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Determination of forage yield and quality parameters of different mixture ratios of grass pea and various cereal forage crops

Mürdümük ve farklı buğdayğil yem bitkilerinin karışım oranlarının yem verimi ve kalite parametrelerinin belirlenmesi

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ABSTRACT

This study was carried out to determine the suitable mixture ratio for a high-yield and applicable mixed planting system for the grass pea plant. In the project, grass pea (*Lathyrus sativus L.),* barley (*Hordeum vulgare L.*), triticale (*Triticosecale Wittmack),* and oat (*Avena sativa L.*) were used. The project was carried out in the winter seasons according to the randomized block experimental design with 3 replications. In the trial, plant height (cm), total dry forage yield kg da^{-1}), crude protein yield kg da^{-1} digestibility dry matter yield, botanical composition ratios by weight, Land Equivalent Ratio and ratio of legumes to cereals were determined. The study was carried out for two years, and average values were calculated. In the study, depending on the increase in grass pea seed ratio, green grass yield, dry grass yield, and crude protein yield increased. In both years, although the pure barley, triticale, oat and the 20% grass pea + 80% barley mixture had high dry grass yield, the crude protein yield of the pure grass pea and the 60% grass pea + 40% barley mixture was found to be high. When the yield and quality characteristics of the 20% grass pea + 80% barley mixture are evaluated together a mixture of 60% grass pea + 40% barley can be recommended to obtain high-yield and quality roughage.

Key Words: Grass pea, Fodder plants, Yield, Quality

ÖZ

Bu çalışma mürdümük bitkisi için yüksek verimli ve uygulanabilir karışık ekim sistemi için uygun karışım oranını belirlemek amacıyla gerçekleştirilmiştir. Çalışmada mürdümük *(Lathyrus sativus* L.), arpa (*Hordeum vulgare* L.), tritikale (*Triticosecale Wittmack*) ve yulaf (*Avena sativa* L.*)* kullanılmıştır. Proje kış sezonunda tesadüf blokları deneme desenine göre 3 tekrarlamalı olarak yürütülmüştür. Denemede; bitki boyu (cm, kuru ot verimi (kg da^{-1}), ham protein verimi (kg da^{-1}), sindirilebilir kuru madde verimi, ağırlıkça botanik kompozisyon oranları (%), toplam oransal verim, alan eşdeğerlilik oranı ve baklagillerin tahıllara oranı belirlenmiştir. Çalışma iki yıl boyunca yürütülmüş ve ortalama değerler hesaplanmıştır. Çalışmada mürdümük tohum oranındaki artışa bağlı olarak yeşil ot verimi, kuru ot verimi ve ham protein verimi artmıştır. Her iki yılda da saf arpa, tritikale ve yulaf, %20 mürdümük +%80 arpa karışımının kuru ot verimi yüksek olmasına rağmen, saf mürdümük ve %60 mürdümük +%40 arpa karışımının ham protein verimi yüksek bulunmuştur. 20% mürdümük + %80 arpanın verim ve kalite özellikleri birlikte değerlendirildiğinde yüksek verim ve kalitede kaba yem elde etmek için %60 mürdümük +%40 arpa karışımı önerilebilir.

Anahtar Kelimeler: Mürdümük, Yem bitkileri, Verim, Kalite

Introduction

Turkey possesses suitable ecological conditions for the cultivation of various forage crops. To advance forage crop agriculture, alternative forage species adapted to the country's ecological conditions are required in addition to alfalfa, maize, and vetch, which are among the top three cultivated plants. One of the annual leguminous forage crops suitable for cultivation in the arid regions of Turkey is grass pea (*Lathyrus sativus L*.). A total of 77 grass pea species have been identified within the Turkish flora of which 25 are endemic (Arslan, 2018). It has been determined that, under the climatic and soil conditions of Diyarbakır province, the cultivation of grass pea (*Lathyrus sativus*), particularly as a winter catch crop within field farming systems, can yield favorable results. In this context, the grass pea, being a leguminous crop, not only improves soil structure for subsequent crops but also provides an additional source of income for local farmers when cultivated either for forage or seed production (Seydoşoğlu et al., 2015). Common grass pea is tolerant to drought, cold and moderate salinity levels and can grow across a wide range of climatic and soil conditions (Tripathi et al.,2022). However, grass pea has a weak stem and is prone to lodging during the rainy spring period, resulting in feed losses due to decay. For this reason, it is common practice to intercrop grass pea with an upright-growing grass forage species. Barley, oat, triticale, and wheat are among the most preferred crops for mixed forage cultivation (Gennatos & Lazaridou, 2021; Özdemir et al., 2020; Papanaoum et al., 2020; Oruç & Avci, 2024a, 2024b). Instead of cultivating single crops, mixed planting systems make more efficient use of existing conditions and generally produce higher yields. *Poaceae* species benefit from the nitrogen fixed by legumes in the soil. Roughage obtained from mixed crops tends to be more balanced in terms of carbohydrates and proteins and contains higher nutrient content. For these reasons, mixed cropping systems are widely adopted in Mediterranean countries (Sayar, 2014).

In this study; the effects of barley (*Hordeum vulgare L.*) , triticale (*Triticosecale wittmack),* and oat (*Avena sativa L*.) intercropped with grass pea on yield and quality traits were investigated.

Material and Method

The experiment was conducted at the Koruklu Research Station of the GAP Agricultural Research Institute. The materials used in the study included grass pea (*Lathyrus sativus L*.) variety Gürbüz 2001, barley (*Hordeum vulgare L*.) variety Ruha, triticale (*Triticosecale Wittmack*.) variety Egeyıldızı, and oat (*Avena sativa L*.) variety Manas. The forage crops were evaluated for their performance both as sole crops and in binary mixtures. The experiments were carried out during the 2022-2023 and 2023-2024 winter growing seasons using a randomized complete block design with three replications. To characterize the general soil properties of the sowing area, soil samples were collected and analyzed in the laboratory for organic matter content, pH, lime content, salinity levels, and selected plant nutrients. Figure 2 presents the long-term monthly average temperature and precipitation data for Şanliurfa Province, covering the period from 1929 to 2024.

Table.1. Chemical properties of experimental

Texture	pH	CaCO3 (%)	P2O5 (kg da^{-1})	Organic Matter (%)	Water Saturation (%)
Clay	7.63	28.1	1.56	2.02	74

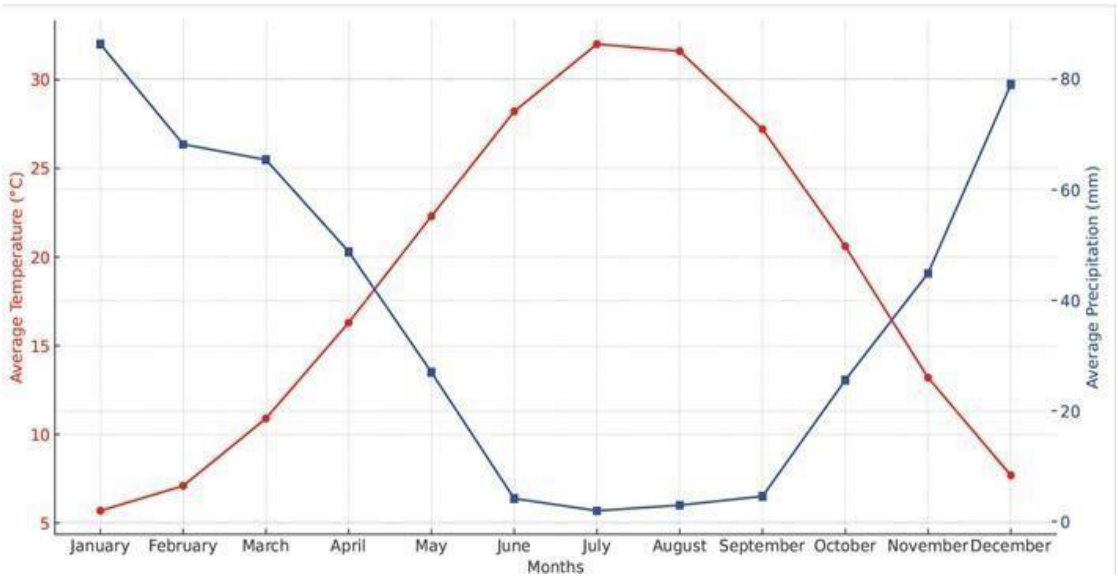

Figure 1. Sanliurfa Province 1929 – 2024 Long-Term Monthly Average Temperature and Precipitation

Method

In the study; row spacing was maintained at 20 cm and each plot consisted of 6 rows, each 5 m in length. Sowing was carried out in the second week of November in both 2022 and 2023. The cereal crops used in the experiment included barley, triticale and oat, while grass pea was used as the legume. The plots were arranged as follows: 100% grass pea (*Lathyrus sativus L.*), 100% barley ((*Hordeum vulgare L.*), 100% oat (*Avena sativa L.),* 100% triticale (*Triticosecale Wittmack*), 80% cereal + 20% legume, 60% cereal + 40% legume and 40% cereal + 60% legume. In pure sowings, the seeding rates were 18 kg da^{-1} for barley and oat plots, 25 kg da^{-1} for triticale plots and 14 kg da^{-1} for grass pea plots. For mixed sowings, the seed amounts were calculated according to the mixture ratio based on the pure sowing seed rates for each crop. Plot dimensions were 1.8 m × 5 m (9 m²) with a row spacing of 20 cm, plot spacing of 0.5 m, and block spacing of 2 m. After excluding the border rows on the right and left sides of each plot to avoid edge effects, the remaining area (0.8 m × 5 m = 4 m²) was designated as the harvest area, where observations and measurements were conducted. During the growing period, irrigation, hoeing, and all necessary growing techniques were performed. Based on soil analysis results, 10 kg da^{-1} nitrogen and 5 kg da^{-1} phosphorus were applied at sowing in the establishment year, using urea and triple superphosphate fertilizers. Half of the nitrogen was applied in the fall at sowing and the remaining half was applied during the stem elongation stage of the cereals. Weed control was performed as necessary. Harvesting was carried out at the full flowering stage of grass pea. The proportion of legumes and cereals in the mixtures was determined for each plot by separating and weighing the components. To determine dry matter yield, a random sample of 500 g of fresh forage was collected from each plot, weighed and dried for 48 hours in a forced-air oven at 70 ºC (Yücel et al., 2018a, 2018b). In the experiment, plant height (cm), total dry forage yield (kg da^{-1}), crude protein yield (kg da^{-1}), digestible dry matter yield, botanical composition ratios by weight, total proportional yield, and the ratio of legumes to cereals (barley, triticale, and oat) were determined according to established methodologies reported in the literature. The data obtained

from the traits without conducting the experiment were analyzed using the MSTAT-C software package. Analysis of variance (ANOVA) was performed according to the randomized complete block design and mean comparisons were made using the LSD test at the 5%

significance level.

Results and Discussion

Plant height of Grass pea (cm)

Table 2 presents the average plant heights of grass pea obtained from the treatments in the study. Examination of the table reveals that the plant height values of grass pea in the first year are similar to those recorded in the second year. Considering the two-year averages of the treatments, plant height ranged from 51.68 cm to 76.12 cm. The lowest plant height was observed in the pure grass pea treatment, while no statistically significant differences were found among the plant heights of the other treatments. Plant heights in the mixed sowings of grass pea were higher than those in the pure sowings. Additionally, as the proportion of grass pea in the mixture increased, the plant height of grass pea also increased, likely due to improved competitive ability against cereals. These findings are consistent with those reported by Kendir (1999), Başbağ and Peker (2003), higher than those reported by Kendir (2000) and Bucak (2009), and lower than the values reported by Iptaş and Karadağ (2003), Bayram et al. (2004) , Gedik (2007).

Total dry forage yield (kg da^{-1})

The average total total dry forage yields obtained from the treatments in the study are presented in Table 2. Examination of the table indicates that the total dry forage yield values in the second year of the study were higher than those in the first year. Based on the two-year averages, the lowest total dry forage yield of 1100.90 kg da^{-1} was recorded in the pure grass pea treatment, while the highest total dry forage yield of 1354.18 kg da^{-1} was obtained from the mixture kg da^{-1} consisting of 20% grass pea and 80% barley. In our study, the total dry forage yield as a percentage of green forage was approximately 30% in the first year, increasing to around 60% in the second year. This can be attributed to the fact that in the first year, the green forage in the mixtures predominantly consisted of cereals, which have a higher leaf-to-stem ratio compared to legumes (Smetham, 1990), resulting in lower moisture content in the forage. The high dry matter content of cereals is thus an expected outcome. Indeed, as the proportion of cereals in the mixtures increased, the dry matter content also increased; conversely, as the proportion of grass pea increased, the dry matter content decreased. Bingöl et al. (2007) reported that dry matter content may vary among species. According to Gibson (2009), dry matter content has a linear relationship with the maturation period and is also influenced by rainfall, especially in arid and semi-arid climates. Seydoşoğlu et al. (2015) reported that the highest total dry forage yield in grass pea was 767.38 kg da-1 while the lowest was 330.67 kg da^{-1} The total dry forage yield values obtained in the present study were consistent with the findings of Tükel et al. (2001) and Artan and Polat (2019), but lower than those reported by Sayar et.al. (2014). Yücel et al. (2006) stated that in pure grass pea plantings under GAP conditions, fresh forage yield ranged between 3109 and 4574 kg da^{-1} while total dry forage yield ranged between 683 and 833 kg da^{-1}.

Table 2.Plant height of grass pea and dry matter yield in the trial

Mixtures	Plant Height of Grass pea (cm)			Total dry forage yield (kg da^{-1})		
	2023	2024	Mean	2023	2024	Mean
%100 grass pea	51.23e	52.14d	51.68de	1050.15cd	1155.5c	1100.90c
%100 oat				1150.25c	1205.25b	1177.75 bc
%100 triticale				1215.33b	1365.87a	1290.60 ac
%100 .barley				1255.25b	1355.58a	1305.41ab
20% G + 80% O	60.45cf	65.25df	62.85f	1318.12b	1322.52bc	1320.32b
40% G + 60% O	65.22d	64.14d	64.68f	1295.15b	1311.25ab	1303.02a
60% G + 40% O	64.12bd	66.78c	65.45e	1111.32b	1125.56bc	1118.44cd
20%G + 80% T	73.22cd	72.55ce	72.88cd	1300.11ab	1355.32a	1327.71a
40% G + 60% T	72.36ce	74.44cd	73.40ce	1205.25b	1265.25b	1235.25 bc
60% G+ 40% T	74.14bc	75.66b	74.90c	1109.25bc	1140.65b	1124.95b
20% G + 80% .B	76.14b	75.25bc	75.69bd	1356.33a	1352.04a	1354.18a
40% G + 60% B	74.16bc	73.45c	73.80bd	1265.32ab	1295.36ab	1280.34b
60% G + 40% B	75.47a	76.77a	76.12a	1054.33d	1074.36cd	1064.34c
Mean	68.65	69.64	69.14	1206.62	1255.74	1231.03
LSD %5	7.96	8.09	9.21	297.13	308.77	411.12
CV (%)	5.24	6.09	9.82	15.44	12.55	14.52

Plant height of cereals (cm)

In the experiment; the plant height of cereals (barley, triticale, and oat) was observed to be higher in the second year compared to the first year. When cereals were grown in mixtures, their plant heights were greater than those observed in pure stands. Based on the two-year average plant height data, in the pure oat and grass pea mixture treatments, plant height ranged from a minimum of 120.13 cm to a maximum of 129.22 cm. In the pure triticale and grass pea mixture treatments, plant height ranged from 120.00 cm to

127.53 cm, while in the pure barley and grass pea mixture treatments, it ranged from 118.90 cm to 129.40 cm. These findings are consistent with those reported by Sağlamtimur et al. (1986a) and Büyükkılıç and Polat (2022).

Table 3. Plant height of cereals

Mixtures	Plant Height of cereals (cm)		
	2023	2024	Mean
%100 oat	120.13c	122.73b	121.43c
%100 triticale	120b	123.7b	121.86b
%100 .barley	118.9d	120.1c	119.5c
20% G + 80% O	124.47b	125.33b	124.9b
40% G + 60% O	126.17b	127.13ab	126.65b
60% G + 40% O	128.42a	129.22a	128.82a
20%G + 80% T	124.12ab	125.68b	124.9b
40% G + 60% T	125.25a	126.5ab	125.87ab
60% G+ 40% T	125.33a	127.53a	126.43a
20% G + 80% .B	122c	124.31b	123.15b
40% G + 60% B	126.4b	125b	125.7b
60% G + 40% B	127.2a	129.4a	128.3b
Mean	124,03	125.55	124.76
LSD %5	6.96	7.05	6.21
CV (%)	4.24	5.09	5.82

Ratio of Legume to cereals (%)

In pure sowings, the ratio was 100%, whereas in mixed sowings, the legume-to-cereal ratios were 20%, 40%, and 60% respectively. The results of the analysis of variance and the means for the binary mixtures of grass pea with oat, barley, and triticale at various proportions are presented in Table 4. Significant differences were observed among the mixture treatments in terms of legume proportions. The highest legume proportion was obtained from the grass pea–oat (60:40) mixture ratio. As the proportion of legume in the mixture increased, the legume content in the botanical composition also increased. The highest legume proportion was determined in mixtures of grass pea with oat, while the lowest was found in mixtures with barley. Among the monoculture cereals, the highest cereal proportion in the botanical composition was observed in oat, followed by triticale and barley, respectively; however, the differences among them were not statistically significant. These results are consistent with those reported by Parlak and Göçmen (2017).

Table 4. Ratio of Legume to cereals (%)

Mixtures	Legume ratio			Cereal ratio		
	2023	2024	Mean	2023	2024	Mean
%100 grass pea	76.75 a	74.45a	75.6a	0	0	0
%100 oat	0	0	0	80.26 b	72.8 c	76.53bc
%100 triticale	0	0	0	83.28 b	85.22 ab	84.25a
%100 barley	0	0	0	91.82 a	89.52 a	90.67a
20% G + 80% O	18.76 c	12.52c	15.64c	45.27 b	47.29 b	46.28c
40% G + 60% O	32.35 b	28.25ac	30.30ab	33.74 bc	35.32 c	34.53cd
60% G + 40% O	46.27 a	44.57a	45.42a	25.34 c	27.28d	26.31d
20%G + 80% T	17.92 cd	12.32d	15.12c	42.57 b	40.25 b	41.41c
40% G + 60% T	35.55 bc	41.25bc	38.40ab	36.93 c	38bc	37.46cd
60% G+ 40% T	45.19 a	43.65a	44.42a	24.13 d	24.5 c	24.31d
20% G + 80% B	13.48 c	17.44c	15.46cd	37.49 c	35.8c	36.64c
40% G + 60% B	25.66 bc	33.58bc	29.62c	25.05 d	23.4 d	24.22d
60% G + 40% B	36.49 a	44.55a	40.52a	13.81 cd	15.5 c	14.65d
Mean	26.80	27.12	26.96	41.51	41.14	41.32
LSD (%5)	8.25	7.96	7.13	8.44	8.25	7.45
C.V. (%)	3.02	3.29	2.72	2.44	3.15	2.14

Land Equivalent Ratio

The Land Equivalent Ratio as adopted by De Wit and Van Den Berg (1965) is calculated using the following formula:

RYT=(Yxz/Yxx)+(Yzx/Yzz) RYT= Land Equivalent Ratio

Yxz= Yield of species X in mixture

Yxx= Yield of species X under monoculture conditions

Yzx= Yield of species Z in mixture

Yzz= Yield of species Z under monoculture conditions

The average Land Equivalent Ratio (LER) obtained from nine different treatments in the mixture cultivation of legume and wheatgrass crops was 1.10 in 2023 and 1.13 in 2024. The two-year average LER values for the mixture treatments ranged from 1.01 to 1.16 (Table 5). According to De Wit and Van den Bergh (1965), if the proportional yield sum (LER) of forage crops in a mixture is less than 1, it is more advantageous to cultivate the crops in monoculture. However, if the LER value exceeds 1, cultivating the crops as a mixture is more beneficial. As shown in Table 5, considering the overall average of both years in our study, the most advantageous crop mixture was found to be 20% grass pea + 80% triticale, with an LER value of 1.29. These results are consistent with those reported by Çınar (2012), Artan and Polat (2019).

Botanical Composition Proportions of grass pea by Weight (%)

Based on the two-year average botanical

composition ratios of nine different mixture treatments of legume and cereal crops, the lowest legume proportion was observed in the 20% grass pea
+ 80% triticale mixture at 56.17%, while the highest proportion was recorded in the 60% grass pea + 40% oat mixture at 81.21%. These results are consistent with the values reported by Avcı (2000) and Taşkın (1975).

Table 5. Land Equivalent Ratio Yield and Botanical Composition Proportions of grass pea by Weight

Mixtures	Land Equivalent Ratio			Botanical Composition propotions by Weight of grass pea		
	2023	**2024**	Mean	**2023**	**2024**	Mean
20% G + 80% O	1.11 ab	1.16a	1.13a	64.49 c	61.48 bc	62.98c
40% G + 60% O	1.09 b	1.12ab	1.10ab	76.36 bc	71.60 b	73.98b
60% G + 40% O	1.01 ab	1.08b	1.04b	81.21 a	79.92 ab	80.56a
20%G + 80% T	1.14 a	1.16a	1.15a	56.17e	60.75 d	58.46cd
40% G + 60% T	1.12 a	1.13a	1.12ab	71.33 cd	69.68 cd	70.50b
60% G+ 40% T	1.08 ab	1.09ab	1.08bc	76.36 bc	74.63 b	75.49bc
20% G + 80% .B	1.16 ab	1.18a	1.17a	61.27 c	57.23 cd	59.25cd
40% G + 60% B	1.11 ab	1.16ab	1.13b	69.49 bc	61.48 ab	65.48c
60% G + 40% B	1.09 ab	1.12b	1.10ab	75.36 a	70.60 ab	72.98bc
Mean	1.10	1.13	1.11	70.22	67.48	68.85
Lsd %5	0.28	0.32	0.37	6.10	8.89	8.05
C.V.	1.5	1.8	2.1	4.24	6.09	5.82

Table 5. Land Equivalent Ratio Yield and Botanical Composition by Weight Ratios of *grass pea*

Crude Protein Yield (kg da^{-1})

The average crude protein yields in pure and mixed applications were 103.40 kg da^{-1} in 2023 and 104.88 kg da^{-1} in 2024. The crude protein yields by year in pure and mixed applications were found to be lowest in pure barley at82.32kgda^{-1}and highest in pure grass pea at 126.65 kg da-1. In the mixtures, the lowest crude protein yield was 101.21 kg da^{-1} from the 20% grass pea + 80% oat mixture, while the highest yield was 114.55 kg da^{-1} from the 60% grass pea + 40% barley mixture. Based on the two-year averages, the lowest crude protein yield was
82.32 kg da^{-1} in pure barley and the highest was 126.65 kg da^{-1} in pure grass pea.Kir (2021) reported the lowest crude protein yield of 44.8 kg da^{-1} from pure grass pea and the highest yield of 87.8 kg da^{-1} from a 50% grass pea + 50% oat mixture in their study. Differences in crude protein yields between pure and mixed applications are attributed to variations in crude protein content and total dry forage yields.Karadağ and Büyükburç (2003) reported crude protein yields of 153 kg da^{-1} from a 50% grass pea + 50% barley mixture. Yavuz (2017) found
64.2 kg da^{-1} from a 30% pea + 70% oat mixture. Ay and Mut (2017) reported crude protein yields of 73.3 kg da^{-1} from a 30% oat + 70% pea mixture and 72.4 kg da^{-1} from a 40% barley + 60% vetch mixture. Sabancı et al. (2016) found crude protein yields ranging from 17.7 to 31.5 kg da^{-1} in grass pea varieties, while Uzun and Halil (2019) reported yields ranging from 22.53 to 33.17 kg da^{-1} in oat genotypes.

Digestible Dry Matter Yield (DDMY)

Digestible dry matter yield (DDMY) was calculated by multiplying the digestible dry matter ratio (DDMR) by the dry matter yield (DMY); (DDMY = DDMR × DMY). In the first year of pure and mixed applications, the average DDMY was 204, while it was 204.46 in the second year. According to the two-year average DDMY values in pure and mixed applications, the lowest yield was observed in pure grass pea at 174.5, and the highest yield was recorded in pure barley at 227.5. Digestible dry matter yields are calculated based on total dry forage yields and digestible dry matter content; therefore, it is expected that mixtures with high

total dry forage yields and those containing cereals would have higher DDMY than pure legumes. Büyükkılıç and Polat (2022) reported the lowest value of 630 in pure smooth brome and the highest value of 1079 in pure ryegrass in their study. Kır (2014) obtained similar results in his study on determining the pure and mixture ratios of Hungarian vetch with different cereals. These values are consistent with our findings. Zengin and Kır (2022) found the lowest DDMY in pure legumes and the highest DDMY in pure cereals in their study.

Table 6. Crude Protein Yield and Digestible Dry Matter Yields in the trial

Mixtures	Crude Protein Yield			Digestible Dry Matter Yields		
	2023	2024	Mean	2023	2024	Mean
%100 grass pea	125.16ab	126.65a	125.90a	174 bc	175 bc	174.5bc
%100 oat	95.33b	94.25bc	94.79bc	220 ad	218 c	219ac
%100 triticale	85.36bc	89.87b	87.61b	215 bc	220 a	217.5bc
%100 barley	82.32c	85.58b	83.95b	230 ab	225 a	227.5a
20% G + 80% O	101.21ab	102.52ac	101.86ac	208 bc	205 c	206.5c
40% G + 60% O	108.45a	109.25ab	108.85a	195 c	200 c	197.5c
60% G + 40% O	112.25b	111.56b	111.90a	190 abc	193 bc	191.5bc
20%G + 80% T	100.25bc	102.32b	101.28b	205 ab	202 bc	203.5b
40% G + 60% T	106.65b	105.25b	105.95b	200 a	198 bc	199c
60% G+ 40% T	111.23c	112.65b	111.94bc	190bc	195 ab	192.5c
20% G + 80% B	101.65d	103.45c	102.55bc	220 a	218bc	219b
40% G + 60% B	104.66c	105.58c	105.12b	205 ab	204 bc	204.5b
60% G + 40% B	109.68bc	114.55c	112.11b	200 ab	205 ab	202.5c
Mean	103.40	104.88	104.13	204	204.46	204.23
Lsd %5	12.25	14.96	15.13	15.4	17.6	14.5
C.V.	6.02	6.09	7.72	8.44	7.15	8.14

Conclusion

As a result of this two-year study conducted to determine the effects of mixture ratios of grass pea forage with certain wheatgrass forage crops on yield and quality, when evaluating yield and quality characteristics together in both years, a mixture of 60% grass pea and 40% barley can be recommended to obtain high-yielding and high-quality forage in Şanliurfa and similar ecological conditions.

Declarations

Conflict of Interest: The authors declare that there are no conflicts of interest among them.

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