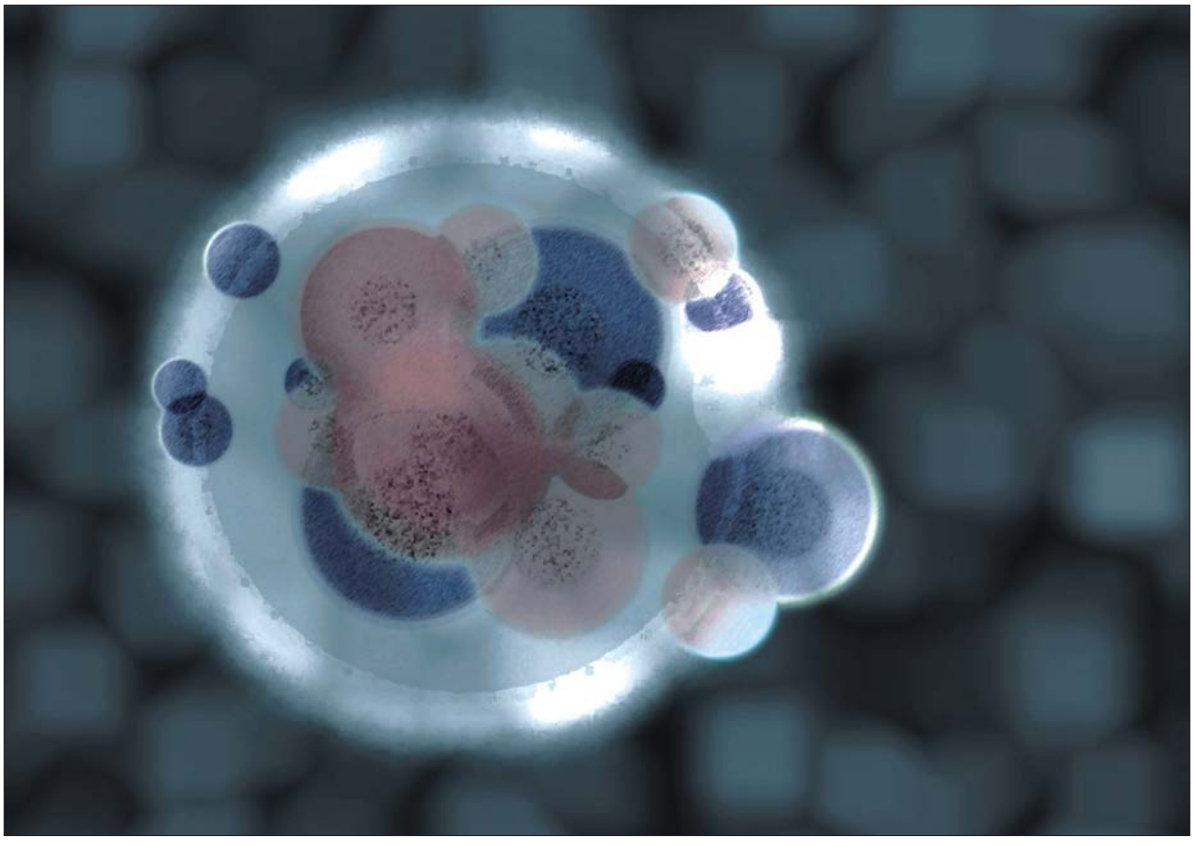

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The Effects of Different Harvesting Periods in Some Forage Crops Mixture on Herbage Yield and Quality

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Abstract: This study was carried out between 2002-2004 in Suleyman Demirel University Agricultural Faculty Experimental and Application Farm in order to determine the effect of different Hungarian vetch-barley mixture rates and harvesting periods. In the experiment, the effects of three different harvesting periods (Pre-blooming, 50% blooming, fruit ripening) and five different mixture rates (25% vetch+ 75% barley, 50% vetch +50% barley, 75% vetch+ 25% barley only vetch and only barley) on plant length, herbage yield, dry matter yield and crude protein yield were investigated. At the end of the research it was found out that when the rate of barley increased in the mixture plants became taller, herbage yield and dry matter yield increased and crude protein yield decreased. The highest herbage and dry matter yield were obtained between single barley and the mixture of 25% vetch + 75% barley, pre-blooming and 50% blooming periods the highest value of crude protein yield was obtained in the mixture of 75% vetch+ 25% barley. Harvesting period didn't effect the plant length and crude protein yield.

Key words: Hungarian vetch, barley, mixture rates, harvesting period, plant height, herbage yield, dry matter yield, crude protein yield

INTRODUCTION

Human beings have been in the efforts of better nutrition, lodging and dressing. In better nutrition, animal nourishment plays the most significant role. On Earth, people are fed better where cattle breeding is better. However, in under developed countries people are not fed enough.

This problem can only be abolished by means of increasing cattle breeding. In order to increase cattle breeding, genetic materials having high yield capability, must be used and animals must be fed with suitable food. A good and suitable nutrition is possible when animals have enough carbohydrates, proteins, vitamins, minerals and other materials.

Leguminosae and cereal fodders, when they are used together in animal nourishing, have great nutritive feature with the nutrition materials they contain. Animals eat the leguminosae-cereal mixture with a good appetite, because these mixtures are much more delicious than single leguminosae and cereal. Leguminosae food plants provide high product increase since they contain protein at high rate and vitamins and some mineral materials in their structure (Serin *et al*., 1999; Avcioglu, 2000; Açikgöz, 2001). Cereal food-plants, play a great role on cattle feeding, the work of animals stomach and intestine systems, because they contain carbohydrates at different rates in their structures.

In mixed sowing, rates of the vetch and grains and cropping in a suitable period are the most important factors that affect the yield and quality.

Herbage and dry grass yield increased with the cereals increase in the mixture (Arslan and Gülcan, 1996). In some researches, dry herbage grass and crude protein yields were obtained when leguminosae-cereal rate was 50 +50 % in the mixture (Anlarsal and Yücel, 1994; Bayram and Çelik, 1996; Basbağ *et al*., 1999). In general, the higher herbage, dry grass and dry matter yields were found vetch-barley mixture in proportion with plain sowing (Orak, 1997).

In addition to the mixture rates, another factor effecting the yield and nutrition values of fodder crop is harvesting period. While Akyildiz (1986) and Ergül (1988) claim that dry matter and crude cellulose rates increase, but crude protein rate decreases when the increased of growth period for all plants (Akyildiz, 1986; Ergül, 1988). Ayhan *et al*. (2004) claims that during the growth periods of leguminosae fodder crops, herbage, dry grass and dry matter yields values obviously increase (Ayhan *et al*., 2004).

This research has been carried out to determine the most convenient mixture rate and harvesting period of Hungarian vetch which can be grown in winter and barley according to yield and quality.

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MATERIALS AND METHODS

This research was carried out in the years of 2002 and 2004 at Suleyman Demirel University Agricultural Faculty Experimental and Application Farm.

In both two years, the average heat and relative moisture rates of the Experiment Area during the vegetation period were nearly equal. However, the total rainfall in the second year (570.5 mm) was much higher than the first year (543.1 mm) (Anonymous, 2004). For the research Hungarian Vetch (*Vicia pannonica* Crantz.) and Barley (*Hordeum vulgare* L.)are provided from Field Crops Central Research Institute; In divided plots harvesting periods formed the main plots and mixture rates formed the sub-plots. The experiment was replicated three times according to the experiment pattern.

The harvesting periods were determined taking the physiologic periods of the Hungarian vetch into consideration. The harvest was done in pre-blooming, 50% blooming and fruit ripening periods. The mixture rates were as follows: 75% Hungarian vetch + 25% Barley, 50% Hungarian vetch + 50% Barley, 25% Hungarian Vetch + 75% Barley , 100% Vetch and 100% Barley. After sowing, 5 kg day^{-1} nitrogen and 5 kg day^{-1} phosphorus were applied the plots. In single sowing, 12 kg day^{-1} vetch and 25 kg day^{-1} barley were sowed and the mixtures were prepared on these norms. The experiment plots were formed with 6 rows (each row 5 m length) and sowing distance was 30 cm in the plots. The plots were hoed in early spring. The edges of the plots (50 cm) were harvested in each harvesting period and they were excluded in the study. Ten plants were selected randomly for recording data on plant height. Herbage yield was measured by reaping and weighing the parcels and converting the values into kg day^{-1} in the period that sub-legumes of plants were filled after throwing the side efficient. Dry matter proportion was found following these steps; firstly 100 g herbage sample, taken from each parcel randomly were dried in open air, then the samples were placed in an oven at 105°C until the weights were fixed and finally the samples were weighed and compared to wet weights. Dry matter yield (kg day^{-1}) calculated by multiplying herbage yield and dry matter proportion in each parcel and converting the results into kg day^{-1}. The dried plant material was ground for crude protein content using Kjeldahl method (Kaçar, 1984). Crude protein values were obtained by multiplying crude protein proportions by dry herbage values of parcels and by converting these values into square kg day^{-1}.

The data was evaluated in MSTAT-C statistic programme and the LSD was used to determine the importance level of the difference among the averages.

RESULTS AND DISCUSSION

It was found that the effects of the mixture rates on the height of the vetch was significantly important in the averages in two years. However harvesting periods didn't have any significant effect on the height of the vetch. Shortest plants were obtained from the plots where single vetch was sowed in 2003-2004 and the highest plants were found from the plots where 50% or less vetch were sowed. When averages are compared in two years, the shortest plants (56 cm) were found from single vetch sowing and the highest plants (62.3 cm) were obtained from 25% vetch + 75% barley mixture. The height of the plant in mixtures was higher than the single vetch sowing could be caused by the competition between vetch and barley and this position might have affected the height of the plant positively (Table 1). Arslan and Gülcan (1996) and Soya *et al.* (1996) also reported similar results in their researches. Like vetch, barley mixture rates statistically played important roles on plant height in two year average; however harvesting periods didn't cause important differences. Generally, when barley rate increased in mixtures, plants heights also increased and reached its highest values in single barley harvesting. Arslan and Gülcan (1996) also notified similar results to our findings.

The mixture rates on herbage yield were found statistically significant as shown in Table 1 in 2003 and 2004 and in two year averages. The highest herbage yield were obtained from the plots where single barley and 25% vetch 75% barley were sowed and the lowest herbage yields were taken from the plots where single vetch was sowed. When the barley rate in the mixture was increased the herbage yield was also increased (Table 1). Arslan and Gülcan (1996) also agree with these results. The effect of harvesting period on herbage yield in 2004 and two year average was found statistically important. The highest herbage yield in 2004 (2400.9 kg day^{-1}) was obtained in pre-blooming period and the lowest (2275.5 kg day^{-1}) was found in fruit ripening period. According to the two year average, the herbage yields determined from the harvesting in pre-blooming and 50% blooming periods were high. Generally, it seems that when harvesting period was late, herbage yield was lower (Table 1). The plants were in generative period and the sub-leaves ran dry caused the herbage yields decrease when harvesting period was late.

The effect of the rates of different mixture on dry matter yield has been found statistically important. The highest dry matter yield has been obtained from the parcels which single barley has been sowed and the lowest dry matter yield has been obtained from the parcels

Table 1: The average values of plant height and herbage yield which has been obtained from five different mixture and three different harvesting time

	Plant height (cm)								
	Vetch			Barley			Herbage yield (kg day^{-1})		
Properties	2003	2004	Average	2003	2004	Average	2003	2004	Average
Mixture rate									
100% Vetch	55.2c	56.9c	56.0d	-	-	-	1660.0d	1729.6d	1694.8d
100% Barley	-	-	-	82.7a	82.9a	82.8a	2521.1a	2588.7a	2554.9a
25% Vetch+75% barley	62.0a	62.7a	62.3a	77.6b	76.7b	77.2b	2547.2a	2605.3a	2576.3a
50% Vetch+50% barley	60.8a	61.5a	61.2b	76.2b	75.3b	75.8c	2359.1b	2469.1b	2414.1b
75% Vetch+25% barley	58.9b	59.3b	59.1c	73.0c	76.4b	74.7c	2246.1c	2328.6c	2287.3c
LSD (5%)	1.628	1.657	1.121	1.994	1.970	1.374	109.3	71.88	63.71
Harvesting time									
Before blooming	47.3	47.4	47.3	61.8	61.6	61.7	2299.3	2400.9a	2350.1a
50% Blooming	47.1	48.5	47.8	62.4	63.2	62.8	2281.3	2356.3b	2318.8a
Fruit ripening	47.7	48.4	48.1	61.5	62.0	61.8	2219.5	2275.5c	2247.5b
LSD (5%)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Average							2266.7b	2344.2a	

Table 2: The average values of dry matter yield and cmde protein yield which has been obtained from five different mixture and three different harvesting time

	Dry matter yield (kg day^{-1})			Cmde protein yield (kg day^{-1})		
Properties	2003	2004	Average	2003	2004	Average
Mixture rate						
100% Vetch	333.3e	343.9e	338.6e	56.00c	57.64c	56.82d
100% Barley	607.3a	622.8a	615.1a	50.93d	52.46d	51.70e
25% Vetch+75% barley	581.3b	600.3b	590.8b	62.16b	64.54b	63.35c
50% Vetch+50% barley	548.0c	572.5c	560.3c	71.86a	75.02a	73.44b
75 %Vetch+ 25% barley	516.3d	534.5d	525.4d	76.10a	78.44a	77.27a
LS (5%)	21.47	13.86	12.45	4.284	4.090	2.885
Harvesting time						
Before blooming	524.7	547.8a	536.3a	63.29	66.35	64.82
50% blooming	518.3	536.8b	527.5a	62.71	64.99	63.85
Fruit ripening	508.8	519.8c	514.3b	63.29	65.53	64.88
LSD (5%)	NS	3.793	10.50	NS	NS	NS
Average	517.3b	534.8a		63.41b	65.62a	

where single vetch has been sowed. According to the average within two years in proportion to the parcels where single vetch has been sowed (338.6 kg day^{-1}) 81.7% more dry matter yield has been obtained in the parcels which single barley has been sowed (Table 2). The increase of the rate of barley in the mixture caused an increase in the dry matter yield. This is because barley has developed more strongly than vetch. The effect of the time of harvesting on dry matter yield hasn't been found statistically significant in 2003 but it has been found significant in 2004 and the average within two years. In 2004, the highest dry matter yield has been obtained from the parcels which has been harvested before blooming (547.8 kg da^{-1}) and the lowest dry matter yield has been obtained from the parcels which has been harvested in fruit ripening period. According to the average within two years before blooming and in the 50% blooming period the crop is high whereas in fruit ripening period the crop is low. Generally, it seems that if the harvesting has been delayed the dry matter yield has decreased.

The effect of the rate of mixture on the crude protein yield has been found statistically significant and the effect of the time of harvesting on crude protein yield hasn't so much importance in 2003 and 2004. The highest crude protein yield has been obtained from 50% vetch + 50% barley and 75% vetch + 25% barley mixture and the lowest crude protein yield has been obtained from single barley parcels (Table 2). According to the results of the average within two years the highest crude protein yield has been obtained with 77.27 kg day^{-1} and with the mixture of 75% vetch + 25% barley. The lowest crude protein yield has been obtained with 51.70 kg day^{-1} and by sowing single barley. As the rate of vetch in the mixture has increased, the rate of crude protein has also increased, so 75% vetch + 25% barley mixture has the highest crude protein yield. Although the highest dry matter yield has been obtained from single barley parcels, as the rate of crude protein is low in barley, the lowest crude protein yield has been obtained from the parcels which barley has been sowed.

As a result, the height of the plant single barley and the mixture of barley at high rate has been found higher and the time of harvesting hasn't effected the height of the plant either in barley or in vetch. The highest herbage and dry matter yield has been obtained with the mixture of 25% vetch and 75% barley and between before blooming

and 50% blooming period. The highest value with regard of crude protein yield has been obtained in the mixture of 75% vetch + 25% barley and it has been concluded that the time of harvesting has no importance on crude protein yield.

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