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Agronomic evaluation of introduced accessions of *Vicia narbonensis* L. under contrasting environments and two years period

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Abstract. This work aimed to evaluate agronomic and nutritive characteristics of 9 accessions of *Vicia narbnonensis* received from ICARDA under the framework of germoplasm exchange. They were evaluated in two contrasting locations (Oued Mliz, semi arid and Oued Béja, sub humid) during two cropping years (2009-2010 and 2010-2011) in comparison with two checks arranged in a randomised complete bloc design with three replications. Seed yields, pod and seed number, flowering date and winter vigour were scored. During first year, analysis of variance showed significant effects of site, accession and their interaction for all agronomic traits. Flowering and pod set are earlier in Oued Mliz while pod maturity was earlier in Oued Béja with highest number of pods. Seed number and seed weight were higher in Oued Mliz. Significant correlations were obtained between flowering and pod set and flowering and pods/plant. Among these accessions, 6 were selected and evaluated the following year. During second year, seed yield of these accessions was two times higher in Oued Béja. Based on yield and yield components, two accessions were released for cultivars registration.

Keywords. *Vicia narbonensis* L. – Agronomic evaluation – Semi-arid – Sub humid.

Evaluation agronomique d'accessions introduites de* Vicia narbonensis *L. dans deux localités et deux années

Résumé. *Ce travail a pour objectif d'évaluer les caractéristiques agronomiques et nutritionnelles de neuf accessions de* Vicia narbonensis *L. reçues de l'ICARDA. Elles ont été évaluées dans deux sites contrastants durant deux campagnes consécutives en comparaison avec deux témoins locaux. Le dispositif expérimental étant en bloc aléatoire complet à 3 répétitions. Des paramètres agronomiques, phénologiques et de rendement ont été mesurés. Durant la première année, l'analyse de variance a montré un effet hautement significatif du site, de l'accession et de leur interaction sur tous les paramètres sauf le pourcentage de gousses vides. La floraison est précoce à Oued Mliz alors que la maturité est précoce à Oued Béja. Des corrélations significatives sont obtenues entre la floraison et la formation de la 1ère gousse et la floraison et le nombre de gousses. Parmi ces accessions, 6 ont été retenues pour être ré évaluées la campagne suivante. Durant la deuxième année, le rendement grainier est deux fois plus élevé à Oued Béja qu'à Oued Mliz. En se basant sur ces résultats, 2 accessions ont été retenues et vont faire l'objet d'inscription variétale.*

Mots-clés. Vicia narbonensis *L. – Évaluation agronomique – Semi aride – Sub humide.*

I – Introduction

Vicia narbonensis L. (Narbon vetch) is a leguminous species with the potential to become an important grain and straw crop for animal feed in dry temperate areas (Bennett and Maxted, 1997). *V. narbonensis* var. *narbonensis* is currently cultivated as a minor crop in the Middle East (Maxted, 1995). It is widely distributed in Mediterranean basin where it is cultivated under rained conditions and often used to feed animals. *V. narbonensis* was found to be a widespread calcicole species in Syria and Turkey with two botanical varieties, narbonensis and salmonea; the

variety jordanica was restricted to southern Syria (Enneking and Maxted, 1995). In Tunisia, only the var. *narbonensis* was found (Hassen, oral communication); it grows spontaneously on deep alkaline sandy and silty soils on low altitudes. It is often found in faba bean crops in north Tunisia as well as in protected areas and cereals crops in the centre region. Several research works have shown that Narbon vetch is a good yielding species with good tolerance to cold and drought conditions. Vetch seeds could be integrated in livestock feeding to replace some protein sources like soybean. Selection of *V. narbonensis* accessions adapted to local conditions and those that could promise to improve animal performance is targeted.

This work was undertaken to evaluate the agronomic and nutritive value of introduced accessions of Narbon vetch in order to select promising lines for cultivars registration.

II - Materials and methods

1. Trials management

The trials were conducted under rainfed conditions in two contrasting sites (Oued Béja and Oued Mliz) during two cropping years. Oued Beja has a sub humid climate with 600 mm annual rainfall, cold winter and hot summer. Oued Mliz has a semi arid environment with 460 mm rainfall, cold winter and hot dry summer. The rainfall during the two cropping seasons is shown in Fig. 1.

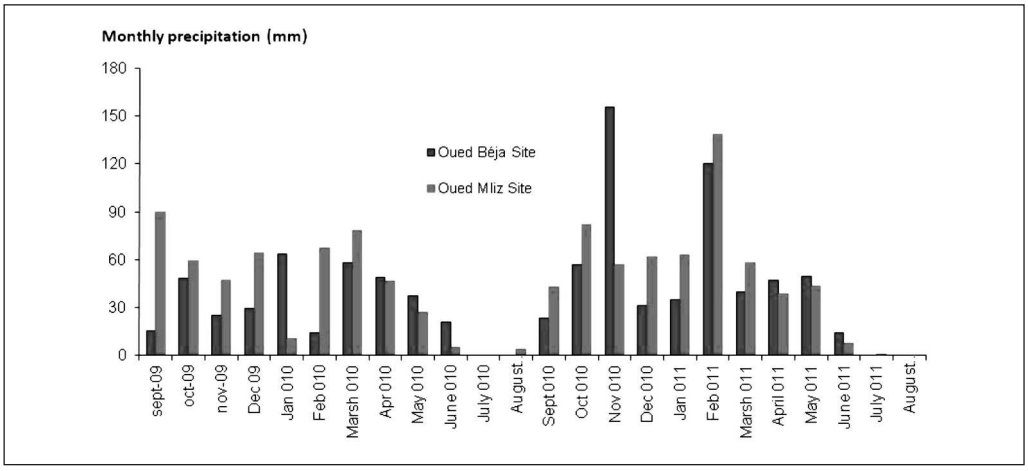

Fig. 1. Monthly precipitation recorded in Oued Béja and Oued Mliz sites during the two cropping years (2009-2010 and 2010-2011).

2. Plant material

In 2009-2010, nine accessions received from ICARDA in the frame of germoplsam exchange were evaluated in comparison with two local checks (acc. P1 and acc. 545). These accessions are originated from different Mediterranean countries. In 2010-2011, only 6 accessions were selected for a new evaluation. For each year and site, a complete bloc design with 3 replications was used. Each accession was sown in a plot of 4 rows of 4 m long and 30 cm intervals.

3. Measurements

Agronomic potential was determined during the first year in both locations by measuring seed yield and biological yield as well as phenological and agronomic traits such as seed and pod weight, percentage of shattering and empty pods. The second year, phenological traits, vigour and seed yield were measured in both sites. Yield components as pods plant^{-1}, seeds pod^{-1}, percentage of empty pods and percentage of shattering were evaluated at Oued Béja only and that on 20 plants taken randomly from each plot. The remaining plants in the plot were cut for seed yield evaluation in addition to the seeds of the 20 plants used for the other traits. Nutrient contents of Narbon vetch accessions seeds and straw are under analysis.

4. Statistics

Analysis of variance was performed on seed yield where year and site are regarded as random effects while accessions and replication are considered as fixed. For the other agronomic traits (phenological and yield components), ANOVA was performed on one year (random effect) and accessions and replications are fixed effects. Means was compared using Duncan test at 5% level.

III – Results and discussion

1. Seed yield

Seed yield is the only trait that was recorded in two sites during two years. Oued Béja site was more favourable for seed yield of Narbon vetch accessions than Oued Mliz (Table 1). This result was in agreement with that reported by Orak and Nizam (2009) in which, environmental factors strongly affect seed yields of Narbonne vetch.

Table 1. Seed yield (kg ha^{-1}) of Vicia narbonensis accessions evaluated in two sites during two cropping years (2001 & 2011)

	Oued Béja				Oued Mliz			
Accession	**2010**		**2011**		**2010**		**2011**	
	Mean	**SD†**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
1	5019	523	6488	634	4939	762.7	3000	511.6
10	6750	995	6218	261	5529	847.5	2347	843.1
12	4307	679	–	–	4181	1617	–	–
13	4227	1202	–	–	4846	788.5	–	–
14	5138	90	5011	1875	5784	741.2	2278	685.3
7	5348	886	5619	1219	5891	1081	1946	1094
8	5395	661	4582	424	5933	996.3	2181	126
9	5982	904	5956	2970	4662	2550	2139	1143.9
Local check (P1)	5329	3401	3694	2813	4845	301	2458	448
Local check (545)	234	35	–	–	4213	2967	–	–
Mean year	4943a		5367a		5082a		2336b	
Mean site		5117a			3951b			

–: Not included in the trial; values covered by the same letter are not significantly significant at P<0.05.
SD†: Standard deviation.

Average seed yield of all accessions not differed significantly from site to site (4943 kg ha^{-1} vs. 5082 kg ha^{-1}) during the first year (2010), despite the large difference in total amount of seasonal rainfall between sites. This proves that this legumes species is well adapted for a wide range of bioclimatic conditions. During the second year (2011), high significant effect of site was observed on seed yield (P<0.0001) while accession and site by accession interaction effects were not significant. Average seed yield was two times higher in Oued Béja than in Oued Mliz (5367 kg ha-1 vs. 2336 kg ha-1) despite the favourable rainfall conditions in both sites. Seed yield increased between 2010 and 2011 in Oued Béja while it decreased in Oued Mliz. This trend may be related to environmental conditions rather than genotypic effect. This was also noted by Ücel (2003) on *V. narbonensis* lines evaluated in southern Turkey for seed yield components. According to this author, as low temperature delays the date of flowering, seed yield and major yield components decrease.

3. Phenological traits and yield components

During the first cropping year (2009-2010), all traits measured on 10 accessions differed between sites. Most accessions set flowers and pods earlier in Oued Mliz than in Oued Béja (109 days vs. 102 days and 114 days vs. 123 days, respectively) while pods mature earlier in Oued Béja (154 vs. 164 days) and were higher in this site (76 pods vs. 36). Seed number and 100 seeds weight were higher in Oued Mliz. The ranking of accessions for these traits is given in Table 2.

Table 2. Means of all accessions for the phonological traits and yield components measured in 2009-2010 in both sites

Accession name	Origin	Days to flowering	Days to pod set	Days to pod maturity	Pods plant^{-1}	Seeds pod^{-1}	1000 seed weight
8	Lebanon	108a	118.7ab	160abc	55.22abc	4.02a	228.2a
12	Lebanon	107.8a	119ab	160abc	73.78a	4.45a	168.2cd
545†	Tunisia	107.8a	120.4a	162.4a	41.9c	3.88a	143.2d
P1†	Tunisia	106.8ab	120a	157.9c	54.57bc	3.98a	190.5abcd
1	Lebanon	106.6abc	118.6ab	158.8bc	51bc	4.73a	221.1ab
7	Lebanon	106.5abc	118.8ab	158.7bc	57.08abc	5.2a	180.2bcd
13	Lebanon	104.5bc	118.3ab	158.5c	54.7bc	4.74a	171.7cd
10	Turkey	104.5c	118.2ab	158c	58.05abc	4.53a	211.7abc
9	Syria	104.2c	118.7ab	160.7abc	66.1ab	4.41a	174.8cd
14	Iraq	104c	117.3b	161.1ab	61.36ab	4.33a	201.3abc
Average		106.1	118.8	159.5	57.8	4.41	189.7
SE		0.61	0.61	0.67	3.57	0.14	6.3

A,b,c,d Different letters in the same Colum denote significant difference (P<0.05) between means.

†: local checks.

Significant correlations were found between flowering and pod set (r^2 = 0,88; P<0,001; n = 60) and flowering and pods/ plant-1 (r^2 = 0,61; P<0,001; n = 60). Seed yield was positively correlated to seed weight (r^2 = 0,65; P<0,001; n = 59). Based on seed yield and yield components, acc. 1 and acc. 9 were selected as promising lines that deserve registration in the national catalogue. Both accessions had low percent of empty pods. Acc. 1 had prostrate growth habit with low lodging susceptibility while Acc. 9 is early flowering and is having an erect growth habit.

IV – Conclusion

The evaluation of Narbon vetch under contrasting environments has demonstrated interesting grain yield under semi arid conditions. Seed weight is an important criterion for selecting high yielded accessions. In semi-arid conditions, earliness is important for selecting material having the ability to complete life cycle before the spring drought. The integration of Narbon vetch seeds in livestock feeding to replace some protein sources like soybean meals still depending on future nutritive values under evaluation.

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