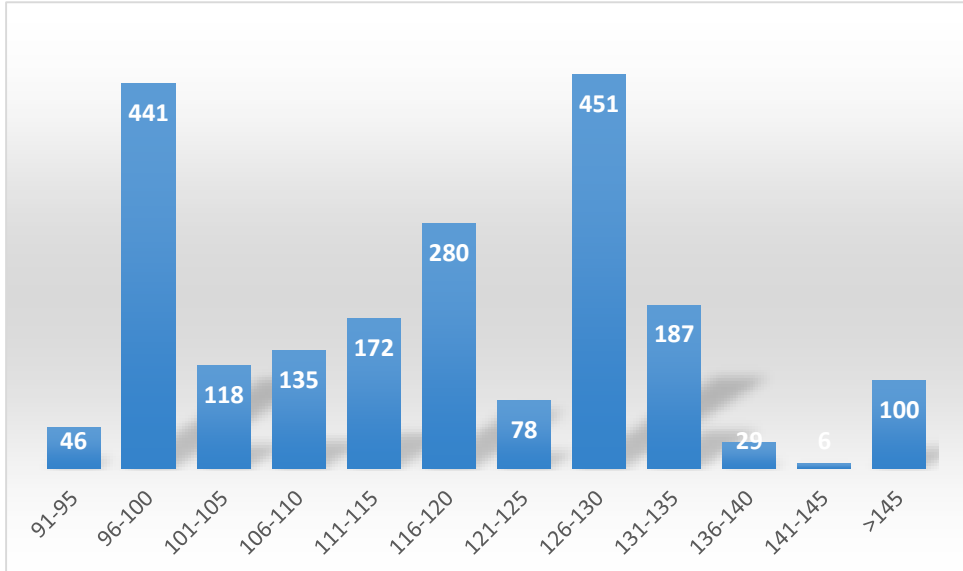
<b>Title</b>	:	Evaluation of lentil germplasm at hot spots																										
<b>Objectives</b>	:	Identification of novel genetic variation for earliness, disease resistance and seed traits																										
<b>Activities</b>	:	Continued.																										
<b>Observations to be taken</b>	:	Days to flowering, Days to maturity, seed traits, disease scores																										
<b>Materials and methods</b>	:	2040 germplasm accessions received from USDA were evaluated for phenological traits in non-replication augmented trial. Evaluation of association panel of lentil (150 genotypes) for phenological traits in replicated alpha design to determine marker-trait associations, identify potential quantitative trait loci (QTL) and beneficial alleles for crop improvement.																										
<b>Key outcome</b>	:	<p>Days to 50% flowering ranged from 93 (IG162923) to 144 (IG163659 and IG163649) with a mean of 115 days (<b>Attachment: MEL-F01</b>). We selected 46 lines for further evaluation to identify novel variability that could be utilized for widening the genetic base of earliness in lentil. Earliness in cultivars presently in farmers’ fields is based on a single gene derived from ‘Precoz’.</p> <div><table><tr><th>Days to 50% flowering</th><th>Frequency</th></tr><tr><td>91-95</td><td>46</td></tr><tr><td>96-100</td><td>441</td></tr><tr><td>101-105</td><td>118</td></tr><tr><td>106-110</td><td>135</td></tr><tr><td>111-115</td><td>172</td></tr><tr><td>116-120</td><td>280</td></tr><tr><td>121-125</td><td>78</td></tr><tr><td>126-130</td><td>451</td></tr><tr><td>131-135</td><td>187</td></tr><tr><td>136-140</td><td>29</td></tr><tr><td>141-145</td><td>6</td></tr><tr><td>&gt;145</td><td>100</td></tr></table></div>	Days to 50% flowering	Frequency	91-95	46	96-100	441	101-105	118	106-110	135	111-115	172	116-120	280	121-125	78	126-130	451	131-135	187	136-140	29	141-145	6	>145	100
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Figure 1. Frequency distribution of lentil germplasm based on days to 50% flowering and maturity at Marchouch during 2016

- Evaluation of association panel of lentil revealed a variation of 60 to 123 days to 50% flowering and 96 to 149 days to maturity with a mean of 90 and 129 days, respectively (Figure 2). Lentil genotype ILL595 flowered in less than 70 days and matured in 96 days (**attachment: MEL-F02**). GBS using the two-enzyme (*Pst*I, *Msp*I) method identified eight marker-trait associations (Table 1).

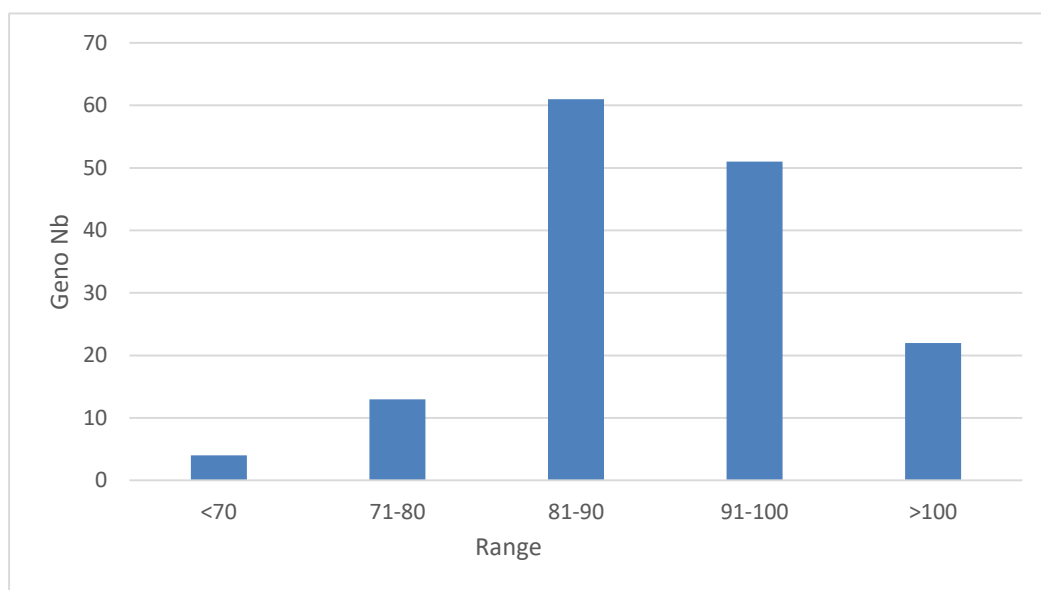


Figure 2. Frequency distribution of lentil genotypes used in association panel for days to 50% flowering

**Table 1.** The preliminary results of GWAS describing the marker-trait associations in agronomic traits.

Trait	Marker	P	r <sup>2</sup>
Seed weight	986	0.0002	0.10
Seed weight	9594	0.0005	0.10
Seed weight	5617	0.0007	0.09
Plant height	13524	0.0008	0.10
Days maturity	824	0.0001	0.13
Days maturity	244	0.0007	0.13
Seeds per pod	10700	0.0008	0.07

- Evaluation of 38 lentil genotypes at various locations in India resulted in identification of four genotypes (ILWLS 118, IPLS 09-17, IPLS 09-5 and IPLS09-34) with <45 days to 50% flowering.
- Screening of lentil lines at hot spots in Ethiopia resulted in identification of 17 genotypes with multiple resistance to rust and Ascochyta blight. Screening of 200 lentil lines for Ascochyta blight in Sinana, Ethiopia yielded 63 sources of resistance (1-3 ratings).
- Screening of 77 improved lines of lentil against stemphylium blight along with susceptible (K-75) and resistant (Precoz) checks showed only 14 lines with moderate resistance:

Sl. No.	Genotype	PDI (%)	Disease score	Disease reaction
2	LP-15-2	28.15	2.53	MR
3	LP-15-3	26.67	2.40	MR
6	LP-15-6	31.81	2.86	MR
7	LP-15-7	25.93	2.33	MR
8	LP-15-8	31.85	2.87	MR
13	LP-15-14	25.19	2.27	MR
17	LP-15-20	27.41	2.47	MR
<b>22</b>	LP-15-25	20.00	1.80	MR
24	LP-15-27	26.85	2.42	MR
29	LP-15-33	24.44	2.20	MR
35	LP-15-39	25.93	2.33	MR
48	LP-15-57	27.41	2.47	MR
62	LP-15-75	26.67	2.40	MR
65	LP-15-79	25.93	2.33	MR
76	Precoz (RC)	18.89	1.70	MR
77	K-75 (SC)	50.56	4.55	MS
	SEm(±)	1.70		
	CV (%)	5.9		
	CD (0.05)	4.80		