Effect of Sowing Rate on Seed Yield and Yield Components of Narbon Vetch (*Vicia narbonensis* L.) Under Rainy Condition in Semi-Arid Regions of Turkey

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Abstract

This study was conducted to determine the effect of sowing rate (120, 140, 160, 180 and 200 kg ha⁻¹) on seed yield and yield components of different narbon vetch genotypes (Lines 2466, 2461, 2467, 2391, and 129). There was no significant difference among narbon vetch genotypes within each year, except for 1000-seed weight in 2002. Seed yield of genotypes was significantly high in the above-average rainfall year compared to below-average rainfall years. Seed yield varied from 2592 to 2868 kg ha⁻¹, 274 to 565 kg ha⁻¹ and 971 to 1493 kg ha⁻¹ in 2000, 2001 and 2002, respectively. The sowing rate did not impact narbon vetch seed, biological yield and harvest index. It was concluded that these genotypes respond similarly to changes in sowing rate and 120 kg ha⁻¹ sowing rate was suitable for seed production.

Key words: narbon vetch (*Vicia narbonensis* L.), sowing rate, yield components

Introduction

Traditional cereal/fallow cropping systems are used by the majority of the farmers in the arid and semi-arid regions of Turkey. To provide better quality feed for livestock population in these areas, and to improve soil fertility, annual forage legumes need to be introduced to replace fallow in the region (Acikgoz, 1988; Abd El Moneim et al., 1990). Grain legumes have lately been taken considerable attention in the central and southeastern areas of Turkey and Mediterranean-type environments among grain legumes, vetches (*Vicia* ssp.), lathyrus (*Lathyrus* ssp.), lentil (*Lens culinaris* Medik.) and chickpea (*Cicer arietinum* L.) shows good potential for their resistance to dry weather and adaptability to unfavourable environments. Especially, vetches (*Vicia* ssp.) are the most important forage crop in Turkey and grown for green herbage, hay and seed production. In addition, the seeds are widely used as a concentrate feed mixed with straw or cereal grains for livestock. Commercially, four species are cultivated in Turkey: common vetch (*Vicia sativa* L.), hairy vetch (*Vicia villosa* Roth.), Hungarian vetch (*Vicia pannonica* Crantz.) and narbon vetch (*Vicia narbonensis* L.). Common vetch is sensitive to cold, whereas hairy vetch, narbon vetch and Hungarian vetch are tolerant (Acikgoz, 1982; Acikgoz, 1988). Therefore, narbon vetch, Hungarian vetch and hairy vetch can be seeded in the fall without winter cold-damage in central regions of Turkey (Acikgoz, 1988; Buyukburc and Iptas, 2001). Narbon vetch is grown under a wide range of environmental conditions including drought, and has a high crude protein content and erect growth habit simplifying mechanical harvesting as well as several desirable agronomic characteristics. It may be used as dual-purpose crop for both grain and hay or green manure (Abd El Moneim, 1992; Turk et al. 2003).

The main objective of this study was to determine effects of sowing rate on the seed yield and yield components of narbon vetch lines in the semi-arid (medium rainfall <400 mm) regions of Turkey.
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Materials and method

This study was conducted in the experimental area of Agricultural Faculty of Gaziosmanpasa University, Tokat/Turkey, in 1999-00, 2000-01 and 2001-02. Climatic data during the experimental period and longterm average are shown in Table 1.

![Table 1. Average monthly rainfall and mean temperatures during the growing season of 1999-2002.](image)

The soils of the experimental area were slightly alkaline (pH 7.80), medium in calcium carbonate content (10.0%) and in P content (80.1 kg ha\(^{-1}\) P\(_2\)O\(_5\)), high in K (959 kg ha\(^{-1}\)) and poor in organic matter (1.68%) content. The experimental design was a randomized complete block in a split-plot arrangement with four replicates. Main plots consisted of lines or genotypes (lines 2466, 2461 and 129, origin Turkey; lines 2467, 2391, origin Lebanon), subplots consisted of sowing rates (120, 140, 160, 180 and 200 kg ha\(^{-1}\)). These lines were selected from previous evaluations of a range of germplasm as the best adapted material due to high seed yield and biological yield (Buyukburc and Iptas, 2001). Sub-plots were 6 m long in length and 6 rows wide. Seeds were planted at 20 cm row spacing. The seeding dates were 5 November 1999, 1 November 2000 and 8 November 2001. Prior to harvest, two border rows from each side and 0.5 m from each end of the plot were removed to eliminate border effects. Crops were not inoculated because they are common to the area in which they were grown and all produced healthy and active nodules. Before sowing, 30 kg ha\(^{-1}\) N and 60 kg ha\(^{-1}\) P\(_2\)O\(_5\) were uniformly broadcasted on all the plots. Ten uniform plants were collected randomly from the central four rows and yield component variables, including 1000-seed weight (g), biological yield (t ha\(^{-1}\)), seed yield (kg ha\(^{-1}\)) and harvest index (%) were recorded for each plot. Harvest index was calculated by dividing the seed yield by the total biological yield. Data for each year were analysed separately for a randomized complete block design with split-plot arrangement, because of variable weather conditions across the years of the study. Treatment means were compared by using Fisher’s Least Significant Difference (LSD) test at the 0.05 and 0.01 probability level (Gomez and Gomez, 1984).

Results

Differences for seed yield were not significant among genotypes. When compared all investigated years, seed yields were significantly lowest in the dry 2001 season (Table 2). Seed yield of genotypes varied from 2592 to 2868 kg ha\(^{-1}\), 274 to 565 kg ha\(^{-1}\), and 971 to 1493 kg ha\(^{-1}\) in 2000, 2001 and 2002, respectively. There was no significant difference between the 120 and 200 kg ha\(^{-1}\) sowing rate (Figure 1). Also, there was no genotype x sowing rate interaction effect on seed yield during the study period. 1000 seed weight of genotypes ranged from 315.8 to 349.3 g, 255.7 to 314.3 g, 314.4 to 347.4 g in years of 2000, 2001 and 2002. There was significant difference between the sowing rate for 1000 seed weight in 2002, whereas no significant differences was obtained in 2001 and 2002. No significant differences were observed among biological yields of genotypes. However, biological yields for all genotype and sowing rates in the year of 2000 were higher than those of 2001 and 2002. Biological yield of lines ranged from 10.53 to 11.29, 2.15 to 2.97, and 5.03 to 6.09 t ha\(^{-1}\) in 2000, 2001 and 2002, respectively. Biological yield was not significantly different among 120 to 200 kg ha\(^{-1}\) sowing rates in 2000, 2001 and 2002. Harvest index of genotypes was different in 2000, 2001 and 2002 growing season. Harvest index in 2000 was higher than that of 2001 and 2002, because of maximum total rainfall in this year. Increasing sowing rate did not affect harvest index in 2000 and 2001, but it was affected in 2002. Harvest index ranged from 12.7 to 25.7%, and the highest was obtained from genotype 129. In addition, harvest indexes of sowing rate (from 120 to 200 kg ha\(^{-1}\)) were between 24.0% and
25.2% in the first; 14.5% and 19.6% in the second; and 19.0% and 23.6% in the third year, respectively (Figure 1).

**Table 2. 1000-seed weight, biological yield, seed yield and harvest index in 2000, 2001 and 2002 under rainfed**

<table>
<thead>
<tr>
<th>Genotype</th>
<th>1000-seed weight (g)</th>
<th>Biological yield t ha⁻¹</th>
<th>Seed yield kg ha⁻¹</th>
<th>Harvest index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1¹</td>
<td>2²</td>
<td>3³</td>
<td>1</td>
</tr>
<tr>
<td>2466</td>
<td>349.3</td>
<td>276.3</td>
<td>347.4</td>
<td>10.7</td>
</tr>
<tr>
<td>2461</td>
<td>335.4</td>
<td>293.7</td>
<td>333.7</td>
<td>11.2</td>
</tr>
<tr>
<td>2467</td>
<td>332.8</td>
<td>314.3</td>
<td>331.2</td>
<td>11.0</td>
</tr>
<tr>
<td>2391</td>
<td>347.8</td>
<td>255.7</td>
<td>314.4</td>
<td>10.8</td>
</tr>
<tr>
<td>129</td>
<td>315.8</td>
<td>280.7</td>
<td>321.9</td>
<td>10.5</td>
</tr>
<tr>
<td>LSD</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>16.3**</td>
</tr>
</tbody>
</table>


**Discussion**

During the study period, the effects of annual rainfall and its monthly distribution on narbon vetch seed yield and other characteristics can be clearly seen. In semiarid regions, agricultural production mostly depends on the amount of annual rainfall and its distributions during the vegetative period. For annual forage legumes, the water is needed mostly during the sowing time (October, November) and the intensive growth period (March, April and May). Especially, water deficiency may constraints crop growth in these months (Acikgoz, 1988; Buyukburc and Iptas, 2001). Since amount of rainfall during the vegetative period in the year of 2000 was higher than that in the years of 2001 and 2002 (Table 1), so narbon vetch seed yield was high for the year of 2000. Seed yields obtained in the years of 2000, 2001 and 2002 were 2705, 437 and 1104 kg ha⁻¹, respectively (Figure 1). There were no significant differences among narbon vetch lines within each
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year. The relationship between seed yield and amount of rainfall during growing season shows variability for different crops. For example, Abd El Moneim (1992) reported that narbon vetch of seed yield was not related to total rainfall and the highest yield was obtained from low rainfall. However, Abd El Moneim and Cocks (1993) stated that seed yields of Lathyrus species was linearly related to total rainfall in similar ecological conditions. Also Siddique et al. (1993) concluded that there was a positively relationship between growing season rainfall and seed yield for faba bean, narrow leaf lupin and chick peas whereas no relationship obtained for field pea, lentil and albus lupin. Despite the difference in amount of annual rainfall, increasing sowing rate from 120 to 200 kg ha⁻¹ did not significantly affect seed yield. Similar results have been obtained by Anlarsal (1996) concluded that narbon vetch seed yield was not affected by increasing sowing rate from 160 to 240 kg ha⁻¹. However, Turk et al. (2003) stated that narbon vetch seed yield was significantly increased by increasing plant density (40 to 80 plant m⁻²).

Due to variability in amount of rainfall, there were important changes in biological yield of narbon vetch lines. Biological yield of narbon vetch lines was significantly higher for the year (2000) that has above-average rainfall compared to below-average rainfall years (2001 and 2002). These results agree with Thomson and Siddique (1997) who reported that maximum biological yield achieved by V. faba L., V. narbonensis L., and L. ochrus L. in the above-average rainfall year than in the dry year. Biological yield of narbon vetch was highly related to early spring rains (Abd El Moneim, 1992). In this study, increasing sowing rate was not increased seed yield of narbon vetch (Figure 1).

Narbon vetch has similar characteristics with faba bean. For this reason, it is expected that pod per plant and seed yield for narbon vetch decrease in years with high temperature and low rainfall (Siddique et al. 1993). Harvest index is an important yield component for narbon vetch. In semi-arid regions, narbon vetch with high grain yield and harvest index can be used as dual purpose crop for grain and straw production. In general, the selections with high harvest index also have high potential biological yields (Abd El Moneim, 1990, Abd El Moneim 1992). In this study, it can be concluded that biological yield in the years with above-average rainfall was high, and this can cause an increase in seed production (Table 2 and Figure 1). This result was consistent with the results of Thomson and Siddique (1997) and Buyukburc and Iptas (2001). The highest harvest index for the genotype 129 which matures latter was 25.7 and 24.5% for 2000 and 2002, respectively.

**Conclusion**

Annual rainfall and its distribution significantly affect seed yield and yield components of narbon vetch in semi-arid regions (250-500 mm). High seed and biological yield can be obtained from narbon vetch especially in years with above-average rainfall. Therefore, narbon vetch can be an alternative legume crop to Hungarian vetch and hairy vetch in these areas. Increased sowing rate did not affected seed yield of narbon vetch and 120 kg ha⁻¹ of sowing rate was suitable for seed production.

**References**


