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POSSIBILITIES OF GROWING VETCH (*V. pannonica, V.villosa, V. dasycarpa,*) AND CEREAL (Barley, Oat, Triticale) MIXTURES IN FALLOW FIELDS IN ESKIŞEHIR CONDITIONS

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ABSTRACT

This study was carried out during growing seasons of 2001 and 2002 in Eskişehir to investigate the possibility of growing various vetch species in mixture with cereal crops in fallow areas of Eskişehir. A split plot design was arranged as cereals in main plots and vetch cultivars in sub-plots; in which three replicates of randomized complete blocks were used. Proportions of vetches and cereals in these plant mixtures were 75% and 25% respectively. Harvesting was performed at the stage in which 50% vetch flowering was evident. In relation to the plant mixtures, measurements were taken for herbage yield, hay yield, and crude protein yield. Results of the study showed that characteristics of the mixtures studied were significantly influenced by the year of growth. According to the two year averages, herbage yield varied from 3412.5 kg/da to 2312.1 kg/da depending on the mixture. The highest hay yield (780.3 kg/da) was obtained from the mixture of oat with vetch variety, Tarm Beyazı. The mixture of triticale + vetch cultivar, Efes had the highest crude protein yield (88.1 kg/da).

Key word: Vetch, Cereals, Mixtures.

INTRODUCTION

Eskişehir is one of the provinces that have the largest area in the Central Anatolia Region. Due to prevailing continental climate conditions, different farming methods are applied in the arid and irrigated regions of the province. In the arid areas, which account for 33.7 % of its surface area, wheat farming is applied on the basis of fallowing-wheat crop rotation, and in the remaining irrigated areas, industrial plant farming, such as sugar beet farming is performed. Animal husbandry, another branch of agriculture, is neglected in this province similar to the condition observed in other provinces of Turkey.

The lack of a systematic forage production program is among the most important issues in relation to the province livestock. Natural grass-pasture and crop residues in an area of 343 918 hectares, constitute the province's main roughage sources for a total of 674 308 cattle. Due to the unconscious use of natural pastures in the province, forage production from therein has been lost substantially.

Appropriate breeding methods should be used to produce high quality forage and plenty of pasture again. However, for a fundamental solution to the problem of provincial livestock forage, it is necessary to increase the proportion of forage plant breeding in field agriculture along with breeding of grass-pasture forage crops. In the current systems of fallowing-wheat crop rotation, applied in the province, annual leguminous plants including vetch, fodder peas and Alexandria clover are mixed with oats, barley or triticale in cultivation.

When fallowing-wheat crop rotation is taken into consideration, the fallow fields will be yielding products every year and the problem of feed will be solved by growing forage crops in the fields. Vetch as a legume fodder crop is the most preferred animal feed, primarily because of its taste and its property of unaffecting the fertility of the arable land in which it is harvested, leaving it suitable for the successive field planting (Tekeli *et. al.,* 1992). In our country, one of the major problems in relation to the use of vetch plants as high value food crops is that they are not durable to lying due to their weak bodies. Contact with the ground causes the plants to lose their stems and leaves and decaying losing its nutritional value. Evidently this results in reduced amount of forage yield. In order to eliminate the lying problem, it is more advantageous to grow this plant with a grain group, rather than its isolated cultivation (Haynes, 1980). This will evidently increase the amount of vest yield (Hadjichristtodoulou, 1975; Aydın and Tosun, 1991). Especially, mixed cultivation of vetch with cereals such as green grass, hay and silage is very important in terms of dairy production (Hatipoğlu *et. al*., 1990). In animal nutrition, the mixture provides a balanced fodder in respect to carbohydrate and protein.

The present study was conducted to determine the vetch species and grain variety that can be most suitable for cultivation as mixture of vetch with cereal in the fallow fields. The purpose of the study is to provide a

This paper has been summarized from Ph.D thesis of first author

solution for the demands of high quality forage in our country, and as the research area Eskişehir province was selected.

MATERIALS AND METHODS

The field experiments on the present investigation were conducted in the 2000-2001 and 2001-2002 growing seasons in Eskişehir Anatolian Agricultural Research Institute where fallowing-wheat crop rotation systems were applied.

In Eskişehir province where the experiments were carried out, a terrestrial climate was present in which the winters were cold and rainy, but summers were arid. In the first year (September 2000-May 2001) of the experiment, monthly average temperature and amount of total rainfall were 8.1 ^{0}C and 202.5 mm, respectively. In the second year (September 2001- May 2002) of the study, corresponding values were 8.3 ^{0}C and 487.9 mm. These meteorological data reflected that both first and second years of the study were hotter compared to normal conditions; but two years contrasted in the level of humidity with respect to standard meteorological states. The amount of total rainfall and average of long years temperature during September-May period in Eskişehir province were 7.5^{0}C and 302.6 mm, respectively. January, February and March months in both years of the experiment were hotter than normal. After winter entered covering the period of September-December, falling precipitation in the first year (52.3 mm), the second year (250.5 mm) and for long years (104.3 mm) were below the level. In the first experiment year, there was lower rainfall compared to the same period in the second year and long year averages.

The cereals and vetch varieties used in the experiment are depicted in Table 1.

Table 1. Cereal , Vetch species and varieties used for the experiment

Species	Varieties
Hungarian vetch (*Vicia pannonica* Crantz)	Ege Beyazı, Tarm Beyazı, Anadolu Pembesi 2002
Hairy vetch *(Vicia villosa* Roth.)	Munzur-98, Menemen-79, Efes-79
Tüylü Meyveli Fiğ (*Vicia dasycarpa)*	Eraç 2002, Baydurbey 2002, Seğmen 2002
Barley (*Hordeum vulgare* L.)	Kalaycı 97
Oat (*Avena sativa* L.)	Cheocata
Triticale (*Triticosecale* Witt)	Karma 2000

In the present study, the ratio of vetch-cereal mixture was 75:25 and a total of 27 mixtures were obtained from three cereal varieties with nine vetch varieties (Table 2). The field experiments were planned and conducted once for each year with three repetitions of randomized complete blocks with split plot design. The main plots consisted of grain species and the subplots consisted of vetch species. Subplots in the trials were 5 m long consisting of six rows and six spaces.

RESULTS AND DISCUSSION

Herbage yield: Average forage yields measured during first and second years of this study were statistically different (808.1 vs 4567.4 kg/da), respectively. Combined cultivation of different species/varieties of grain and vetch resulted in differential interactions which is reflected by the difference in average herbage yield measurements for each cereal with vetch pair. Among the investigated combinations, mixture of Eraç 2002 variety (*Vicia dasycarpa* species) with oat gave the highest herbage yield (1181 kg/da) from first year of the experiment. This was statistically higher than any value of average herbage yield measured for the mixtures of different herbs with barley (631.7 kg/da) or triticale (723.5 kg/da). Similar herbage yield averages were previously reported in relation to measurements taken on different cereal + herb mixtures (Basbag *et.al.,*1999; Polat *et.al.,* 1999; Acar and Ozkaynak, 2000; Buyukburc and Karadag, 2002). Average herbage yield results obtained in this study were lower than previously reported values of various publications (Soya *et.al.,*1999; Tan and Celen, 2001) excluding the data obtained by Polat *et.al.,* (1999), which was higher in comparison to data of the current study.

From second year of the experiment, the observed average herbage yield values of the mixtures ranged from 3906.4 kg/ da to 5877.9 kg/da (Table 3). For the second year of the experiment, there was no significant difference between the average herbage yields obtained from cultivation pairs including barley, triticale, or oat in combination with a vetch variety. Additionally, ANOVA results revealed that the main effects of cereal and vetch variety on herbage yield were also insignificant. Averages of herbage yield for all mixture combinations showed great variability. As seen from 3, although insignificant differences between vetch varieties for the second year were observed, an average herbage yield (5010 kg/da) for Tarım Beyazı-a Hungarian vetch variety in the second year was much higher than the average values for mixtures containing other vetch varieties. On the other hand, average herbage yield of oat (4919 kg/da) containing vetch varieties was higher compared to the values measured for vetch varieties containing barley (4237.5 kg/da) or triticale (4545.7 kg/da). The highest and lowest herbage yields were

measured correspondingly for mixture of oat with Tarm Beyazı (5877.9 kg/ da) and the mixture of barley with Seğment 2002 (3906.4 kg/ da).

Taking into consideration the average measurements of two years, it was observed that species of mixture of grain species and varieties of vetch had insignificant effect on herbage yield. The highest average herbage yield (3432.5 kg/da) was obtained from a mixture of oat with the Hungarian vetch varieties of Tarm Beyazı. The lowest average herbage yield (2312.2 kg/ da) was measured for a mixture of barley + Seğmen 2002 of Woolypod vetch varieties. The results obtained for the second year were consistent with several previous reports (Tan and Çelen, 2001, Buğdaycıgil, 1996), but higher compared to others (Polat *et al.,*1999; Soya *et.al.,*1999; Tan and Celen, 2001). This variation might owe to various species used in cereal vetch combinations and different ecological conditions.

Table 2. Average herbage yields (kg/da) for mixtures of cereal-vetch varieties

Species	2001				2002				Combined Two Years			
(Varieties)	Barley	Oat	Triticale	Aver.	Barley	Oat	Triticale	Aver.	Barley	Oat	Triticale	Aver.
Tarm Beyazı (*V.pannonica*)	763.3^{hk1}	987.0^{cd}	556.7^{q}	768.7^{ef3}	4407.7	5877.9	4744.6	5010.1	2585.5	3432.5	2650.7	2889.5
Ege Beyazı (*V.pannonica*)	737.9^{ik}	966.8^{cd}	779.0^{g-j}	827.3^{cd}	4367.2	5060.4	4844.8	4757.5	2552.6	3013.6	2811.9	2792.7
Anadolu Pembesi (*V.Pannonica*)	824.6^{eg}	979.4^{cd}	849.6^{ef}	884.1^{b}	4188.5	5534.4	4204.2	4642.4	2506.6	3256.9	2526.9	2763.5
Munzur (*V.villosa*)	797.0^{fh}	877.3^{e}	580.0^{p-q}	751.1^{fg}	4355.2	4447.7	4487.0	4430.0	2576.1	2662.5	2533.5	2590.7
Menemen (*V.villosa*)	599.0^{pq}	951.0^{d}	616.0^{op}	721.8^{g}	4404.2	5232.1	4717.2	4784.5	2501.6	3091.6	2666.6	2753.3
Efes (*V.villosa*)	724.2^{jl}	995.8c^{d}	666.0^{m-o}	795.1^{de}	4379.2	4318.6	4391.7	4363.2	2551.7	2657.2	2528.8	2579.3
Eraç 2002 (*V.dasycarpa*)	631.7^{np}	1181.1^{a}	723.5^{l-m}	845.0^{c}	4023.8	4794.3	4544.1	4454.1	2327.8	2987.7	2633.8	2649.8
Seğmen 2002 (*V.dasycarpa*)	717.8^{km}	789.6^{gi}	676.0^{lm}	727.1^{g}	3906.4	4486.8	4089.4	4160.9	2312.1	2638.3	2382.7	2444.4
Baydurbey 2002 (V.*dasycarpa*)	724.9^{jl}	1012.0^{b}	1122.2^{b}	952.6^{a}	4105.2	4518.4	4888.3	4504.0	2415.1	2765.20	3005.3	2728.5
Average	724.2b^{2}	970.7^{a}	729.4^{b}	808.0^{b4}	4237.5	4919.0	4545.7	4567.4^{A}	2481.0	2945.1	2637.8	
CV%	4.37				12.45				14.98			

[1]Difference between two mixtures means with different small letter within mixtures of all the cereal-vetch varieties was significant (P<0.05) (comparison of mixtures in 2001, 2002 and combined years)

[2]Difference between means with different small letter in average line was significant (P<0.05) comparison of cereal means in 2001)

[3]Difference between means with different letter in average column in 2001, was significant (P<0.05) (comparison of vetch varieties in within a year)

[4]Difference between means with different capital letter in average line was significant (P<0.05) (comparison of years)

Hay yield: The hay yields of the mixtures showed significant differences between the two years of the study. The average hay yields of the mixtures were 198.1 kg/ da for the first year and 1191.1 kg/da for the second year. Increased rainfall might be a reason for a higher value of hay yield during second year. A mixture of oat + Eraç 2002 was observed to give the highest hay yield during first year. The average hay yield obtained from this mixture was higher than average hay yields obtained from other mixtures including barley with Eraç 2002 and triticale + Eraç 2002. Besides, ANOVA results did not support a significant correlation between hay yield and choice of different cereal species/vetch varieties in cultivation pairs. Hay yield averages recorded for the first year of the experiment were higher than earlier findings of Polat *et al.,* (1999), but lower compared several other reports (Qamar 1999a; Altinok, 1999; Basbag *et al.,* 1999; Geren, 2001; Buyukburc and Karadag, 2002).

However, during second year, in relation to cereals, the averages of hay yield were higher for barley with vetch mixtures (1268.9 kg/da) than averages for mixtures of vetch varieties with oat (1060 kg/da) or triticale (1244.4 kg/da). Moreover, in relation to vetch varieties, Ege beyazı + triticale had higher hay yield, compared to mixtures consisting of other Hungarian vetch varieties with oat or barley. These findings were found to be consistent with those of Bayram and Celik, (1999). The two-year averages reflected that the choice of grain type or vetch variety in the cultivation mixtures did not result in a significantly significant increase in hay yield. According to the two-year averages, the highest (780.3 kg/da) and lowest hay yields (574.7 kg/da) were respectively obtained from a mixture of oat and Tarim Beyazi variety and a mixture of oat + Munzur 98, which is one of hairy vetch varieties. Hay yield averages obtained for different mixtures in the second year were

found higher than reported previously elsewhere. (Qamar 1999a; Altinok, 1999; Buyukburc and Karadag, 2002) except for Geren, (2001). These differences might be due to different mixtures and various ecological conditions.

Table 3. Average hay yields (kg/da) for mixtures of cereal-vetch varieties

Species (Varieties)	2001				2002				Combined Two Years			
	Barley	Oat	Triticale	Aver.	Barley	Oat	Triticale	Average	Barley	Oat	Triticale	Aver.
Tarm Beyazı (V.pannonica)	190.3^{i-l}	222.0^{ef}	146.0^{m}	186.7^{e3}	1301.6	1339.0	1338.0	1326.2	746.0	780.3	741.7	756.0
Ege Beyazı (V.pannonica)	184.0^{i-k}	231.0^{de}	190.3^{gh}	202.2^{cd}	1270.6	1052.2	1361.5	1228.1	727.0	641.0	775.7	714.6
Anadolu Pemb. (V.Pannonica)	208.0^{f-h}	231.0^{de}	185.0^{h-i}	208.3^{bc}	1263.7	1076.1	1233.1	1191.0	735.3	653.3	709.0	699.2
Munzur (V.villosa)	207.0^{f-h}	208.7^{fg}	148.0^{lm}	188.3^{e}	1288.3	941.5	1263.4	1164.4	747.3	574.7	705.3	675.8
Menemen (V.villosa)	191.7^{hı}	217.3^{e-f}	160.0^{j-m}	190.0^{e}	1337.0	1105.1	1276.0	1239.4	764.3	661.0	717.7	714.3
Efes (V.villosa)	167.0^{k-n}	244.3^{cd}	169.0^{i-k}	193.7^{de}	1313.3	967.8	1130.3	1137.1	739.7	606.0	649.3	665.0
Eraç 2002 (V.dasycarpa)	163.3^{k-o}	305.0^{a}	171.0^{i-k}	213.7^{b}	1270.8	1040.3	1170.5	1160.6	717.0	672.3	670.7	686.0
Seğmen 2002 (V.dasycarpa)	152.0^{n-p}	193.0^{gh}	156.0^{k-m}	167.6^{f}	1141.2	1024.2	1190.3	1118.6	646.3	608.7	673.0	642.7
Baydurbey 2002 (V.dasycarpa)	175.0^{j-l}	254.0^{c}	279.0^{b}	236.3^{a}	1233.4	994.0	1236.4	1154.6	704.0	623.7	757.7	695.1
Ortalama	182.0 ^{b2}	234.0 ^{a}	178.3^{b-e}	198.1^{B4}	1268.9	1060.0	1244.4	1191.1A	725.2	646.8	711.1	
CV%			5.07				13.80				11.82	

[1]Difference between two mixtures means with different small letter within mixtures of all the cereal-vetch varieties was significant (P<0.05) (comparison of mixtures in 2001,2002 and combined years)
[2]Difference between means with different small letter in average line was significant (P<0.05)(comparison of cereal means in 2001)
[3]Difference between means with different letter in average column in 2001, was significant (P<0.05) (comparison of vetch varieties in within a year)
[4]Difference between means with different capital letter in average line was significant (P<0.05) (comparison of years)

Table 4. Averages of Crude Protein Yield (kg/da) of mixtures of different cereal-vetch varieties

Species (Varieties)	2001				2002				Combined Two Years			
	Barley	Oat	Triticale	Aver.	Barley	Oat	Triticale	Aver.	Barley	Oat	Triticale	Aver.
Tarm Beyazı (*V.pannonica)*	27.7^{a-l}	30.9^{e-g}	21.3^{kl}	26.6^{d3}	146.0^{al}	141.7^{ab}	115.3^{d-h}	134.0^{a3}	87.1^{a-l}	86.0^{a-c}	68.5^{f-g}	80.54
Ege Beyazı (*V.pannonica*)	23.3^{i-k}	30.0^{e-g}	29.2^{e-g}	27.5^{cd}	142.7^{a}	100.2^{e-h}	129.33^{a-e}	124.1^{ab}	83.3^{a-d}	65.2^{g}	79.5^{a-e}	75.99
Anadolu Pem. (V.Pannonica)	28.1^{e-h}	32.9^{c}	30.5^{e-g}	30.5^{b}	132.0^{a-d}	114.5^{d-h}	104.7^{e-h}	117.1^{b}	80.2^{a-e}	73.9^{d-g}	67.7^{f-g}	73.93
Munzur *(V.villosa)*	28.3^{d-h}	28.3^{d-h}	25.0^{h-g}	27.2^{cd}	138.0^{a-c}	105.8^{e-h}	117.3^{c-h}	120.4^{b}	83.7^{a-d}	67.1^{f-g}	71.3^{e-g}	73.93
Menemen (*V.villosa*)	27.3^{f-j}	31.3^{c-f}	29.6^{e-g}	29.4^{bc}	146.7^{a}	104.5^{e-h}	109.2^{e-h}	120.1^{b}	87.1^{a-b}	68.1^{f-g}	69.6^{e-g}	74.93
Efes (*V.villosa*)	20.5^{l}	32.2^{c-d}	30.5^{e-g}	27.7^{cd}	146.3^{a}	114.9^{d-h}	145.0^{a}	135.4^{a}	83.7^{a-d}	73.7^{d-g}	88.1^{a}	81.82
Eraç 2002 (*V.dasycarpa*)	23.1^{k-l}	38.8^{b}	30.8^{e-g}	30.9^{b}	128.0^{a-e}	106.3^{f-h}	118.3^{c-h}	117.5^{b}	75.8^{c-f}	72.6^{e-g}	74.7^{d-g}	74.40
Seğmen 2002 (*V.dasycarpa*)	20.5^{l}	27.3^{g-j}	29.6^{e-g}	25.8^{d}	132.0^{a-d}	105.2^{e-h}	119.9^{b-g}	119.0^{b}	76.7^{b-f}	66.3^{f-g}	74.8^{d-g}	72.62
Baydurbey 2002 (*V.dasycarpa*)	23.9^{j-l}	31.6^{c}	47.6^{a}	34.4^{a}	128.0^{a-e}	97.5^{h}	127.7^{a-f}	117.7^{b}	76.2^{c-f}	64.6^{g}	87.8^{a}	76.21
Ortalama	24.7^{b2}	31.5^{a}	30.5^{a}	28.90^{B4}	138.74	109.96	120.8	123.17^{A}	81.50	70.8	75.8	
CV%			8.49				10.77				8.50	

[1]Difference between two mixtures means with different small letter within mixtures of all the cereal-vetch varieties were significant (P<0.05) (comparison of mixtures in 2001,2002 and combined years)
[2]Difference between means with different small letter in average line was significant (P<0.05) (comparison of cereal means in 2001)
[3]Difference between means with different letter in average column in 2001, was significant (P<0.05) (comparison of vetch varieties in within a year)
[4]Difference between means with different capital letter in average line was significant (P<0.05) (comparison of years)

Crude protein yield: ANOVA results revealed that year factor significantly affected crude protein (Table 5). Crude protein yield averages for the mixtures for the first and second years were found to be 28.90 kg/da and 123.17 kg/da respectively.

During first year a mixture of triticale with Baydurbey 2002 produced higher crude protein yield compared to mixtures of triticale + other vetch varieties. In line with this finding, it could be suggested that crude protein yield was reduced in relation to decreased hay yield. In the first year of the experiment, averages of crude protein yield obtained from different mixtures were lower than the similar data reported by several authors (Altinok, 1999; Qamar *et.al.,*1999b; Buyukburc and Karadag, 2002).

In the second year of the experiment, average crude protein yield obtained from a mixture of Menemen + oat (146.7 kg/da) was found to be statistically higher than the average crude protein yield of mixtures consisting of Menemen + other cereal species ($P<0.05$). The crude protein yield from a mixture of Baydurbey 2002 + oat was detected to be statistically lower than the corresponding yield data regarding to the mixtures consisting of Baydurbey 2002 + other cereal species ($P<0.05$). With respect to the average of measurements obtained for two years, the highest crude protein yield (88.1 kg/da) was obtained from Efes + triticale. Also, no significant differences were observed among the mixtures of triticale + Efes, triticale + Baydurbey 2002 (87.8 kg/da) and triticale + Ege Beyazı (79.5 kg/da) in terms of crude protein yield averages calculated with data obtained from both years of the study. Averages for these three mixtures were statistically higher than those of triticale + other vetch varieties ($P<0.05$). In the second year of the experiment, averages of crude protein yield obtained for different mixtures of annual leguminous and cereal species were in agreement with several reports (Altinok, 1999; Qamar *et al.,* 1999b). However, crude protein yield averages obtained in the present paper were lower than those determined by Buyukburc and Karadag, (2002). It was concluded that mixtures of various cereal species and vetch varieties could lead to different levels of crude protein yield depending on ecological conditions.

REFERENCES

Acar, R. and I. Ozkaynak, (2000). Growing possibilities of legume fodder plants and cereal mixtures under irrigated conditions. Süleyman Demirel Univ. J. Agric. Fac. 14(21): 1-9.

Altınok, S., (1999). Fodder yield in Vetch species(Vicia spp.) and Barley (Hordeum vulgare L.)grown to obtain grain and silage. Turkish 3rd. Field Crops Congress (Fodder plant and edible grain legumes) 85; 15-18 November 1999. Adana

Aydın, I., and F. Tosun (1991). A research on the effect of different mixture ratios for Common Vetch + some Cereal species grown under Samsun ecological conditions on hay yield, crude protein proportion and yield Turkish 3rd. Field Crops Congress 322-340.

Başbağ, M., I. Gül, and V. Saruhan, (1999). The effect of different mixture ratios in some annual legume and cereal mixtures on yield and its components under Diyarbakır conditions Turkish 3rd. Field Crops Congress (Fodder plant and edible grain legumes) 69-74; 15-20 November 1999. Adana

Bayram, G. and N. Çelik. (1999). Studies on effects of mixture ratio and nitrojen manure on hay yield and quality for mixture plantation of Oat (Avena sativa L.) and Common Vetch (Vicia sativa L.). Turkish 3rd. Field Crops Congress (Fodder plant and edible grain legumes) 53-58. 15-18.

Buğdaycıgil, M., C. O. Sabancı, H. Ozpinar, and G. Eginlioglu, (1996). The effect of various Vetch + Barley mixture ratios on hay yield and quality. Turkish 3rd. Field Crops Congress (Fodder plant and edible grain legumes) 316-320.

Büyükburç, U. and Y. Karadağ, (2002). A research on the effect of annual Legume + Triticale mixtures on hay and grain yield, hay quality, and NO3-N amount fixed by legume to soil. Turk J. Agric For 26: 281-288.

Geren, H. (2001). The effect of some fodder crop mixtures on some yield characterictics. Turkish IV. Field Crops Congress. 131-135. Tekirdağ

Hadjichristodoulou, A., (1975). Effect of Seed Rate on Forage Production of Cereals and Legumes Under Rainfed Conditions. Agric., İnst., Technical Bul:19 Nicosia, Cyprus

Hatipoğlu, R., A. E. Anlarsal, T. Tükel, and H. Baytekin, (1990). The effect of harvest time on hay yield and botanical composition relating Vetch + Barley mixtures grown at the arid conditions of Cukurova region. Çukurova Univ. J. Agric. Fac. 5(3):173-182.

Haynes, J. (1980). Competitive aspects of the Grass-Legume association. Adv. in Argonomy. 33:227-261.

Polat, T., I. Acar, I. Baysal, and Y. Şılbır, (1999). Investigations on the effect of mixture proportions of Vetch (Vicia sativa L.) + Barley (Hordeum vulgare L.) to be grown as sub-plant in Pistachio (Pistacia vera L.) plantation under Ceylanpınar arid on conditions yield components. GAP I. Agric. Congress. 821-828; 26-28 May 1999.Şanlıurfa

Qamar, I. A., J. D. H. Keatinge, N. Mohammad, A. Ali and M. A. Khan (1999a). Introduction and management of Vetch /Barley forage mixture in

the rainfed areas of Pakistan. forage yield. Aust.J.Agric.Res,50:1-9.

Qamar, I. A., J. D. H. Keatinge, N. Mohammad, A. Ali and M. A. Khan (1999b). Introduction and management of vetch /barley forage mixture in the rainfed areas of Pakistan.forage quality. Aust.J.Agric.Res,50: 11-19.

Soya, H., Ş. Gülenç, R. Avcıoğlu, and H. Geren, (1999).The effect of various harvest periods on yield and its characteristics in the mixtures of Hairy Vetch (Vicia villosa Roth.) with Barley (Hordeum vulgare L.) as winter second product. Turkish 3rd. Field Crops Congress (Fodder plant and edible grain legumes). 59-63, 15-18 November 1999. Adana.

Tan, E. and A. E. Çelen, (2001). The effect of harvest time on yield and quality characteristics of some fodder plants and their mixtures. Turkish 4. Field Crops Congress.137-142. Tekirdağ.

Tekeli, S., A. Orak, and M. Tuna (1992). A research on important agricultural characteristics of Common Vetch grown as winter and their interrelationship. Tekirdağ Univ. J. Agric. Faculty 1(2):121-131.