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The Effects of Different Row Spacings on Seed Yield of Some Common Vetch Varieties (Vicia sativa L.)

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ABSTRACT: *This research was conducted under Middle Anatolian conditions in 2013 and 2014. Five common vetch (**Vicia sativa** L.) varieties (Kubilay-82, Cumhuriyet, Alinoglu-2001, Alper and SZF-1) were grown in a split plot design with three replications, varieties being sub plots and three row spacing applications (20, 40 and 60 cm) as main plots. Plant height, pod number per plant, seed number per pod, thousand seed weight, biological and seed yields, and harvest index were recorded.*

Seed yields of common vetch varieties under different row spacings ranged between 0.39-1.12 t ha^{-1}. There were not significant differences among row spacings. Similar yields were obtained with the first two row spacings, but the yield decreased in 60 cm application. Biological yield changed from 1.08 to 2.87 t ha^{-1}. High yields were observed in narrow spacings while the lowest value was belonged to 60 cm.

Keywords: *Vetch,**Vicia sativa** L., row spacing, seed yield.*

Farklı Sıra Aralarının Bazı Fiğ (Vicia sativa L.) Çeşitlerinin Tohum Verimine Etkisi

ÖZ: *Araştırma 2013-2014 yıllarında Orta Anadolu koşullarında yürütülmüştür. Beş fiğ (**Vicia sativa** L.) çeşidi (Kubilay-82, Cumhuriyet, Alinoglu-2001, Alper ve SZF-1) bölünmüş parseller deneme deseninde üç tekerrürlü olarak yetiştirilmiştir. Sıra araları (20, 40 ve 60 cm) ana parselleri, çeşitler alt parselleri oluşturmuştur. Bitki boyu, bitkide bakla sayısı, baklada tane sayısı, bin tane ağırlığı, biyolojik verim, tohum verimi ve hasat indeksi özellikleri incelenmiştir. Fiğ çeşitlerinin farklı sıra arası uygulamalarında tohum verimleri 39-112 kg/da arasında değişmiştir. Sıra arası mesafeleri arasında önemli farklar gözlenmemiştir. İlk iki uygulamada benzer verimler elde edilmiş, 60 cm uygulamasında verimin azaldığı belirlenmiştir. Biyolojik verim 108-287 kg/da arasında değerler almıştır. Yüksek verimler dar sıra aralığında alınmış, en düşük değer 60 cm uygulamasında saptanmıştır.*

Anahtar kelimeler: *Fiğ, **Vicia sativa** L., sıra arası, tohum verimi.*

INTRODUCTION

The common vetch (*Vicia sativa* L.) is one of the most important cool season legumes, a self-fertilized annual forage crop (Dong *et al.,* 2016; Tigka *et al.,* 2016). It has wide adaptability and can be grown for many different purposes (Abbasi *et al.,* 2014). Common vetch is used as a green fertilizer for soil improvement or cover plant, silage, seed and coarse feed production, and it is also an ideal plant for rotation or annual grain-legume mixtures (Abbasi *et al.,* 2014; Firincioglu, 2014; Kim *et al.,* 2015; Dong *et al.,* 2016).

Hay production being the main input of the expenses is one of the essential sources of animal feed together with pasture and meadows. The percentage of forage crops sowing area has steadily increased in recent years in Turkey, and reached over 9 % of the total (Acar *et al.,* 2015). Governmental support has had an important role in this augmentation since early 2000s. In spite of this increase, the hay production is far beyond the necessary amount for the livestock feeding. To compensate the need of hay amount, it is necessary to increase production areas, to grow high yielding varieties, and to find out alternative forage species.

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Alfalfa is the main forage crop in hay production and the vetches follow it. The area of different vetch species is nearly 500 000 ha with hay production of 4.3 million tonnes. The cultivated area in Middle Anatolia is 30 % of total agricultural area. However, forage crops were sown in 15 % of overall area, and only 6.7 % of total green forage production was concerned (Baskoy, 2015).

There are some researches on common vetch performed in different ecological conditions. The results of these studies showed that there might be great differences for many characters of common vetch varieties or lines. In Ankara conditions, Kendir (2000) found out that plant height, number of pods per plant, number of seeds per pod, thousand seed weight, and biological yield ranged between 59.5-87.6 cm, 6.42-11.72, 3.98-5.47, 36.7-50.7 g, and 2.94-5.01 t ha^{-1}, respectively. Buyukburc *et al.* (2004) reported high seed yields, 2.03-5.61 t ha^{-1}, for common vetch varieties in contrast to the findings of Tamkoc and Avci (2004) who obtained 0.38-0.71 t ha^{-1} seed yields. Similarly Kokten (2011) had a mean seed yield of 0.78 t ha^{-1}, under Bingol ecological conditions. Basbag and Peker (2003) investigated the effect of row spacings for some varieties, and stated that the highest seed yield was obtained from 60 cm application while it was from 40 cm for thousand seed weight.

In a research conducted with different common vetch varieties in Erzurum ecological conditions, it was reported that plant height ranged from 40.2 to 52.3 cm, and crude protein ratio between 17.39-17.53 %. Pod number per plant, number of seeds per pod and thousand seed weight were found between 5.1-10.2, 4.0-4.5 and 58.3-73.9 g, respectively (Avci, 1994). Serin *et al.* (1995) obtained the highest protein content of 16.68 % with the application of 12 cm row spacing at the same region.

Common vetch is a nutritive forage crop. It is generally grown for seed production in Middle Anatolian conditions. The aims of this study were to find out suitable common vetch varieties for the region, and to determine the optimum row spacing which is an important application in cultivation.

MATERIALS AND METHODS

Common vetch varieties were grown in the experimental area of Agricultural Faculty, Ahi Evran University in Kirsehir during 2013 and 2014. The experiment was established with five varieties by using three row spacings (20, 40 and 60) with three replications in a split plot design with no irrigation. The row spacings were fixed as main plots, and the varieties as subplots. The common vetch varieties and the institutions where the cultivars were improved were given in Table 1.

Table 1. The common vetch varieties and the institutions.
Çizelge 1. Fiğ çeşitleri ve ait olduğu kurumlar.

Variety Çeşit	Origin Orijin
Kubilay	Aegean Agricultural Research Institute, Izmir, Turkey
Alper	Aegean Agricultural Research Institute, Izmir, Turkey
Cumhuriyet	Aegean Agricultural Research Institute, Izmir, Turkey
Alinoglu	Field Crops Central Research Institute, Ankara, Turkey
SZF-1	Selcuk University Agricultural Faculty, Konya, Turkey

The experiment was established on 22nd of March in 2013, and 18th of March in 2014. Before planting 7 kg da^{-1} phosphorus (P_2O_5) and 3 kg da^{-1} nitrogen fertilizers were applied. Plot size was 6 m^2 with 6 rows of 20 cm, 3 rows of 40 cm and 2 rows of 60 cm spacing. Weed control was done by hand when necessary. The plots were harvested in the July, on the 14th and 10th in 2013 and 2014, respectively.

In the period of five months in which the experiment was conducted from March to July, the average temperature was 16.3 °C in 2013, and 16.5 °C in 2014 both being higher than long term value as shown in the Figure 1. There was a great difference in the amounts of precipitation between two years. In the 5-month period, the second year the total amount of precipitation with 167.8 mm was higher than the first year (83.1 mm). The total amount of rainfall in this period of the second year was doubled that of the first year.

The soil was clay-loam with low organic matter and pH of 7.5. The total salt was 0.02 %, with the

relatively rich concentrations of phosphorus, potassium and calcium.

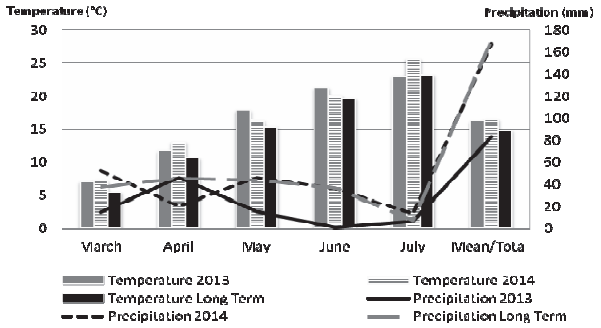

Figure 1. Temperature and precipitation of the experimental years in Kirsehir.
Şekil 1. Denemenin yürütüldüğü yıllarda Kırşehir'de yağış ve sıcaklık değerleri.

Plant height (cm), number of pods per plant, seed number per pod were calculated as average of ten plants. A hundred seeds was counted and multiplied by ten, it was repeated four times and thousand seed weight (g) was calculated as average. The other characteristics recorded were seed yield (t ha^{-1}), biological yield (t ha^{-1}) and harvest index (%).

The data was subjected to variance analysis by using Microcomputer Statistical Program (Russell, 1982) and the differences between the means were compared with LSD (Least Significant Difference) test (Steel and Torrie, 1980; Yurtsever, 1984).

RESULTS AND DISCUSSION

Plant height

The analysis showed that the differences between the means of years, row spacings and varieties were significant at the probability level of $p<0.01$. All interactions were significant, too. Plant heights varied between 35.2-47.1 cm with an overall mean of 40.6 cm. In the first year average plant height was 33.7 cm being significantly lower than that in the second year with 47.5 cm (Table 2). In 2013 the sudden decrease of the temperature immediately after the sowing caused significant reduction in the growth.

Table 2. Plant heights of common vetch varieties (cm).
Çizelge 2. Fiğ çeşitlerinin bitki boyu değerleri (cm).

Variety Çeşit	Row spacing (cm)/ Sıra arası (cm)			Mean[1] Ortalama [1]
	20	40	60	
		2013		
Kubilay	34.5	34.8	35.5	34.9
Cumhuriyet	31.5	33.5	33.6	32.8
Alper	31.5	33.0	35.4	33.3
Alinoglu	32.4	32.3	33.1	32.6
SZF-1	32.8	35.6	35.6	34.7
Mean	32.5	33.8	34.6	33.7
CV (%): 7.66				
		2014		
Kubilay	43.3	56.4	38.9	46.2 c
Cumhuriyet	38.9	43.9	48.4	43.7 d
Alper	39.2	50.2	42.1	43.8 d
Alinoglu	46.9	47.8	48.0	47.6 b
SZF-1	53.3	56.8	58.7	56.2 a
Mean	44.3 c	51.0 a	47.2 b	47.5
CV (%):1.64; LSD ($p<0.05$) V: 0.75, RS: 0.58, V x RS: 1.29				
		Average of two years / İki yıl ortalaması		
Kubilay	38.9 def	45.6 a	37.2 fg	40.6 b
Cumhuriyet	35.2 g	38.7 ef	41.0 bcd	38.3 c
Alper	35.3 g	41.6 bc	38.8 ef	38.6 c
Alinoglu	39.6 cde	40.0 cde	40.5 cde	40.1 b
SZF-1	43.1 a	46.2 a	47.1 a	45.5 a
Mean [1]	38.4 c	42.4 a	40.9 b	40.6
CV(%): 4.69; LSD ($p<0.05$): V: 1.27, RS: 0.99, Year x RS: 1.39, Year x V: 1.80, V x RS: 2.20, Year x V x RS: 3.11				

[1]There are not significant differences between the means with the same letter.
V:Variety, RS: Row Spacing.

Cultivar (cv) SZF-1 had the highest plant height and cv Cumhuriyet had the lowest. These results were in agreement with the findings of Babat and Anlarsal (2011) and Seydesoglu (2014). Kokten (2011) obtained values in Bingol ecological conditions similar to the first year results, and he reported that the low plant height was due to being late for sowing, allowing the plants to mature in a short time. Cv Kubilay was not in the first group, but it provided higher plant heights than the other varieties except SZF-1. In a trial conducted in Tekirdag conditions, Dundar (2010) gained the highest plant height from cv Kubilay.

In Ankara ecology, Kendir (2000) achieved higher plant heights than the results presented here while Tamkoc and Avci (2004) found out low values in Konya. It is expected to obtain different results in different ecological conditions.

The differences were significant between row spacings, the highest plant height was obtained in 40 cm, and the lowest in 20 cm application. Basbag and Peker (2003) acquired high plant height in 80 cm row spacing likewise this study in which lower plant heights were obtained in narrower rows.

Number of pods per plant

The number of pods per plant as the means of years is given in Table 3. There is a significant difference between two years. The mean over varieties and row spacing was 5.48 in 2013, and 7.77 in 2014, with an overall mean of 6.64 (Table 3). Much precipitation in the second year resulted in the increases in plant height which caused increases in number of pods. The differences between varieties and year x variety interaction were significant, indicating different reactions of varieties to dissimilar conditions.

Table 3. Number of pods per plant of common vetch varieties.
Çizlge 3. Fiğ çeşitlerinin bitkide bakla sayıları.

Variety Çeşit	Row spacing (cm)/ Sıra arası (cm) 20	40	60	Mean[1] Ortalama[1]
	2013			
Kubilay	5.07	4.03	4.07	4.39 b
Cumhuriyet	5.03	4.63	4.40	4.69 b
Alper	6.87	7.33	8.93	7.71 a
Alinoglu	4.57	4.63	5.40	4.87 b
SZF-1	7.50	4.90	4.90	5.77 b
Mean	5.81	5.10	5.54	5.48
CV (%): 28.02; LSD (p<0.05) Variety: 1.49				
	2014			
Kubilay	6.03	6.23	5.96	6.07 c
Cumhuriyet	6.26	6.53	5.90	6.23 bc
Alper	8.36	9.33	8.20	8.63 a
Alinoglu	9.20	7.96	6.73	7.96 b
SZF-1	11.33	10.50	8.20	10.01 a
Mean	8.23	8.11	6.99	7.77
CV (%):23.36; LSD (p<0.05) Variety: 1.76				
	Average of two years / İki yıl ortalaması			
Kubilay	5.55	5.13	5.02	5.23 c
Cumhuriyet	5.65	5.58	5.15	5.46 bc
Alper	7.62	8.33	8.57	8.17 a
Alinoglu	6.88	6.30	6.07	6.42 b
SZF-1	9.42	7.70	6.55	7.89 a
Mean[1]	7.02	6.61	6.27	6.64
CV(%): 4.69; LSD (p<0.05): Variety: 1.13, Year x Variety: 1.51				

[1]There are not significant differences between the means with the same letter.

As the averages of two years, cultivars Alper and SZF-1 appeared to have high pod numbers and located in the same group. Cvs Kubilay and Cumhuriyet had low values. It was observed that the varieties having more pods per plant provided higher seed yields (Table 5). In his study with common vetch varieties in Ankara conditions, Kendir (2000) observed number of pods per plant between 6.42-11.72 and Avci (1994) found out 5.1-10.2 pods in Erzurum. Our results are in agreement with those cited above. In contrast, high values obtained by some other researches (Gorgulu, 2010; Kokten, 2011; Seydosoglu, 2014) reflect the effects of different ecological conditions and genetic structure of varieties on number of pods per plant.

Significant differences between row spacings did not occurred, the narrowest one was slightly higher than the others. Basbag and Peker (2003) had conflicted results in Diyarbakir. They found the highest number from 60 cm, and the lowest from 40 cm application.

Number of seeds per pod

Variance analysis showed that there were no significant differences between varieties and row spacings. The interactions were also non-significant. The mean of the second year (3.92) was significantly higher than that of the first year (2.93). This might be attributed to the environmental conditions. The overall mean was 3.43 seeds per pod (Table 4).

Average seed number per pod ranged from 3.14 to 3.76. Although not significant, cv. Alinoglu appeared to have the highest seed number, whilst cv Cumhuriyet was the lowest variety. Several researches have reported higher seed numbers per pod than this study. The seed numbers obtained in Konya, Isparta and Diyarbakir conditions were between 4.48-9.25 cited by Tamkoc and Avci (2004), Gorgulu (2011), and Seydosoglu (2014), respectively. The differences between row spacings were not statistically significant, the values being very close to each other.

Table 4. Number of seeds per pod of common vetch varieties.
Çizelge 4. Fiğ çeşitlerininbaklada tane sayıları.

Variety Çeşit	Row spacing (cm)/ Sıra arası (cm)			Mean[1] Ortalama [1]
	20	40	60	
		2013		
Kubilay	3.03	2.85	3.38	3.08
Cumhuriyet	3.02	3.08	2.83	2.98
Alper	2.75	3.07	2.53	2.78
Alinoglu	2.75	3.02	2.81	2.86
SZF-1	2.71	2.90	3.26	2.96
Mean	2.85	2.99	2.96	2.93
CV (%): 14.27				
		2014		
Kubilay	4.04	3.99	4.14	4.06
Cumhuriyet	3.59	3.66	3.46	3.57
Alper	3.91	4.16	4.27	4.12
Alinoglu	3.89	3.70	4.08	3.89
SZF-1	3.75	3.99	4.17	3.97
Mean	3.84	3.90	4.02	3.92
CV (%): 10.99				
		Average of two years / İki yıl ortalaması		
Kubilay	3.53	3.42	3.76	3.57
Cumhuriyet	3.30	3.37	3.14	3.27
Alper	3.29	3.62	3.40	3.45
Alinoglu	3.32	3.36	3.44	3.73
SZF-1	3.24	3.44	3.71	3.46
Mean	3.34	2.44	3.49	3.43
CV (%): 12.39				

Seed yield

Variance analysis showed that years and varieties significantly affected seed yield. The interaction between varieties and row spacings was also statistically significant. The discrepancies in seed yields of varieties in different row spacings specify this significant interaction, as Stevovic *et al.* (2012) expressed. The average seed yield was low, 0.43 t ha^{-1}, in the first year. The yield reached up to 0.68 t ha^{-1} in 2014 (Table 5). One of the most important factors in trials conducted under non irrigation conditions is annual amount of precipitation and its distribution. The total amount in 2013 was lower than that in 2014. More importantly, the precipitation in the second year in the growing period of March-June doubled the rainfall in 2013, which caused higher seed yields.

Cultivar SZF-1 appeared to have the highest yield with 0.69 t ha^{-1}, followed by cv Alper with 0.67 t ha^{-1}. Cv Cumhuriyet had the lowest seed yield with 0.44 t ha^{-1}. Cultivar SZF-1 has been improved in Konya, and that explains why its performance was good in Kirsehir having similar climatic conditions.

The findings are in agreement with those obtained by some researchers in resembling ecologies. Karadag *et al.* (2008) recorded seed yields between 0.43-1.16 t ha^{-1} in Tokat and Amasya provinces. Seed yield ranged from 0.31 to 0.71 t ha^{-1} in Konya as stated by Tamkoc and Avci (2004). Results presented here were relatively lower than some studies conducted in Diyarbakir conditions. Increased seed yields have been cited by Babat and Anlarsal (2011) as 0.40-1.71 t ha^{-1}. Seydosoglu (2014) reached seed yields up to 2.94 t ha^{-1}. These discrepancies might be attributed to the environments and genetic differences of the varieties used.

Avci (1994) obtained seed yields between 1.76-2.19 t ha^{-1} with irrigation in Erzurum. In the same ecology without irrigation, Avci and Gokkus (1997) procured low yields changed between 0.81-1.05 t ha^{-1}. Although the climate is harder in Erzurum than in Kirsehir, the results were close to those gained in non-irrigated trial. It is an expected result to have higher yields with irrigation as Cil *et al.* (2004) obtained 3.66 t ha^{-1} seed yield.

Table 5. Seed yields of common vetch varieties (t ha^{-1}).
Çizelge 5. Fiğ çeşitlerinin tohum verimleri (t ha^{-1}).

Variety Çeşit	Row spacing (cm)/ Sıra arası (cm)			Mean[1] Ortalama [1]
	20	40	60	
		2013		
Kubilay	0.44	0.41	0.41	0.42
Cumhuriyet	0.44	0.50	0.42	0.45
Alper	0.47	0.50	0.41	0.46
Alinoglu	0.41	0.40	0.40	0.40
SZF-1	0.43	0.43	0.40	0.42
Mean	0.44	0.45	0.41	0.43
CV (%): 9.57				
		2014		
Kubilay	0.50	0.55	0.41	0.49 c
Cumhuriyet	0.39	0.44	0.45	0.43 c
Alper	0.75	1.05	0.82	0.87 a
Alinoglu	0.89	0.64	0.51	0.68 b
SZF-1	1.12	0.96	0.79	0.96 a
Mean	0.73	0.73	0.60	0.68
CV (%): 23.83; LSD (p<0.05) Variety: 0.16, Year x Variety: 0.27				
		Average of two years / İki yıl ortalaması		
Kubilay	0.47	0.48	0.41	0.45 c
Cumhuriyet	0.41	0.46	0.44	0.44 c
Alper	0.61	0.78	0.61	0.67 a
Alinoglu	0.65	0.52	0.45	0.54 b
SZF-1	0.78	0.69	0.60	0.69 a
Mean	0.58	0.59	0.50	0.56
CV (%): 21.33; LSD (p<0.05): Variety: 0.08, Year x Variety: 0.11				

[1]There are not significant differences between the means with the same letter.

Differences between row spacings were noticeable although not significant. The yields achieved from 20 and 40 cm applications were relatively higher than 60 cm. Basbag and Peker (2003) had similar results, having the highest yield from 20 cm, and the lowest from 60 cm row spacing. Al and Baysal (1999) studied with bitter vetch, and found out the highest seed yield with 20 cm. They observed decreasing yields with the increasing row spacings as present study.

Biological yield

Variance analysis showed that the differences between years and varieties were significant while row spacings did not have an effect on biological yield. All interactions were non-significant. The biological yield was 1.49 t ha^{-1} in 2013 while it was 2.26 t ha^{-1} in 2014 (Table 6). As mentioned above, the varied amount of rainfall was the essential reason for this dissimilarity. The data as the averages of two years are presented in Table 6.

The overall mean biological yield was 1.87 t ha^{-1}. The varieties with the highest yield were SZF-1 (2.04 t ha^{-1}) and Alper (1.95 t ha^{-1}) holding a place in the same statistical group. Cv Cumhuriyet had the lowest yield with 1.68 t ha^{-1}. The results are in accord with some previous studies. One of them was conducted by Tamkoc and Avci (2004) in Konya conditions obtaining the yield between 1.44-2.12 t ha^{-1}. Resembling ecological conditions can be considered as the reason for the similarity of the findings.

Cv Kubilay had 1.81 t ha^{-1} biological yield being close to the overall mean. Babat and Anlarsal (2011) reported higher yields than the present study for the same variety. It is possible to conclude that this variety shows different reactions in dissimilar conditions. In some other trials conducted in various environments, biological yields were relatively higher than the present study (Ozpinar *et al.,* 1999; Kendir, 2000; Buyukburc *et al.,* 2004; Cil *et al.,* 2004; Karadag *et al.,* 2008; Yucel *et al.,* 2008). The reason could be due to changing environments and growing periods, and also different amounts of the precipitation in April and May.

Table 6. Biological yields of common vetch varieties (t ha^{-1}).
Çizelge 6. Fiğ çeşitlerinin biyolojik verimleri (t ha^{-1}).

Variety Çeşit	Row spacing (cm)/ Sıra arası (cm) 20	40	60	Mean[1] Ortalama [1]
		2013		
Kubilay	1.49	1.56	1.60	1.55
Cumhuriyet	1.08	1.34	1.65	1.36
Alper	1.42	1.79	1.44	1.55
Alinoglu	1.39	1.72	1.37	1.49
SZF-1	1.40	1.63	1.44	1.49
Mean	1.36	1.61	1.50	1.49
CV (%): 16.41				
		2014		
Kubilay	2.09	2.38	1.76	2.08 b
Cumhuriyet	2.16	1.96	1.90	2.01 b
Alper	2.42	2.37	2.27	2.35 ab
Alinoglu	2.67	2.16	1.94	2.26 ab
SZF-1	2.87	2.40	2.50	2.59 a
Mean	2.44	2.25	2.08	2.26
CV (%): 17.70; LSD ($p<0.05$): Variety: 0.30				
		Average of two years / İki yıl ortalaması		
Kubilay	1.79	1.97	1.68	1.81 bc
Cumhuriyet	1.62	1.65	1.78	1.68 c
Alper	1.92	2.08	1.86	1.95 ab
Alinoglu	2.03	1.94	1.65	1.88 bc
SZF-1	2.14	2.02	1.97	2.04 a
Mean	1.90	1.93	1.79	1.87
CV (%): 17.68; LSD ($p<0.05$): Variety: 0.22				

[1]There are not significant differences between the means with the same letter.

The highest biological yield was obtained with 40 cm row spacing, although not significantly higher than the others. Cultivars SZF-1 and Alinoglu gave higher yields with 20 cm application. The yield was relatively low with 60 cm row spacing.

Harvest index

The effect of varieties was statistically significant on harvest index. Years and row spacings did not significantly affect. The averages of the two years were very close with an overall mean of 29.7 % (Table 7). The interactions between years and varieties was significant reflecting different reactions of varieties to dissimilar environments. Significant year x variety x row spacing interaction shows differing seed yield performances of varieties at different row spacings and ecological conditions.

Mean values over years changed from 24.4 to 34.9 %. The results are compatible with the findings of some researches. Buyukburc *et al.* (2004) and Babat and Anlarsal (2001) found harvest indices between 20.9-35.1 % and 17.0-32.0 %, respectively. Depending upon environmental conditions and genetic differences of the cultivars, harvest indices of the present study were slightly lower than those of Cil *et al.* (2004) and Kendir (2000).

The differences between row spacings were not significant. The highest harvest index appeared at the narrowest row spacing, and it declined slightly as the row spacing increased.

Thousand seed weight

The differences between years and varieties were significant. Average thousand seed weight was higher in the second year with 56.9 g than that in 2013 with 47.4 g while overall mean was 52.2 g (Table 8). The year x variety and year x variety x row spacing interactions were significant. The significance of the interactions remarks that the effects of the varieties and row spacings changed at different environmental conditions.

Thousand seed weight of cv Alper was significantly higher than that of the others. Cultivars Alinoglu and Cumhuriyet located in the second group. Cv Kubilay had the lowest thousand seed weights. The findings are in the range of the results of some other

Table 7. Harvest indices of common vetch varieties (%).
Çizelge 7. Fiğ çeşitlerinin hasat indeksleri (%).

Variety Çeşit	Row spacing (cm)/ Sıra arası (cm)			Mean[1] Ortalama [1]
	20	40	60	
		2013		
Kubilay	29.6	27.0	25.8	27.4 b
Cumhuriyet	41.4	36.9	26.2	34.8 a
Alper	35.4	27.9	28.9	30.7 ab
Alinoglu	30.1	23.2	30.4	27.9 b
SZF-1	31.1	27.5	29.3	29.3 b
Mean	33.5	28.5	28.1	30.0
CV(%): 16.89; LSD (p<0.05): Variety: 4.93				
		2014		
Kubilay	23.7	23.5	23.0	23.4 c
Cumhuriyet	17.2	22.0	24.3	21.2 c
Alper	31.2	44.7	35.6	37.2 a
Alinoglu	32.4	29.8	26.1	29.4 b
SZF-1	38.7	39.5	28.5	35.6 a
Mean	28.6	31.9	27.5	29.3
CV(%): 18.22; LSD (p<0.05): Variety: 5.24				
		Average of two years / İki yıl ortalaması		
Kubilay	26.6	25.3	24.4	25.4 c
Cumhuriyet	29.3	29.5	25.3	28.0 bc
Alper	33.3	36.3	32.3	34.0 cd
Alinoglu	31.2	26.5	28.2	28.6 a
SZF-1	34.9	33.5	28.9	32.4 b
Mean	31.1	30.2	27.8	29.7
CV(%): 15.79; LSD (p<0.05): Variety: 3.14 Year x V: 4.45 Year x Variety x RS: 7.70				

[1]There are not significant differences between the means with the same letter.

previous studies. Albayrak *et al.* (2005) reported that thousand seed weight was between 38.3-70.2 g in Samsun ecology. Similarly, Babat and Anlarsal (2011) and Kokten (2011) obtained thousand seed weights of common vetch varieties in the range of 49.3-62.6 and 50.7-62.7 g, respectively. Several investigators have reported higher yields than this study (Buyukburc ve ark., 2004; Karadag *et al.,* 2008; Yucel *et al.,* 2008). Dissimilarities of ecological conditions can be considered as the reason for these different findings.

CONCLUSION

The objectives of the present study were to compare the adaptabilities of some common vetch varieties and different row spacing applications. Although differences between row spacings were not significant, it was recorded that the biological yield decreased as row spacing increased. Seed yield, number of pods per plant and number of seeds per pod did not change at 20 and 40 cm, but the declines were noticeable in 60 cm row spacing.

Cultivar SZF-1 had the highest performances for plant height, number of pods per plant, number of seeds per pod, seed and biological yields. Cultivar Alper appeared to have sufficient seed yield with the highest harvest index. It was concluded that cultivars SZF-1 and Alper could be recommended for Kirsehir and similar ecologies. The differences between row spacing were not significant, but 40 cm row spacing might be suggested in consideration with its practical application.

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Table 8. Thousand seed weights of common vetch varieties (g).
Çizelge 8. Fiğ çeşitlerinin bin tane ağırlıkları (g).

Variety Çeşit	Row spacing (cm)/ Sıra arası (cm) 20	 40	 60	Mean[1] Ortalama [1]
		2013		
Kubilay	44.4	45.3	44.3	44.7 e
Cumhuriyet	48.9	48.1	47.4	48.2 cd
Alper	51.1	51.4	47.7	50.1 c
Alinoglu	44.2	46.6	49.2	46.7 de
SZF-1	50.0	46.1	46.1	47.4 d
Mean	47.7	47.5	46.9	47.4
CV (%): 4.78; LSD (p<0.05): Variety: 2.20				
		2014		
Kubilay	55.6	56.7	55.9	56.0 b
Cumhuriyet	55.5	56.6	55.1	55.7 b
Alper	59.5	59.6	62.2	60.4 a
Alinoglu	61.3	56.6	57.6	58.5 a
SZF-1	54.1	53.7	54.3	54.0 b
Mean	57.2	56.6	57.0	56.9
CV (%): 4.50; LSD (p<0.05): Variety: 2.41				
		Average of two years / İki yıl ortalaması		
Kubilay	50.0	51.0	50.1	50.4 c
Cumhuriyet	52.2	52.4	51.3	51.9 bc
Alper	55.3	55.5	54.9	55.3 a
Alinoglu	52.8	51.6	53.4	52.6 b
SZF-1	52.0	49.9	50.2	50.7 c
Mean	52.4	52.1	52.0	52.2
CV (%): 4.54; LSD (p<0.05): Variety: 1.60, Year x V: 2.20, Year x Variety x RS: 3.90				

[1]There are not significant differences between the means with the same letter.

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