Determination of the Yield and Yield Components of Narbon Vetch (Vicia narbonensis L.) Lines Grown in Spring

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Abstract: Fifteen narbon vetch (*Vicia narbonensis* L.) lines obtained from ICARDA were used in this study. The highest seed yield (1163 kg/ha) was obtained by the line 2390, the lowest seed yield was obtained (1110 kg/ha) by the line 2561. As an average, the 1000-seed weight ranged between 171.4 g and 318.8 g, whereas biological yield ranged between 4043 kg/ha and 7899 kg/ha. It has been found that the relationship among the traits varied according to the years. Although there were negative correlations (-0.656**) between 1000-seed weight and seed per pod, and also there was positive correlations (0.830**) between 1000-seed weight and pod length. The biological yield was positively correlated (0.680**) with pod length and 1000-seed weight. Except for the plant height, there was no significant correlation between the seed yield and other characteristics in summer sown lines.

Keywords: Narbon vetch (*Vicia narbonensis* L.), plant height, 1000-seed weight, biological yield, seed yield, relationship between seed yield and other traits.

Introduction

In the arid and semi-arid regions of Turkey, traditional cereal/fallow cropping systems are practiced by majority of the farmers. Every year, about 16.7 million ha are under cultivation and 5.1 million ha are left as a fallow (Anonymous, 1998). Hence, approximately one fifth of the crop land is left as a fallow for 12-14 months. Central and southeastern areas generally receive less than 500 mm average annual precipitation during December and May months. Plant growth is seriously affected by the amount and distribution of rainfall. The fallow practice could be ended by using suitable cropping system in transitional regions having 400-500 mm or more annual rainfall (Acikgoz 1988, Iptas et al. 1994). Tokat Province is located in the region of the Transitional climate. Hence, the amount of rainfall varies according to year-to-year. Since the fallow area was 25.1% of the total cropland in the year 1980, it reduced to 8.9 % in the year 2000. The area obtained by reducing fallow area can be used to grow chick-pea, lentil and vetch species. Vetch species are grown either as pure stand or as a mixture with cereals for green herbage, hay and seed production. Narbon vetch (Vicia narbonensis L.) is grown for seed production widely in arid and semi-arid regions (Acikgoz, 1988; Eason et al. 1987; ICARDA 1988). Buyukburc et al. (1994), Iptas et al. (1994), Buyukburc & Iptas (2001) have found that narbon vetch has a potential importance for seed production, when sown either in autumn or in spring in Tokat Province. Major portion of precipitation occurs in early spring months in Tokat Province. Climatic conditions are suitable between the end of February and the second quarter of March for spring sowings. Narbon vetch crop when sown as spring legume under Tokat ecological condition will get it's seed maturation within 119-128 days. The seed of narbon vetch contains about 20-32 % protein, hence it is expected to play a very important role in the dietary of broiler chickens (Abd-el Moneim 1992, Eason et al. 1990, Thomson et al. 1990). The straw is palatable as a forage for sheep (ICARDA, 1989).

The objectives of this study are to: (i) determine the yield and the yield components, (ii) determine the relationship between the seed yield and other agronomic traits.

Material and Methods

This study was carried out during the year 1995 and 1996 under Tokat-Kazova (40° 13' -40° 22' N, 36° 1' - 36° 40' E, elevation 623 m) ecological conditions by growing narbon vetch lines as a spring crop. Some climatic data regarding the research area are given in Table 1. As it is seen in Table 1 that total rainfall of 236.8 mm, 354.1 mm and 203.6 mm was recorded between March and June months during the 1995, 1996 and long durations, respectively. In 1996, the amount of rainfall was higher than the year 1995 and long durations. Almost half of the annual rainfall has fallen into March and June months in Tokat-Kazova region as long durations. The study soils are slightly alkaline in reaction, medium in calcium carbonate content, medium to poor in P content, high in K content and medium to poor in organic matter.

Months	Average temperature (°C)			Rainfall (mm)			Relative humidity (%)		
	1995	1996	Long duration	1995	1996	Long duration	1995	1996	Long duration
March	9.0	5.2	7.1	30.1	112.9	40.2	45.7	73.8	57.9
April	10.9	10.2	12.5	115.3	122.1	63.7	52.8	69.4	57.6
May	17.1	18.8	16.3	33.7	83.9	60.3	44.9	64.0	55.2
June	21.0	18.6	19.5	57.7	35.2	39.4	45.3	58.8	55.5
July	20.9	23.0	21.9	26.7	0.9	11.2	55.2	55.0	52.9
Mean/Total	15.8	15.2	15.5	263.5	355.0	214.6	48.8	64.2	55.8

Table 1: Climatic data regarding the experimental years and long duration period

Fifteen genotypes of narbon vetch were used; 2561 and 2393 accession, Syria origin; 2380, 2383, 2390, 2391, 2392, 2467 and 2468 accession, Lebonan origin; 2461, 2462, 2464, 2465 and 2466 accession, Turkey origin. The experiments were carried out as a randomized complete block design with three replications. The seed bed was prepared conventionally and the plots seeded as 200 seed/plot on 5th March 1995 and 12th March 1996, in rows spaced 30 cm apart with four rows. Before seeding, 30 kg N/ha and 60 kg P_2O_5/ha were uniformly broadcast on all the plots. The plots were weeded manually throughout the growing season as and when needed. At harvest, measurements on the plant height, pod per plant, number of seed per pod, and pod length were also recorded for each plot. These measurements were obtained from 10 plant for each plot. The plots were hand-harvested at the surface of soil and plants were weighed in order to determine the biological yield. After thrashing, clean seeds were weighed and the 1000-seed weight was determined. The harvest index was calculated by dividing the seed yield by total biological yield. Harvests were finished between 15-30 June in both years. The analysis of variance of the years 1995, 1996 and means of 2 years were done, and average differences were determined by Least Significant Difference (LSD) test as suggested by Duzgunes (Duzgunes et al. 1987). Also, the General Linear Model procedure of SAS was used to determine the simple correlation coefficients among all measured variables.

Results and Discussion

Yield And Yield Components

Plant height of narbon vetch lines are presented in Table 2. As it is seen in Table 2, that plant height varied between 53.0 and 77.3 cm (average of two years). Highest plant height was observed for line 2468, lowest for line 2390.

Accession	Plant height (cm)			Pod per plant (no./plant)			Seed per plant (no./plant)		
	1995	1996	Mean	1995	1996	Mean	1995	1996	Mean
2561	63.1	63.6	63.4	5.4	10.6	8.0	4.5	4.7	4.6
2380	64.3	60.0	62.2	4.5	12.4	8.5	4.6	4.1	4.4
2383	72.4	73.4	72.9	5.2	11.9	8.6	4.0	4.4	4.2
2388	65.2	68.9	67.1	5.3	10.0	7.7	3.3	4.1	3.7
2390	49.5	56.4	53.0	7.0	9.7	8.3	3.9	3.8	3.9
2391	63.1	65.1	64.1	5.6	11.9	8.7	3.5	4.1	3.8
2392	61.0	70.2	65.6	7.4	16.1	11.8	4.1	3.8	4.0
2393	66.8	68.4	67.6	4.6	10.9	7.7	3.9	5.1	4.5
2461	64.9	73.4	69.2	5.8	10.4	8.1	3.5	4.2	3.9
2462	65.2	74.3	69.8	7.0	10.0	8.5	3.7	4.7	4.2
2464	74.1	69.3	71.7	6.7	8.5	8.3	2.9	4.5	3.7
2465	63.9	52.2	58.0	6.4	10.7	8.6	3.6	4.4	4.0
2466	69.7	72.3	71.0	6.8	9.6	8.3	3.5	4.1	3.8
2467	75.4	69.7	72.6	6.6	10.5	8.6	3.9	4.4	4.2
2468	76.3	79.1	77.7	6.2	10.5	8.4	4.1	4.1	4.1
Mean	66.3	67.7	67.0	6.0	10.9	8.5	3.8	4.3	4.0
LSD	ns	ns	13.5**	ns	ns	ns	0.9**	0.7*	0.6**

*,** significant at 0.05 and 0.01 probability levels

Table 2: Plant height, pod per plant and seed per plant of narbon vetch lines

Accession	Pod length (mm)			1000 seed weight (g)			Biological yield (kg/ha)		
	1995	1996	Mean	1995	1996	Mean	1995	1996	Mean
2561	44.6	47.6	46.1	182.6	160.3	171.4	4033	3590	3811
2380	50.6	53.3	52.0	233.0	246.0	239.5	3985	3854	3919
2383	50.0	57.3	53.6	259.3	256.5	257.9	4666	4236	4451
2388	49.3	55.6	52.4	265.3	288.1	276.7	4180	4478	4329
2390	47.3	55.3	51.3	243.0	268.9	256.0	4277	3819	4048
2391	49.0	56.6	52.8	273.0	276.8	274.9	3937	4593	4260
2392	52.6	56.3	54.4	234.3	275.2	254.8	3693	2809	3251
2393	53.6	62.3	57.9	298.6	261.8	280.2	5152	3958	4555
2461	51.0	60.6	55.8	299.3	264.6	282.0	5152	4618	4885
2462	53.6	61.3	57.4	322.6	257.0	289.8	7485	5104	6294
2464	51.3	61.3	56.3	345.3	292.3	318.8	6076	5069	5572
2465	50.6	60.0	55.3	304.3	273.3	288.8	5930	4963	5446
2466	51.6	59.6	55.6	327.0	283.5	305.2	6319	4826	5572
2467	53.6	57.3	55.4	274.0	279.4	276.7	5103	3666	4384
2468	56.3	58.0	57.1	264.6	271.5	268.1	5881	3215	4548
Mean	51.0	57.5	54.2	275.0	263.6	269.3	5058	4186	4621
LSD	0.6**	0.7**	0.5**	52**	22**	33**	2065**	1420**	1256**

*,** significant at 0.05 and 0.01 probability levels

Table 3: Pod lenght, 1000 seed weight and biological yield of narbon vetch lines

The number of pod per stem was more during the year 1996 than 1995 (Table 2). The increase in the number of pod per stem was probably due to rainfall distribution during the vegetative stage. Buyukburc & Iptas (2001) also reported that the amount of rainfall had more effect on the number of pod per stem. Mean pod length ranged from 44.6 to 56.3 mm in 1995, 47.6 to 62.3 mm in 1996 and 46.1 to 57.9 mm as a mean of two years. The difference among lines are statistically significant at the 0.01 level. Increased number of pod per plant increased the pod length because of the more rainfall happened during the year 1996. This result confirms the findings of Buyukburc & Iptas (2001). The results regarding the number of seed per pod is given in Table 2. As it is seen in Table 2, that the number of seed per pod varied according to the years. This difference in general was related to the amount of rainfall. The number of seed per pod was the highest (4.6 seed/pod) in line-2561 and the lowest (3.7 seed/pod) in line-2464 and line-2388. For the 2-year average, significant differences ($P<0.01$) in 1000-seed weight were found among narbon vetch lines (Table 3). Weight of 1000-seeds was more in the year 1995 than the year 1996. This difference was due to decreased pod length and the number of seed per pod in the year 1995. Four lines (2464, 2466, 2462 and 2465) showed difference in 1000-seed weight than other lines. According to the means of two years, maximum biological yields were obtained by line-2462 (6294 kg/ha), followed by line-2464 (5572 kg/ha), followed by line-2466 (5572 kg/ha) and followed by line-2465 (5446 kg/ha) (Table 3). Data on seed yield and harvest index are presented in Table 4, respectively. Table 4 also indicates that both seed yield and harvest index varied significantly ($P< 0.01$). Seed yield has also decreased in the second year in lines 2392, 2462 and 2468. The seed yield varied between 728 and 1532 kg/ha during the year 1995 and varied

between 930 and 1848 kg/ha during the year 1996. Data on average of two year indicate that maximum seed yield was obtained from line-2390 (1666 kg/ha), followed by line-2391 (1514 kg/ha), line-2392 (1411 kg/ha) and line-2383 (1373 kg/ha), respectively.

Relationship between seed yield and the other characters

Simple correlation coefficients among the seed yield and the other traits are presented in Table 5. There was no year-to-year variation in terms of relationship between seed yield and yield components. Correlation was found (0.668**) between seed yield and the number of pod per plant (only in 1995). However, this correlation was not found in the year 1996. Decreased plant height, increased, the seed yield (mean of two year). Buyukburc & Iptas (2001) have reported a significant and positive relationship among seed yield, plant height and biological yield of similar lines when sown in winter. Similar authors have also found negative significant relationship with pods per plant. Since summer sowings have less vegetation growing period than winter sowings, due to this summer grown plants complete their vegetation stage in short period than winter grown plants. Hence, the difference in plant height and other agronomic characters is expected between summer and winter grown plants. An increase in pod length and 1000-seed weight have increased biological yield during the year 1995 (Table 5). In second year, a significant negative relationship was observed (-0.610*) between biological yield and number of pods per plant. According to the average of two years, increasing number of seed per pod decreased (-0.656**) the weight of 1000 seed (Table 5). Similar results were reported by Buyukburc & Iptas (2001) in winter sown. It is possible to benefit from the seed and straw of annual legume forage crops grown in arid and semi-arid region (ICARDA 1988, Cakmakci & Acikgoz, 1994). Due to this varieties which give more seed and straw are preferred. As reported by Abd-el Moneim & Cooks (1990) that generally varieties with high harvest index have high biological yield. However, in summer sown crops this position is not true. A significant negative relationship was observed between harvest index and biological yield in both years. This position shows that summer sown lines with high seed yield have high harvest index and low straw yield.

Accession	Seed yield (kg/ha)			Harvest index (%)		
	1995	1996	Mean	1995	1996	Mean
2561	910	1303	1107	23.8	36.0	29.3
2380	1161	1578	1370	29.8	41.3	35.0
2383	1066	1678	1373	22.2	39.4	30.4
2388	728	1848	1288	17.4	41.2	29.8
2390	1532	1800	1666	36.6	46.9	41.0
2391	1240	1787	1514	31.6	39.2	35.4
2392	1492	1331	1411	41.0	47.3	43.6
2393	869	1573	1217	16.7	40.7	26.6
2461	955	1598	1276	18.6	35.0	26.0
2462	1310	1280	1296	17.6	25.0	20.6
2464	1003	1343	1173	16.8	27.1	21.4
2465	1194	1370	1282	19.8	27.5	23.4
2466	1279	1319	1299	20.2	27.2	23.2
2467	1269	1403	1336	24.7	39.0	30.6
2468	1491	930	1211	25.9	29.1	27.0
Mean	1166	1476	1323	24.2	36.1	29.6
LSD	476**	521**	293*	10**	10**	7**

*,** significant at 0.05 and 0.01 probability levels

Table 4: Seed yield and harvest index of narbon vetch lines.

Characters	Plant height	Pod per plant	Seed per pod	Pod length	1000-seed weight	Biological yield	Seed yield
Pod per plant	-0.105 [1]						
	-0.015 [2]						
	-0.055 [3]						
Seed per pod	-0.178	-0.319					
	0.100	-0.331					
	-0.016	-0.093					
Pod length	0.584*	0.217	-0.110				
	0.322	-0.258	0.249				
	0.518**	0.050	-0.236				
1000-seed weight	0.378	0.294	-0.790**	0.509			
	0.176	-0.076	-0.363	0.704**			
	0.316	-0.067	-0.656**	0.830**			
Biological yield	0.424	0.391	-0.418	0.537*	0.783**		
	-0.087	-0.610*	0.283	0.510	0.282		
	0.286	-0.394	-0.265	0.585*	0.680**		
	-0.183	0.668**	0.240	-0.320	-0.062	0.122	
Seed yield	-0.380	0.024	-0.173	-0.118	0.145	0.212	
	-0.528*	0.344	-0.319	-0.138	0.039	-0.335	
Harvest index	-0.510	0.278	0.472	-0.163	-0.600*	-0.622*	0.684**
	-0.256	0.570*	-0.366	-0.448	-0.067	-0.626*	0.611*
	-0.470	0.569*	0.021	-0.464	-0.458	-0.869**	0.729**

1: 1995; 2:1996, 3: means of 2 year.
*,** significant at 0.05 and 0.01 probability levels, respectively.

Table 5: The simple correlations coefficient of seed yield and other traits

Conclusions

This experiment was carried out during the year 1995 and 1996 under Tokat-Kazova ecological conditions. The results are summarized as under:

a) When narbon vetch (Vicia narbonensis L.) was sown in March, it gave 1107-1666 kg/ha seed yield (average of two years).

b) Ecological factors (especially precipitation) have significantly affected the seed yield and agronomic characters.

c) The lines as 2390, 2391, 2392 and 2383 when sown in summer were found to be better than other lines in respect to seed yield.

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