

Bulgarian Journal of Agricultural Science, 15 (No 4) 2009, 323-332
Agricultural Academy

EFFECT OF DIFFERENT RATIOS OF COMMON VETCH (*VICIA SATIVA* L.) – TRITICALE (*TRITICOSECALE* WHATT) MIXTURES ON FORAGE YIELDS AND QUALITY IN CUKUROVA PLAIN IN TURKEY

C. YUCEL and M. AVCI
Cukurova Agricultural Research Institute, Adana, Turkey

Abstract

YUCEL, C. and M. AVCI, 2009. Effect of different ratios of common vetch (*Vicia sativa* L.) – triticale (*Triticosecale* Whatt) mixtures on forage yields and quality in Cukurova plain in Turkey. *Bulg. J. Agric. Sci.*, 15: 323-332

To investigate the introduction of vetch/triticale forage mixtures in the winter season of Mediterranean-type environments, the study was carried out, in 2004/05, 2006/07 and 2007/08 at the Cukurova Agricultural Research Institute, Adana/TURKEY. In this study common vetch (V), triticale (T), and their mixtures were seeded as ratios ranged from 10% to 90 %.

According to the average of three years result, the highest crude protein yields were recorded as 1383.8 and 1339.3 kg ha⁻¹ from V90%+T10% and V80%+T20% mixtures respectively. Research findings showed that more crude protein yield was obtained from the 80-90 percent vetch rate. On account of protein rate and yield, the vetch-triticale composition containing 90-80 % vetch should be preferred to obtain high quality forage. In case of requirement of the forage containing high energy, the mixture containing higher triticale ratio could be preferred.

Key words: common vetch, triticale, mixture, dry matter yield, forage quality

Abbreviations: ADF, acid detergent fiber; CP, crude protein; DDM, digestibly dry matter; DMY, dry matter yield; DMI, dry matter intake; NDF, neutral detergent fiber; DDMR, Digestibility Dry Matter Ratio

Introduction

Vetches (*Vicia* spp.) are legumes well adapted to winter growth in the Mediterranean environments throughout the world on a variety of soil types and are used in west Asia, North Africa, Australia, and Turkey for varied purposes such as dry matter, silage and green manure (Abd El Moneim et al., 1988; Acikgoz, 2001).

E-mail: celalyucel@hotmail.com

Cukurova region in Southern Turkey in particular has very suitable ecological conditions for annual forage production in crop rotation in winter. If herbage production could be increased in this region, it would contribute to the feeding of farm animals and the improvement of soils (Tukel et al., 1991; Anlarsal and Yucel, 1995).

Because of having weak and thin stem, the vetches spread. So harvest gets difficult and because of losing

leaves, its forage and quality decrease. Vetch should be sown mixture with cereals in order to overcome spreading. Because high cereal rate in botanic composition of legume + cereal mixture cause low protein content which is one of the most important factors to determine the forage quality (Anlarsal and Yucel, 1995; Anlarsal and Yagasanlar, 1996; Acikgoz, 2001)?

Use of cereals and grasses in mixtures with legumes not only increases forage yield, but also provides physical support to, which facilitates mechanical harvesting and other benefits of these mixtures include greater use of light, greater uptake of water and nutrients, enhanced weed suppression, and increased soil conservation, (Osman and Osman, 1982; Anil et al., 1998). Experiments conducted with legume/cereal mixture stated that, mixture rate of legume/cereal species in botanic composition affect the dry matter yield and protein yield per unit area. Generally green herbage and dry matter yield and percentage of mixture decreased by increasing seed rate of legume in the mixture (Lunnan, 1989; Roberts et al., 1989; Anlarsal and Yucel, 1995). Mixtures containing 25-50 % legume produced more quality forage and yield per unit area than those of pure sowings (Qamar et al., 1999; Anlarsal and Yagbasanlar, 1996; Alemu et al., 2007; Buyukburc and Karadag, 2002).

The objective of this study was to determine the

effects of different seeding rate on the dry matter and botanical composition of common vetch-triticale mixtures under the lowland condition of Southern Turkey.

Materials and Methods

This study was conducted in the experimental area of the Cukurova Agricultural Research Institute, Dogankent, Adana, Turkey (36° 37.647' N, 35° 29.882' E with an elevation of 10 meters above sea level) in during from mid-November to April, in 2004/05, 2006/207 and 2007/08. The 2005/06 year of the experiment was cancelled because of flooding in area.

Some climatic data for the research area are given Table 1. The Cukurova region has a typical coastal Mediterranean climate. There is a total precipitation of 350 mm and mean temperature of 12.4°C according to the average of the mean of three years recorded during the vegetation period from November to April. The soils at the station are slight alkaline (pH 7.71), medium in calcium carbonate content (20.4%) and available P content (45.2 kg ha⁻¹) high in K (890 kg ha⁻¹) and organic matter (2.02%) content. The texture of soil is clay-loam.

Each plot was 7.5 m² with six rows 5m long and 0.25 m apart. Measurements and harvesting were

Table 1
Climatic data of the experimental area

Years	Nov.	Dec.	Jan.	Feb.	Marc.	April	Mean/Total
Mean temperature, °C							
2004-05	15.9	9.6	10.1	10.4	13.9	18.1	13
2006-07	14.8	10.9	8	11	13.3	15.6	12.3
2007-08	14.8	9.3	6	8.3	15.3	17.8	11.9
Long -term mean	10.3	6.5	9.8	10.4	13.3	17.5	11.3
Total precipitation, mm							
2004-05	141.1	27	51	75.6	61.6	53	409.3
2006-07	101.5	3.3	72.5	82.4	54.7	54.4	371.8
2007-08	30.9	116.3	19.6	50.8	49.2	4	270.8
Long -term mean	86.4	115.6	95	82.5	61.1	50.3	490.9

* Data of Cukurova Agricultural Research Institute Meteorological Station, Adana, Turkey

performed after cutting one row from each side of the plots as side effect and 0.5 m area from the beginning of each row.

The seed proportions were calculated on the basis of recommended sole seed rate of 140 and 240 kg per hectare for common vetch and triticale, respectively (Anlarsal and Yapbasanlar, 1996). Seed of both species was mixed, where required, prior to sowing. N-P fertilizer, 50 kg ha⁻¹ N and 50 kg ha⁻¹ P₂O₅ were uniformly applied to soil before sowing. Common vetch (*Vicia sativa* var. Ozveren) and triticale (*Triticosecale* var. Tacettinbey) were used as plant materials.

The treatments by number of viable seeds sown were:

- 1- Sole crop vetch
- 2- Vetch (90%) + Triticale (10%),
- 3- Vetch (80%) + Triticale (20%),
- 4- Vetch (70%) + Triticale (30%),
- 5- Vetch (60%) + Triticale (40%),
- 6- Vetch (50%) + Triticale (50%),
- 7- Vetch (40%) + Triticale (60%),
- 8- Vetch (30%) + Triticale (70%),
- 9- Vetch (20%) + Triticale (80%),
- 10- Vetch (10%) + Triticale (90%)
- 11- Sole crop triticale

The crops were sown on 15, 20 and 18 November 2004/05, 2006/07 and 2007/08, respectively. When the common vetch reached the early pod formation stage was harvested. The crops were harvested at maturity on 20, 26 and 10 April 2005, 2007 and 2008, respectively. All of the three years, the vetch and triticale in the mixtures were separated manually and analyzed separately. Sub samples were dried at 70° C for 48 h to determine dry matter yield.

Nitrogen was measured using the micro-Kjeldahl procedure (A.O.A.C., 1984) and crude protein (CP) was calculated by the formula CP: N x 6.25. Asit Detergent Fibre (ADF) and Neutral Detergent Fibre (NDF) were measured using the procedure of Van Soest (1982). Dry matter digestibility (DMD) was calculated using formula Jaranyama and Garcia (2004): DMD (%): (88.9-(0.779 x % ADF). After % rate of the spices in botanic composition was determined,

values of HP, NDF and ADF % were calculated. DMI (maximum forage intake) is estimated from NDF: DMI (% of body weight) = 120/NDF%

The researches were designed in a randomized complete block with four replications. Results from the three years combined and analyzed as a randomized complete block design combined over years. All the data were subjected to analysis of variance (ANOVA) procedures using the MSTATC statistical software package. The least significant difference (LSD) test was used to compare the treatments (Steel and Torrie, 1960).

Results and Discussion

According to variance analysis, years, mixture ratios and years x mixture ratios interaction in each year and combined analysis of three years were found statistically significant for vetch and triticale ratio in dry matter, dry matter yield, digestibly dry matter, crude protein ratio, crude protein yield, asit detergent fiber, digestibly dry matter ratio, neutral detergent fiber and dry matter intake.

Vetch and Triticale Ratio in Dry Matter (%): Mean values and groups of 2005, 2007, and 2008 years and combined year about vetch and triticale ratio in dry matter in botanical composition obtained from different mixture rates were given in Table 2.

The highest vetch ratio in dry matter was obtained from the mixture containing 90% and 80% vetch after pure sowing of vetch. The vetch ratio clearly decreased when the proportion of the vetch in mixture decreased. The vetch ratio in dry matter was approximately determined 20% when vetch ratio was below 60% in botanic composition.

In case the ratio of 10% triticale exits in the mixture, the triticale ratio in botanic composition was determined to be approximately 60%. Also, the triticale ratio in botanic composition was seen as 90% in mixtures containing 60% triticale ratio and above.

Just as, in legume/cereal mixtures, rates of the species in mixture are changed and the ratio of cereals increases much more in botanic composition at harvesting time. These results confirm the findings of

Table 2
Vetch and triticale ratio in botanic composition for pure and mixture sowing

Mixture Rates	Vetch Ratio in Dry Matter, %				Triticale Ratio in Dry Matter, %			
	Years				Years			
	2005	2007	2008	Mean	2005	2007	2008	Mean
Sole (100%)	100	100	100	100	100	100	100	100
V%90 + T%10	49.3	44.4	25.9	39.9	50.7	55.6	74.1	60.1
V%80 + T%20	34.8	41.1	20.4	32.1	65.2	58.9	79.6	67.9
V%70 + T%30	22.6	25.7	18.8	22.4	77.4	74.3	81.2	77.6
V%60 + T%40	20.9	25.1	14.2	20.1	79.1	74.9	85.8	79.9
V%50 + T%50	12	14.2	11.2	12.5	88	85.8	88.8	87.5
V%40 + T%60	11.8	12.2	5.5	9.8	88.2	87.8	94.5	90.2
V%30 + T%70	8.7	8.2	4.5	7.1	91.3	91.8	95.5	92.9
V%20 + T%80	6.3	2.2	1.4	3.3	93.7	97.8	98.6	96.7
V%10 + T%90	1.9	2.1	1.4	1.8	98.1	97.9	98.6	98.2
Mean	26.8 a	27.5 a	20.0 b		73.2 b	72.5 b	80.0 a	
CV (%)	5.43	8.51	10.85	8.19	1.76	2.85	2.45	2.4
LSD	2.111	3.396	3.199	1.655	2.121	3.404	3.189	1.656
	Year: 1.406, Year x Mixture Int. 2.857				Year: 1.407, Year x Mixture Int. 2.869			

Table 3
Dry matter yield and digestibly dry matter yield for pure and mixture sowing

Mixture Rates	Dry Matter Yield, kg ha-1				Digestibly Dry Matter Yield, kg ha-1			
	Years				Years			
	2005	2007	2008	Mean	2005	2007	2008	Mean
Sole vetch	5594	6350	4794	5579	3125	3930	2647	3234
V%90 + T%10	7823	9086	15424	10778	4344	5191	8520	6018
V%80 + T%20	8507	10317	13784	10869	4640	5988	7563	6063
V%70 + T%30	10184	8991	13663	10946	5465	5093	7483	6014
V%60 + T%40	9995	9527	12978	10833	5418	5341	7031	5930
V%50 + T%50	9099	9239	12184	10174	4939	5126	6543	5536
V%40 + T%60	7565	11703	13366	10878	4056	6712	7333	6033
V%30 + T%70	8672	12330	12339	11114	4715	7117	6863	6232
V%20 + T%80	9558	13270	13426	12085	5098	7563	6880	6514
V%10 + T%90	11495	10897	12863	11752	6344	5931	6915	6396
Sole Triticale	10341	13087	12523	11984	5458	7384	6622	6488
Mean	8985 c	10436 b	12486 a		4873 c	5943 b	6763 a	
CV (%)	6.25	6.43	7.45	6.93	7.4	7.8	8.12	7.92
LSD	810.7	968.9	1344	598.1	521.1	669.5	792.9	376.5
	Year: 0.4193, Year x Mixture Int. 1.046				Year: 48.59, Year x Mixture Int. 159.3			

Anlarsal and Yucel (1995), Anlarsal and Yagbasanlar (1996) and Karadag (2004). Even if legume ratio is high at sowing time, the legume ratio is obtained much lower at harvesting time in botanic composition. Due to the fact that triticale is grown better, having more tillers and dry matter rate, it decreases legumes rate and increase cereal rate in botanic composition. Similar results were reported by Tukul and Yilmaz (1987) and Karadag (2004).

Dry Matter Yield (kg ha^{-1}): Mean values and groups of 2005, 2007, and 2008 years and combined year dry matter yield (DMY) and digestibility dry matter yield (DDMY) obtained from different mixture rates were given Table 3.

According to Table 3, the highest dry matter yield was found to be 11495 kg ha^{-1} for 10% vetch + 90% triticale in the first year, 13270 kg ha^{-1} for 20% vetch + 80% triticale in the second year, 15424 kg ha^{-1} for 90% vetch + 10% triticale in the third year, 12085 kg ha^{-1} for 20% vetch + 80% triticale in combined analysis of the years. The lowest dry matter yield was obtained from pure vetch in three years. In the research, the ratio of triticale increases statistically the yield of dry matter. Some researches reported that increasing the proportion of legume at sowing decreases the yield of at harvest (Anlarsal and Yucel, 1995; Casrtro et al., 2000; Tuna and Orak, 2007). Some researches also reported that yield sowing mixtures (legume and cereal) was higher than yield of pure sowing (Anlarsal and Yucel, 1995; Anlarsal and Yagbasanlar, 1996; Qamar et al., 1999; Parveen et al., 2001; Alemu et al., 2007). Many researchers reported that 25-50% the ratio of legumes in mixed (legume-cereal) forages can be obtained higher dry matter and crude protein yield per unit area (Anlarsal and Yucel, 1995; Anlarsal and Yagbasanlar, 1996; Bugdaycigil et al., 1996; Qamar et al., 1999; Buyukburc and Karadag, 2002; Albayrak et al., 2004; Alemu et al., 2007; Tuna and Orak, 2007).

In terms of dry matter, there were statistically significant differences among years. Dry matter yield in the third year was higher than the other years. Due to lower mean temperature and precipitation in the third year, growing of vetch might be slow down, however,

triticale which have cold and drought tolerance might be continued growing. As a result of this, triticale ratio in botanic composition increased and determined as 80% (Table 2). Some researches stated that, temperature and precipitation growing period can affect the botanic composition and yield (Anlarsal and Yagbasanlar, 1996; Qamar et al., 1999; Acikgoz, 2001).

Digestibly Dry Matter Yield (kg ha^{-1}): The highest digestibly dry matter yield was found to be 6344 kg ha^{-1} for 10% vetch and 90% triticale in the first year, 7563 kg ha^{-1} for 20% vetch and 80% triticale in the second year, 8520 kg ha^{-1} for 20% vetch and 80% triticale in the third year, and 6514 kg ha^{-1} for 20% vetch and 80% triticale in combined analysis of 3 years (Table 3). The lowest digestibly dry matter yield was obtained from pure vetch in three years and combined years. Even though ADF % value of triticale was found high, digestibly dry matter yield increased since dry matter yield per unit area increased. According to three years average, DDMY was found increased more than in the case the mixtures contained 50% more triticale. The more asit detergent fiber content of forages, the fewer digestibilities is. DDMY in the third year was determined higher than that of obtained from other years.

Crude Protein Ratio (%): According to Table 4, the highest crude protein ratio was obtained from pure vetch sowing. The lowest crude protein ratio was obtained from pure triticale sowing. Due to decreasing the proportion of vetch and increasing the proportion of triticale in mixture at botanic composition, ratio of CP in the mixture decreased. CP % in the third year was determined higher than CP % obtained from other years. McDonald et al. (2002) reported that maturing stage at harvesting time has an effect on DMY and nutrient quality. Many researchers reported that CP rate in pure sowing of legumes are higher than in cereals, and as legumes rate increases, CP rate increases (Lunnan, 1989; Roerts et al., 1989; Anlarsal and Yagbasanlar, 1996; Arzani et al., 2003).

Crude Protein Yield (kg ha^{-1}): The highest crude protein yield (CPY) was found to be 1055 kg ha^{-1} for pure vetch sowing in the first year, $1281.8 \text{ kg ha}^{-1}$

Table 4
Crude protein ratio and crude protein yield for pure and mixture sowing

Mixture Rates	Crude Protein Ratio, %				Crude Protein Yield, kg ha ⁻¹			
	Years				Years			
	2005	2007	2008	Mean	2005	2007	2008	Mean
Sole vetch	18.88	17.65	17.55	18.03	1055	1122	839.8	1005.6
V%90 + T%10	13.4	13.03	12.32	12.92	1051.5	1187.5	1912.3	1383.8
V%80 + T%20	11.4	12.38	12.73	12.17	974.8	1281.8	1761.5	1339.3
V%70 + T%30	10.2	10.85	11.63	10.89	1041.8	974	1587	1200.9
V%60 + T%40	8.81	10.88	11.18	10.29	878.5	1033.5	1460.8	1124.3
V%50 + T%50	8.46	10.25	12.05	10.25	769.5	949.5	1470	1063
V%40 + T%60	8.99	9.53	10.98	9.83	679.3	1114.5	1472.8	1088.7
V%30 + T%70	8.33	8.2	11.02	9.18	725.5	1012	1365.3	1034.3
V%20 + T%80	7.95	8.46	11.05	9.15	760.5	1120.8	1488.8	1123.3
V%10 + T%90	5.82	8.15	11.13	8.37	668.5	886.8	1439	998.1
Sole Triticale	5.83	7.33	9.73	7.76	601.5	1012.8	1215.3	943.2
Mean	9.82 c	10.64 b	11.94 a	10.8	836.9 c	1063.2 b	1455.7 a	1118.6
CV (%)	6.34	5.95	7.83	6.89	9.39	8.75	10.58	10.14
LSD	0.8995	0.9156	1.35	0.6037	113.4	134.4	220.8	91.96
	Yera: 0.4193, Year x Mixture Int.1.046				Yera: 48.59, Year x Mixture Int.159.3			

¹ for 80% vetch and 20% triticale in the second year, (1912.3 kg ha⁻¹ for 90% vetch and 10% triticale in the third year, 1383.8 and 1339.3 kg ha⁻¹ for 90% vetch and 10% triticale, and 80% vetch and 20% triticale in combined years. In these mixture rates, proportion of legumes in botanic composition were determined 39.9% and 32.1%, respectively (Table 2)

CPY was decreased due to decrease the legumes in botanic composition in mixture rates under these mixture rates. In terms of CP yield, legumes rate in mixture to be 25-50 % reported many researches (Bugdaycigil et al., 1996; Kumar et al., 1999; Buyukburc and Karadag, 2002; Albayrak et al., 2004). Mixtures having high legumes rate are rich for vitamin B and minerals and CP content. In the mixtures having high cereal rates sometimes grass tetany can cause a problem. To solve this problem, the mixture forages containing high legumes rates should be preferred. These results are in agreement with the results of Tan and Serin (1996); Rupela et al. (1997), Unkovich et al. (1997), Weichentha et al. (2005). In 2007, the ratio of CPY % was higher than the ratio of

the other years. This might be due to higher CV rate and dry matter yield.

Mean values and groups of 2005, 2007, and 2008 years and combined year ADF rate and DDMR rate obtained from different mixture rates were given Table 5.

ADF Ratio (%): The highest ADF ratio (%) was found to be 46.28% for pure triticale sowing in the first year, 44.25% for 10% vetch and 90% triticale in the second year, 48.28% for 20% vetch and 80% triticale in the third year, 44.93% and 44.72% for 20% vetch and 80% triticale and pure triticale, in combined years. The lowest ADF ratio (%) was determined to %42.38, 34.68% with pure vetch in 2005 and 2007, respectively. As the lowest ADF, 42.67% was determined for 30% vetch and 70% triticale, in 2008. Increasing the ratio of triticale in botanic composition increases % ADF ratio. ADF ratio in 2007 was obtained lower than that in 2005 and 2008 (Table 2).

Digestibility Dry Matter Ratio (%): The highest digestibility dry matter ratio (DDMR) was obtained from pure vetch in all years and the combined years,

Table 5
Asit detergent fiber ratio and digestibly dry matter ratio for pure and mixture sowing

Mixture Rates	Asit Detergent Fiber Ratio, %				Digestibly Dry Matter Ratio, %			
	Years				Years			
	2005	2007	2008	Mean	2005	2007	2008	Mean
Sole vetch	42.38	34.68	43.28	40.11	55.8	61.83	55.13	57.58
V%90 + T%10	42.85	40.78	43.25	42.29	55.45	57.05	55.15	55.88
V%80 + T%20	44.08	39.55	43.67	42.43	54.58	58.03	54.8	55.77
V%70 + T%30	45.2	41.38	43.72	43.43	53.63	56.6	54.75	54.99
V%60 + T%40	44.55	42.17	44.63	43.78	54.13	55.95	54.08	54.72
V%50 + T%50	44.4	42.83	45.13	44.12	54.25	55.48	53.7	54.47
V%40 + T%60	45.3	40.55	43.65	43.15	53.5	57.25	54.85	55.2
V%30 + T%70	44.43	39.97	42.67	42.36	54.23	57.7	55.58	55.83
V%20 + T%80	45.65	40.88	48.28	44.93	53.25	56.95	51.2	53.8
V%10 + T%90	43.23	44.25	45.08	44.18	55.15	54.35	53.73	54.41
Sole Triticale	46.28	41.7	46.17	44.72	52.75	56.35	52.85	53.98
Ort.	44.39 a	40.79 b	44.50 a	43.23	54.24 b	57.05	54.16	55.15
CV	3.16	4.15	2.74	3.36	2.02	2.31	1.76	2.05
LSD	2.025	2.443	1.762	1.177	1.586	1.901	1.375	0.918
	Yera: 0.7114, Year x Mixture Int.2.039				Yera: 0.7711, Year x Mixture Int.2.352			

while the lowest ratio was found to be %52.75 for pure triticale in 2005, %54.35 for 10% vetch and 90% triticale in 2007, %52.20 for 20% vetch and 80% triticale in 2008, and % 53.80 and %53.98 for 20% vetch and 80% triticale and pure sowing in combined years. With increasing triticale ratio in mixture decreased % DDMR. DDMR in 2007 was lower than that in 2005 and 2008 due to higher ratio of vetch and lower ratio of triticale in 2007 than that of other years in botanic composition.

The lower the ADF, the more feed on animal can digest. Thus, a low ADF percentage is desirable. For this reason, digestibility rates of pure vetch and the mixtures containing high vetch rates are seen to be lower. In addition to this, environmental factors that vary from season to season and year to year are responsible for many unexplained differences in legume-cereal and their mixture. These results are in agreement with Arzani et al. (2003) Castro et al. (2000) reported increased vetch proportion at sowing is caused of decreasing the ADF, NDF and organic

matter at harvest.

NDF Ratio (%): The highest NDF ratio (%) was found to be 69.69% for pure triticale sowing in the first year, 62.18% for 20% vetch and 80% triticale in the second year, 69.19% for pure triticale in the third year, while the lowest NDF ratio (%) was determined to %44.53, 42.03% and 48.38 with pure vetch in 2005, 2007, and 2008 respectively. According to three year average, increasing the ratio of triticale in botanic composition increases % NDF ratio.

According to Castro et al. (2000), high vetch rate in the mixture causes ADF, NDF and organic matter to decrease in the harvest. According to years, NDF ratio in the second year is lower than in the other years, due to the lower rate of triticale in botanic composition, in 2005 and 2008 (Table 4).

With the increasing of NDF value of forage important decreasing in the consumption of ruminants were seen. From this point, being low of NDF values of pure vetch and the mixtures containing high vetch rates shows that vetch forage is more valuable than

Table 6
Neutral detergent fiber ratio and dry matter intake for pure and mixture sowing

Mixture Rates	Neutral Detergent Fiber Ratio, %				Dry Matter Intake, %			
	Years				Years			
	2005	2007	2008	Mean	2005	2007	2008	Mean
Sole vetch	49.53	42.03	48.38	46.64	2.42	2.85	2.48	2.58
V%90 + T%10	60.25	55.78	59.9	58.64	1.99	2.15	2	2.04
V%80 + T%20	62.82	57.13	63.67	61.21	1.91	2.1	1.88	1.96
V%70 + T%30	66.22	58.1	64.43	62.92	1.81	2.06	1.86	1.91
V%60 + T%40	66.03	59.9	64.68	63.53	1.81	2	1.85	1.89
V%50 + T%50	67.88	61.75	66.9	65.51	1.77	1.94	1.79	1.83
V%40 + T%60	67.83	57.73	65.95	63.83	1.77	2.08	1.81	1.88
V%30 + T%70	68.1	59.9	67.8	64.97	1.76	2.03	1.77	1.85
V%20 + T%80	67.97	62.18	68.97	66.38	1.76	1.93	1.74	1.81
V%10 + T%90	66.82	61.65	68.05	65.51	1.79	1.94	1.76	1.83
Sole Triticale	69.65	57.6	69.19	65.47	1.72	2.08	1.73	1.84
Mean	64.83 a	57.53 b	64.35 a	62.24	1.86 b	2.10 a	1.88 b	1.95
CV (%)	2.77	2.26	2.9	2.69	2.66	2.32	3.08	2.68
LSD	2.597	1.881	2.695	1.358	0.0646	0.0646	0.0791	
	Yera: 0.7114, Year x Mixture Int.2.039				Yera: 0.0264, Year x Mixture Int.0.4442			

triticale in terms of forage consumption.

Differences in NDF were significant among years. ADF ratio in 2007 was obtained lower than that in 2005 and 2008, due to lower NDF ratio in the other years (Table 4).

Dry Matter Intake (%): The highest DMI ratio (%) was obtained from pure vetch sowing in all years while the lowest DMI ratio (%) was determined with pure triticale in 2005, and 2008, 50% vetch and 50% triticale in 2007. Decreasing the proportion of vetch in mixture decreases the the ratio of DMI. DMI is an estimate of the relative amount of forage an animal will eat, which was affected by NDF ratio in mixture. Increasing the proportion of triticale in mixture increases the ratio of NDF.

Conclusions

The vetch shows more spreading because of the rainy season when it is grown in the Mediterranean Region. As a result of this, both yield and quality loss

occurred. For this reason, higher dry matter yield and crude protein is obtained per unit area, when vetch is sown mixture with cereals in Mediterranean-type environments. It is essential to know the best mixture of vetch and triticale in order to produce suitable dry matter and quality forage per unit area.

In this research, according to 3 years result, the highest crude protein yields were recorded as 1383.8 and 1339.3 kg ha⁻¹ from V90%+T10% and V80%+T20% mixtures respectively. Therefore the mixture containing 20% vetch and 80% triticale were not preferred since the legume rate in it decreased down to 3% level, although the highest dry matter yield and digestibly dry matter yield were obtained from it.

At the result of this study, it was concluded that the mixtures containing high legume rates (80-90%) should be preferred so that it effect DDMY positively and more crude protein yield is obtained from the per unit area. In case of requirement of the forage containing high energy, the mixture containing higher triticale ratio could be preferred.

References

- A.O.A.C.**, 1984. Official Methods of Analysis Association of Official Agricultural Chemists. 15th Ed: Washington D.C.
- Azıkgoz, E.**, 2001. *Yem Bitkileri*. U.U. Gölendime Vakfı Yayın No: 182, 584 pp., Bursa.
- Ad El Monem, A. M., P. S. Cocks and Y. Swedan**, 1988. Yield stability of selected forage vetches (*Vicia* spp) under rain fed conditions in West Asia. *J. of Agric. Sci., Cambridge*, **111**: 295-301.
- Albayrak, S., M. Guler and M. O. Tongel**, 2004. Effects of seed rates on forage production and hay quality of vetch-triticale mixtures. *Asian J. of Plant Sciences*, **3** (6): 752-756.
- Alemu, B., S. Melaku and N. K. Prased**, 2007. Effects of varying seed proportions and harvesting stages on biological compatibility and forage yield of oats (*A. sativa* L.) and Vetch (*V. villosa* R.) mixtures. *Livestock Research for Rural Development*, **19** (1).
- Anil, L., J. Park, R. H. Phipps and F. A. Miller**, 1998. Temperature intercropping of cereals for forage: A review of the potential for growth and utilization with particular reference to the UK. *Grass Forage Sci.*, **53**: 301-317.
- Anlarsal, A. E. and C. Yucel**, 1995. Determining the most suitable seeding rates and cutting times of fieldpea-triticale mixtures under lowland conditions. *Agr. Med.*, **124**: 207-212.
- Anlarsal, A. E. and T. Yagbasanlar**, 1996. Cukurova bölgesi kirac kösullarında fig (*Vicia sativa* L.) ile bazı tahil cinslerinin farklı oranlardaki karışımının kaba yem üretimine etkisi. *Tr. J. of Agriculture and Forestry*, **20**: 157-163.
- Arzani, H., F. Khatibi, M. Basiri and E. Fish**, 2003. Comparison of forage quality of 22 Zagros Mountain rangeland species. *Proceeding of the 12th Symposium of the European Grassland Federation Pleven*, Bulgaria 26-28 May, pp. 222-225.
- Bugdaycigil, M., C. O. Sabancı, H. Özpınar and G. Eginlioglu**, 1996. Degisik figarpa karisim oranlarının ot verimine ve kalitesine etkisi. *Turkey 3. Çayır-Mera ve Yembitkileri Kongresi*, 17-19 Haziran, Erzurum, pp. 316-320.
- Buyukburc, U. and Y. Karadag**, 2002. The amount of NO₃-N transferred to soil by legumes, forage and seed yield, and the forage quality of annual legume + triticale mixtures. *Turk J. Agric For.*, **26**: 281-288.
- Castro, M. P., F. Sau and J. Pineiro**, 2000. Effect of seeding rates of oats (*Avena sativa* L), wheat (*Triticum aestivum* L.) and common vetch (*Vicia sativa* L.) on the yield, botanic composition and nutritive value of the mixture. *CIHEAM- Options Mediterraneennes*, pp. 207-211.
- Jaranyama, P. and A. D. Garcia**, 2004. Understanding Relative Feed Value (RFV) and Relative Forage Quality (RFQ). *College of Agriculture and Biological Sciences, South Dakota State University, USDA*.
- Karadag, Y.**, 2004. Forage Yields, seed yields and botanical compositions of some legume-barley mixtures under rainfed condition in semi arid regions of Turkey. *Asian Journal of Plant Sciences*, **3** (3): 295-299.
- Lunnan, T.**, 1989. Burley-pea mixtures for whole crop forage. Effect of different cultural practices on yield quality. *Norwegian J. of Agric. Sci.*, **3**: 57-71.
- Mc Donald, P., R. S. Edwards, J. F. D. Greenhalgh and C. A. Morgan**, 2002. *Animal Nutrition*. (5th edition), Longman Scientific and Technical, John Wiley and Sons. Inc., New York, pp. 418-433.
- Osman, A. E. and A. M. Osman**, 1982. Performance of mixtures of cereal and legume forages under irrigation in the Sudan. *J. of Agric. Sci., Cambridge*, **98**: 17-21.
- Parveen, S., Qomar, I. A., A. Ali and M. Arshad**, 2001. Effect of legume-grass mixture on forage yield and quality in the Pothwar Plateau of Pakistan. *Journal of Biological Sciences*, **1** (9): 809-811.
- Qamar, I. A., J. D.H. Keatinge, N. Mohammad. A. Ali and A. M. Khan**, 1999. Introduction and management of vetch/barley forage mixtures in the rainfed areas of Pakistan 1. forage yield. *Aust. J. Agric. Res.*, **50**: 1-9.
- Roberts, C. A., K. J. Moore and K. D. Johnson**,

1989. Forage quality and yield of wheat-vetch at different staged of maturity and seeding rates. *Agron. J.*, **81** (1): 57-60.
- Rupela, O. P., C. Johnsen and D. F. Herridge**, 1997. Extending nitrogen in farmers, fields. International Crop Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India.
- Steel, R. G. D. and J. H. Torrie**, 1960. *Principles and Procedures of Statistics*. Mc Grow-Hill Book Comp. Inc. London.
- Tan, M. and Y. Serin**, 1996. Figtahil karəyömlərəndə karəyömlər oranlarə ve bizim zamanlarənən makro besin elementi kompozisyona etkileri. *Turkiye 3. Cayər-Mera ve Yembitkileri Kongresi*, 17-19 Haziran, Erzurum, pp. 308-315.
- Tuna, C. and A. Orak**, 2007. The role of intercropping on yield potential of common vetch (*Vicia sativa* L.)/ oat (*Avena sativa* L.) cultivated in pure stand and mixtures. *J. of Agric. and Bio. Sci.*, **2** (No.2): 14-19.
- Tukel, T., A. E. Anlarsal, V. Tansi, T. Saglamtimur and H. Gulcan**, 1991. Cukurova'da yem bitkilerinin kəyölək ara ьгьн olarak yetistirilme olanakları. *Turkiye 2. Cayər-Mera Yembitkileri Kongresi*, 28-31 Mayıs, pp. 302-310, Izmir.
- Tukel, T. and E. Yilmaz**, 1987. Reserch on determining the most suitable ratios of vetch (*Vicia sativa* L.) + barley (*Hordeum vulgare* L.) mixtures grown under dry conditions of Zukurova. *Tьrk Tarəm ve Ormancələk Dergisi, Doga*, **11**: 171-178.
- Unkovich, M.J., J.S. Pate and P. Sanford**, 1997. Nitrogen fixation in Australian Mediterranean Agriculture. *Australian J. Agric. Res.*, **48**: 267-293.
- Van Soest, P. J.**, 1982. Analytical Systems for Evaluation of Feeds. In: Van Soest, P.J.(Ed.), *Nutritional Ecology of the Ruminant*. Cornell University, Ithaca, NY, pp. 75-94.
- Weichenthal, B. A., D. D. Baltensperger, K. P. Vogel, S. D. Masterson, J. M. Blumenthal and J.M. Krall**, 2005. Annual Forages fort he Nebraska Panhandle. NebGuide, Published By Uni. of Nebraska, Nebraska-Lincoln.

Received February, 13, 2009; accepted for printing April, 23, 2009.