

D2a.2 Report on selected genotypes for abiotic stress tolerance

From the stability study carried out with fifteen **Chickpea** genotypes (13 from the ICARDA collection and 2 from the Portuguese catalogue), during three years and across two sites, four groups of genotypes were identified depending on their performance. For each genotype a linear regression of yield on the mean yield of all varieties for each site and season was computed to measure genotype adaptation. High values of the slope of the regression analysis are associated with high yield potential of each genotype, according to Finlay and Wilkinson (1963).

The 4 groups of genotypes identified are (Fig 1):

- 1) Genotypes 'ILC 3182' and 'FLIP03-145C' showing high slope (b) and high interception (a), indicating good performance across all environments;
- 2) Genotypes such as 'ILC 3279', 'ILC 10722', 'ILC 1302', 'FLIP03-046C' and 'FLIP04-019C' indicating bad adaption to poor environments;
- 3) Genotypes such 'FLIP87-008C' and 'ILC 588' indicating good adaptation for poor environments;
- 4) 'FLIP03-002C'. This is the worst situation, with bad response to all climatic and edaphic conditions.

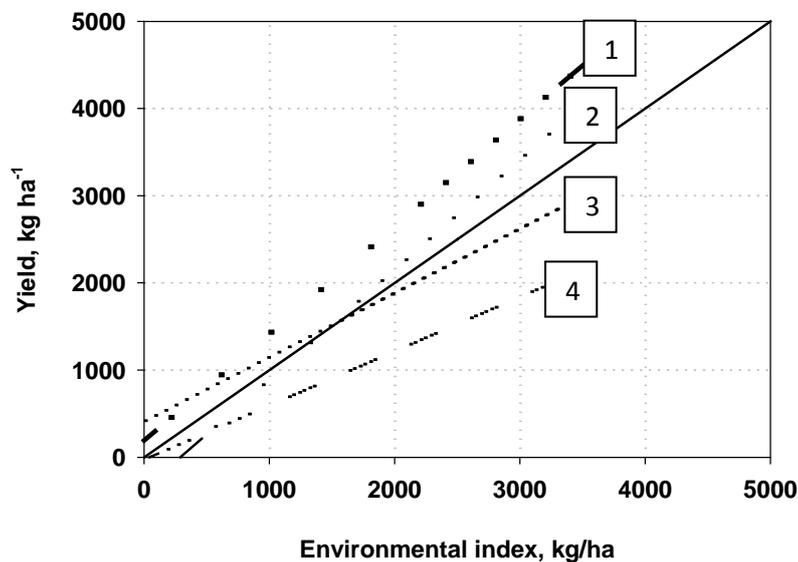


Fig 1: Joint regression analyses with four contrasting groups (1 to 4), calculated by regressing genotype means against a site index, the mean yield or the mean site effect.

We concluded that the genotypes **FLIP03-145C** and **ILC 3182** stand out by their **high yield** in the two regions and three years, showing good adaptation under moderate

and severe water scarcity conditions. In the most stressful years FLIP87-008C and ILC 588 were on the top 5 of chickpea yield in Portugal and Syria (Fig 2).

Differences in phenological development indicate that chickpea genotypes that fasten their development cycle showed in general higher grain yield, especially in drought years. FLIP03-145C and ILC588, which are highly tolerant to drought, present the lowest number of days to maturity. ILC588 is the earliest in flowering.

Distinct patterns were also observed in the principal components analysis of data concerning leaf gas exchange, water relations and hormones in six chickpea genotypes, chosen by their contrasting behavior. This suggests the existence of metabolic differences in the response to stress, in addition to the phenological ones.

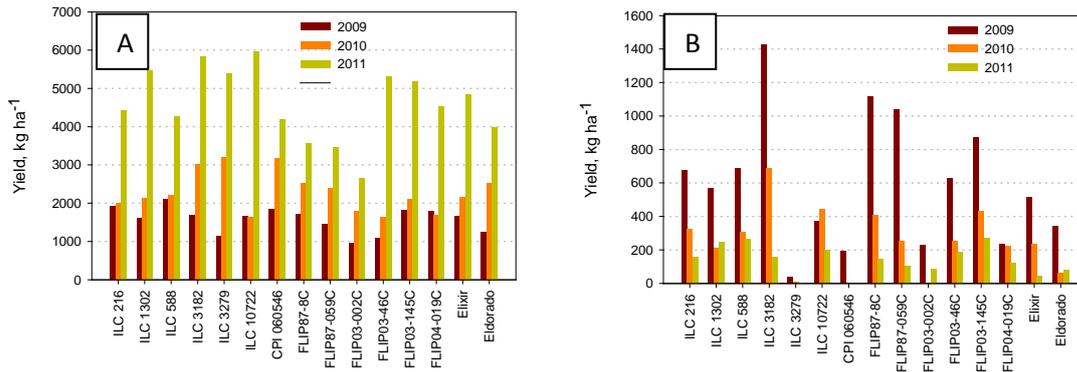


Fig 2: Grain yield mean (kg.ha⁻¹) of chickpea accessions grown in two locations (A- Elvas and B- Aleppo) with respect to all field trials (2009, 2010 and 2011).

From the studies on eleven **Faba Bean** accessions (8 breeding lines and 3 cultivars, Table 1) performed in ICARDA, it was shown that phenological and agronomical traits are affected by terminal drought. Accession 3 of Faba Bean (DT/B7/9043/2005/06) showed the best tolerance to drought in Syria; however, accession 2 (DT/B7/9013/2005/06) was the most stable, showing highest yield on average during the four years of study. Yield ranged from 1000 to 3500 kg/ha in Syria in rainfed conditions and up to 5000 kg/ha under supplementary irrigation. In Morocco the yield ranged between 1000 and 4500 kg/ha under rainfed conditions, with ILB 1270 being the best yield performer.

Supplemental irrigation at flowering stages, podding and grain filling had a positive effect in the biomass, plant height, rhizobium weight for the different studied genotypes. The developed faba bean drought tolerant lines performed homogeneously under rainfed conditions, with water distribution during cropping season of the order of 300 to 400mm. In extreme drought (with less than 250 mm), yield dropped to 1.2 t/ha on average of all developed lines, while traditional varieties went down to less than 1 ton/ha. Days to maturity (DMAT), days to flowering time (DFLR) and distance between nodes

(DTN) explained 87.5% of the grain yield (GY in dry land system, while DMAT, DTN and Rhizobium weight (RHWP) explained 65 % of Biological yield. Faba bean lines genotypes responded positively to supplemental irrigation, with 50% of irrigation of soil water capacity being enough to increase the yield to maximum for some breeding lines.

Table 1: The names and origins of Faba bean genotypes evaluated for drought tolerance in the field

Entry No.	Name	Selection name	Origin
1	FLIP08-054FB	DT/B7/9028/2005/06	ICARDA
2	FLIP06-010FB	DT/B7/9013/2005/06	ICARDA
3	FLIP06-008FB	DT/B7/9043/2005/06	ICARDA
4	FLIP08-057FB	DT/B7/9035/2005/06	ICARDA
5	FLIP12-001FB	DT/B7/9005/2005/06	ICARDA
6	DT/B7/9020/2005/06	DT/B7/9020/2005/06	ICARDA
7	DT/B7/9008/2005/06	DT/B7/9008/2005/06	ICARDA
8	Reina Blanca	ILB 1270	Spain
9	DT/B7/9009/2005/06	DT/B7/9009/2005/06	ICARDA
10	Syrian local large	ILB 1814	Syria
11	Aguadolce	ILB1266	Spain

Fifteen promising **Lentils** breeding lines were selected and planted under rainfed and with supplemental irrigation at two locations in Syria (Tel Hadya and Breda) during four years (2009, 2010, 2011, and 2012). The highest grain yield in lentils growing under rainfed conditions was recorded in ILL 7670 and in ILL 6994, with grain yields around 1000kg/ha. Early maturing lines with high biomass in general performed better under water deficit condition. Heat emerged as a major confounding effect on drought evaluation. Pods and seeds per plant, seed size and harvest index can be useful selection criteria for rainfed condition. As expected, water availability affects both vegetative and reproductive growth of lentils. The response to supplementary irrigation depends on the genotype but also on the year, namely on the total rainfall during the season and its distribution. The increase in seed yield may range from 13 to 37%. Genotypes ILL 590, ILL 6002, ILL7537, ILL8068, ILL10135, ILL10072, ILL 10707 responded positively to irrigation, whereas ILL6994, ILL7670, ILL7947,ILL19691 barely responded. ILL 7537 (1190 kg/ha) and ILL 10707 (1160 kg/ha) were the top yielders under irrigated conditions. In general, high yielding genotypes had lower response to supplementary irrigation as compared to low yielders. Also, small seeded genotypes tended to respond more positively to irrigation than genotypes with larger seeds.