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Effects of Seeding Rates on Yield and Yield Components of Hungarian Vetch (*Vicia pannonica* Crantz.)

Ayşen UZUN*, Uğur BİLGİLİ, Mehmet SİNCİK, Esvet AÇIKGÖZ
Department of Field Crops, Faculty of Agriculture, Uludağ University, Bursa - TURKEY

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Abstract: The effects of 4 seeding rates (20, 40, 80 and 160 kg ha^{-1}) on dry matter yield, seed yield and yield components were evaluated in 4 accessions (L46, L79, L457, Local) of Hungarian vetch (*Vicia pannonica* Crantz.) under fall seeding conditions during the 2000-2001 and 2001-2002 crop years. Dry matter yield, plant height, number of pods per plant, number of seeds per plant, 1000- seed weight, biomass yield, seed yield and harvest index were measured. Based on the 2-year results, no significant differences were found among Hungarian vetch accessions in any of the measured characteristics with the exception of 1000- seed weight. However, seeding rates significantly affected dry matter, seed yield and most of the yield components. High seeding rates resulted in greater dry matter and seed yield than the low seeding rates in both years.

Key Words: Hungarian vetch, seeding rates, dry matter yield, seed yield, yield components

Macar Fiğinde (*Vicia pannonica* Crantz.) Ekim Oranlarının Verim ve Verim Ögeleri Üzerine Etkileri

Özet: Kışlık olarak ekilen dört Macar fiği (*Vicia pannonica* Crantz.) hattında (L46, L79, L457 ve Yerli), farklı dört ekim oranının (20, 40, 80 ve 160 kg ha^{-1}) kuru madde ve tohum verimi ile verim ögeleri üzerine etkileri 2000-2001 ve 2001-2002 yıllarında incelenmiştir. Kuru madde verimi, bitki boyu, bitkide bakla sayısı, bitkide tohum sayısı, 1000 tane ağırlığı, biyolojik verim, tohum verimi ve hasat indeksi değerleri ölçülmüştür. İki yıllık sonuçlara göre; incelenen Macar fiği hatları arasında, 1000 tane ağırlığı dışında ölçülen tüm özellikler bakımından önemli farklılıklar bulunmamıştır. Ancak; ekim oranları, kuru madde ve tohum verimi ile verim ögelerinin çoğunu önemli derecede etkilemiştir. Her iki yılda da sık ekimlerde seyrek ekimlere göre daha yüksek kuru madde ve tohum verimleri elde edilmiştir.

Anahtar Sözcükler: Macar fiği, ekim oranları, kuru madde verimi, tohum verimi, verim ögeleri

Introduction

A number of vetch species (*Vicia* spp.) have considerable potential as grain and forage legumes since they are well adapted to the different soil and climate conditions throughout the Mediterranean environments (Acikgoz, 1988; Martiniello and Ciola, 1995; Papastylianou 1995). In the Mediterranean Basin, including Turkey, vetches are the most common annual forage crops cultivated for hay, pasturage or silage production either alone or mixed with cereals. Hungarian vetch (*Vicia pannonica* Crantz.) is a winter hardy species, which is widely used in regions with cool winter growing conditions (Acikgoz, 1982, 1988).

Previous studies with several vetch species indicated that the seeding rates influenced growth habit, morphological traits and yield (Aydogdu and Acikgoz, 1995; Türk, 1999; Seymour et al., 2002). However, field experiments on the effects of seeding rates on the dry matter, seed yield and yield components are very limited in Hungarian vetch genotypes. Recommended seeding rates for Hungarian vetch ranged from 35 to 130 kg ha^{-1}, depending on geographical locations (Whyte et al., 1953; Schoth and McKee, 1966; Kernick, 1978). Seed yield of Hungarian vetch also varied greatly in different areas (Schoth and McKee, 1966; Nikolaev and Kozmin, 1973). Recently Iptas (2002) obtained an

* Correspondence to: uzunay@uludag.edu.tr

average 1141 kg ha^{-1} seed yield in fall seeded plots with a 120 kg ha^{-1} seeding rate in Hungarian vetch production.

Hungarian vetch is generally recommended in dry regions with continental climates for hay or seed production under fall seeding conditions. However, seed yield was very low in such regions and varied greatly depending on the amount and distribution of spring rains. The main objective of this research was to identify optimum seeding rates of different Hungarian vetch accessions for dry matter and seed production under rainfed Mediterranean-type environments in Turkey.

Materials and Methods

The field trials were conducted during 2 growing seasons (2000-2001 and 2001-2002) at the Uludağ University, Faculty of Agriculture, Department of Field Crops, Bursa (40°11′ N, 29°04′ E). Four Hungarian vetch accessions (3 experimental lines L46, L79, L457, and a widely cultivated local ecotype) were grown at 4 seeding rates (20, 40, 80 and 160 kg ha^{-1}) in all possible combinations in a randomized, completed block experimental design with 3 replications. Seeds were sown by Oyjord drill. The plot size was 1.4 x 10 = 14 m^{-2}, consisting of 8 rows spaced at 17.5 cm. The previous crop was wheat in both years of the study. After seeding (10 November 2000 and 19 November 2001), 30 kg N ha^{-1} was applied. Weed control was performed by pre-plant application of trifluralin at 2 kg a.i. ha^{-1} and hand hoeing when necessary. During the peak podding stage of each accession, 5 plants were taken from each plot for yield component measurement. A 2 m^{-2} section was harvested for green herbage and dried at 70 °C for 48 h. The remaining plots were harvested by hand for biomass yield at maturity and threshed by plot harvester. Seed yield and harvest index were determined after cleaning the seeds. Four replicated 100-seed lots were weighed. All data were subjected to analysis of variance for all traits measured. The significance of the main effects was estimated by the F test. Differences in treatment means were detected by LSD test ($P \leq 0.05$) for comparisons.

The experimental field was located in the coastal area of northwest Turkey, 70 m above sea level. The soil was clay loam, slightly alkaline, and rich in phosphorus and potassium containing 1.8% organic matter. Long-term average total precipitation was 720 mm year^{-1}, mean temperature for the whole year was 15 °C, and relative humidity was 68%.

Results and Discussion

Because of suitable soil moisture and temperature conditions for germination and emergence, excellent stand establishments in both years were obtained. As expected, increasing the seeding rate resulted in increased plant density. Therefore, the plots sown at high seeding rates covered the ground faster in early spring.

An analysis of variance indicated that there were no statistically significant differences in yield and yield components among Hungarian vetch accessions with the exception of seed weight. In general, the accessions showed quite similar results in all yield characteristics and yield components measured. Dry matter and seed yields averaged 4254.3 kg ha^{-1} and 1004 kg ha^{-1}, respectively. The highest seed yield was obtained from the Local accession while L46 accession gave the lowest yield (Table 1).

Seeding rate treatments showed significant effects on dry matter, seed yield and most yield components. Plant height and seed weight were not markedly affected, while pods/plant and seeds/plant significantly decreased with increasing seeding rates. High seeding rates tended to produce higher seed yield and harvest index in both individual years as well as for the combined years. The highest seeding rate (160 kg ha^{-1}) resulted in significantly higher dry matter yield than the lower seeding rates, particularly at 20 and 40 kg ha^{-1} seeding rates. Hungarian vetch sown at 160 kg ha^{-1} produced approximately 6 t ha^{-1} dry matter yield (Table 2).

Seed yield increased with increasing seeding rate in both years, showing no statistically significant difference between 80 and 160 kg ha^{-1} seeding rates. Higher seed yields were obtained with 80 and 160 kg ha^{-1} seeding rates. On average, the lowest seed yield (505 kg ha^{-1}) was obtained with a 20 kg ha^{-1} seeding rate. Very little information is presently available on the seed yield variation of Hungarian vetch under Mediterranean-type environments in Turkey. Schoth and McKee (1966) indicated that the average seed yield of Hungarian vetch varies from 100 to 400 kg ha^{-1} in different areas of the USA. In Crimea, Ukraine, seed yield from pure stands ranged from 290 to 1350 kg ha^{-1}, depending mainly on the seasonal weather conditions (Nikolaev and Kozmin,

Table 1. Yield and yield components of four Hungarian vetch accessions (average of 2 years and 4 seeding rates).

Accessions	Plant Height (cm)	Pods/ Plant	Seeds/ Plant	Dry Matter Yield (kg ha^{-1})	Seed Yield (kg ha^{-1})	Biomass Yield (kg ha^{-1})	Harvest Index (%)	1000-Seeds Weight (g)
L46	78.9	32.3	122.1	4254.0	973.0	5626.0	17.3	38.3 a
L79	79.2	34.1	117.6	4527.0	1008.0	5199.0	19.4	37.0 ab
L457	80.9	30.1	113.2	4328.0	999.0	6070.0	16.5	35.8 bc
Local	78.9	33.9	130.0	3908.0	1036.0	5273.0	19.6	35.3 c
LSD (5%)	ns	ns	ns	ns	ns	ns	ns	**

ns: Not significant
** Significant at P < 0.01

Table 2. Yield and yield components of different seeding rates of Hungarian vetches (average of 2 years and 4 Hungarian vetch accessions).

Seeding rates (kg ha^{-1})	Plant Height (cm)	Pods/ Plant	Seeds/ Plant	Dry Matter Yield (kg ha^{-1})	Seed Yield (kg ha^{-1})	Biomass Yield (kg ha^{-1})	Harvest Index (%)	1000-Seeds Weight (g)
20	81.3	43.9 a	171.2 a	2770.0 c	505.0 c	3595.0 c	14.0 b	37.3
40	80.3	30.4 b	113.4 b	3471.0 c	710.0 b	5068.0 b	14.0 b	36.6
80	78.0	28.3 b	104.0 b	4875.0 b	1398.0 a	6424.0 a	21.8 a	36.2
160	78.4	27.7 b	94.1 b	5901.0 a	1403.0 a	7082.0 a	19.8 a	36.2
LSD (5%)	ns	**	**	**	**	**	**	ns

ns: Not significant
** Significant at P < 0.01

1973). Iptas (2002) found that seed yield averaged 1141 kg ha^{-1} in winter seedings. Our average seed yield data are comparable to or higher than the above results. However, seed yield varied greatly among individual experimental years. In the 2000-2001 growing season, seed yield varied from 336 to 749 kg ha^{-1} and from 759 to 2159 kg ha^{-1} in the 2001-2002 growing season. The main reason for this large difference was the distinction between climatic conditions of growing seasons. During 2001-2002, the average temperature of the December-March period was 3 °C; in the April-June period it was 2 °C lower than in the first year. The minimum temperature of the December-March period was –8.2 °C, which was 5 °C lower than the first year record. Additionally, 146 mm more precipitation was received during the March-June period of 2001-2002. These cool and moist conditions during the 2001-2002 growing period encouraged the winter hardy Hungarian vetch strains and thus seed yield reached exceptionally high levels.

As indicated in our previous study, Hungarian vetch is a winter hardy vetch species (Acikgoz, 1982), and therefore it is particularly grown for hay production in regions with a continental climate. However, our study clearly shows that Hungarian vetch can be grown for dry matter and seed production in the south Marmara region of Turkey with a Mediterranean-type climate. High seeding rates provided greater dry matter and seed yield. A seeding rate of 80 kg ha^{-1} proved to be the optimum and there was no further increase in dry matter and seed yield at higher seeding rates. Potential high seed yields can be obtained in cool and moist years.

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