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BOOK OF ABSTRACTS

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THE EFFECTS OF SEED MIXTURE RATIOS AND HARVEST TIME ON YIELD AND QUALITY OF ANNUAL RYEGRASS MIXTURES WITH ANATOLIAN AND BERSEEM CLOVER

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Summary: The most critical factors determining the quality of grass-legume mixtures in roughage production are the legume ratio in the mixture and the harvest time.

Keywords: Annual ryegrass, Anatolian clover, Berseem clover, Yield, Forage quality

Introduction

Straw is commonly used in livestock diets in Türkiye due to the limited production of high-quality forage crops (Yavuz et al., 2020). Therefore, the cultivation area for forage crops, currently 2.7 million hectares, needs to be expanded to address the roughage deficit effectively. Annual forages can play a crucial role in increasing forage crop production by incorporating them into crop rotations. Growing legumes and grasses in a mixture provides both high yields and a more balanced nutritive value for livestock, but achieving optimal yield and forage quality requires careful adjustment of species proportions in the mixture and harvesting at the appropriate time (Hatipoğlu et al., 2005; Yavuz, 2017). This present study aimed to determine the effects of different mixture rates and harvest times on yield and nutritive value of monocultures and binary mixtures of annual ryegrass *(Lolium multiflorum* Lam), Anatolian clover (*Trifolium resupinatum* L.), and Berseem clover (*Trifolium alexandrinum* L.).

Materials and methods

İlkadım cultivar of annual ryegrass (**AR**), Demet-82 cultivar of Anatolian clover (**AC**), and Efsane cultivar of berseem clover (**BC**) were used as materials in the study. The field experiment was conducted in a split-plot design in randomized blocks with three replications. Three different harvest times were applied in the research: the beginning of budding-flowering, 50% flowering, and third harvest time full flowering. Dry matter yield (**DMY**) was calculated based on the values obtained by weighing 500 g of sample taken from each parcel after drying at 60 ºC until it reached a constant weight. Crude protein (**CP**), acid detergent fiber (**ADF**), and neutral detergent fiber (NDF) content of forages were determined using the C-0904FE-Hay and Fresh Forage calibration with the Foss XDS NIRS analyser.

Results and discussion

Averaged across harvest times, the highest DMY was obtained from 25% AR + 75% AC and 25% AR + 75% BC mixtures (1121 kg da^{-1} and 1112 kg da^{-1}, respectively), and the lowest was obtained from berseem clover, annual ryegrass, and Anatolian clover (758 kg da^{-1}, 791.2 kg da^{-1}, 798.1 kg da^{-1}, respectively). The highest DMY was obtained with the harvest at the full flowering harvest stage (1069.5 kg da^{-1}), while the lowest was obtained at the beginning of flowering (808.2 kg da^{-1}) (Table 1). While the yield of the mixtures was higher than the pure sown species, the DMY increased as the harvest time progressed as also reported by Salawu et al. (2001) and Yavuz, (2017).

The highest CP content was obtained from AC (%19.2) and the lowest from AR (%14.3). The highest crude protein ratio was obtained from the full flowering period (%17.1) and the lowest from the beginning of flowering and 50% flowering periods (%16.8-16.9). Crude protein content of mixtures and pure

legumes were higher than annual ryegrass, and as the proportion of legumes increased in mixtures, so did the CP content of forages (Demirel et al., 2003).

The highest ADF content was obtained from the second and third cutting times (31.41-31.44%, respectively) and the lowest from the first cutting time (30.71%). The highest was obtained from annual ryegrass (33.37%), and the lowest was obtained from Anatolian clover (28.50%). Similar to the ADF ratios of species and mixtures, the highest NDF ratio was obtained from annual ryegrass (54.74%), and the lowest was obtained from Anatolian clover (44.47%). The difference between the NDF ratios of the cutting time averages is statistically insignificant. As the legume ratios in the mixtures increased, the crude protein ratios of all mixtures increased, while the ADF and NDF ratios decreased, and as a result, feed quality improved (Türk & Albayrak, 2012).

Table 1. Dry matter yield (DM), crude protein (CP), acid detergent fiber (ADF), and neutral detergent fiber (NDF) ratios of species and mixtures.

Species And Mixtures	DM (kg da $^{-1}$)				CP content (%)			
	Budding-flowering	50% Flowering	Full flowering	Mean	Budding-flowering	50% Flowering	Full flowering	Mean
100% AR¥	646.3 l**	927.3 f	800.0 hıj	791.2 D**	14.89 n**	13.61 p	14.24 o	14.25 H**
100% AC	726.5 jk	805.9 hıj	862.0 fgh	798.1 D	18.63 c	19.36 b	19.63 a	19.21 A
100% BC	700.2 kl	763.3 ıjk	810.6 hı	758.0 D	17.35 gh	17.51 g	18.19 e	17.68 C
75% AR + 25% AC	768.5 ıjk	1003.0 e	1125.0 cd	965.7 C	16.45 j	16.36 j	16.10 kl	16.31 F
50% AR + 50% AC	791.2 hıj	1187.0 bc	1220.0 b	1066.0 B	17.19 h	17.47 g	17.35 gh	17.33 D
25% AR + 75% AC	869.4 fgh	1169.0 bcd	1326.0 a	1121.0 A	17.93 f	18.32 de	18.47 cd	18.24 B
75% AR + 25% BC	839.5 ghı	906.2 fg	1102.0 d	949.3 C	15.93 lm	15.71 m	15.75 m	15.80 G
50% AR + 50% BC	920.8 f	1015.0 e	1157.0 bcd	1031.0 B	16.40 j	16.25 jk	16.46 j	16.37 F
25% AR + 75% BC	1011.0 e	1101.0 d	1223.0 b	1112.0 A	16.90 ı	16.88 ı	17.36 gh	17.04 E
Mean	808.2 C**	986.5 B	1069.5 A	954.7	16.85 B*	16.83 B	17.06 A	16,91
	ADF content (%)				**NDF content (%)**			
100% AR	32.24 f**	34.46 a	33.41 b	33.37 A**	53.39 c**	56.29 a	54.55 b	54.74 A**
100% AC	29.05 o	28.25 p	28.20 p	28.50 H	45.29 k	44.79 kl	44.22 l	44.77 G
100% BC	30.60 k	31.88 g	31.60 h	31.36 E	48.57 ı	48.74 ı	48.46 ı	48.59 E
75% AR + 25% AC	30.90 j	31.27 ı	31.87 g	31.35 E	50.00 gh	50.50 fgh	51.31 ef	50.60 C
50% AR + 50% AC	30.28 l	30.17 l	30.57 k	30.34 F	48.42 ı	48.41 ı	48.75 ı	48.53 E
25% AR + 75% AC	29.64 m	29.30 n	29.41 n	29.45 G	46.79 j	46.77 j	46.53 j	46.70 F
75% AR + 25% BC	31.55 h	32.73 d	33.12 c	32.47 B	51.35 ef	51.96 de	52.63 cd	51.98 B
50% AR + 50% BC	31.23 ı	32.47 e	32.68 d	32.13 C	50.42 fgh	50.98 efg	51.38 ef	50.93 C
25% AR + 75% BC	30.90 j	32.18 f	32.12 f	31.73 D	49.46 hı	49.87 gh	49.90 gh	49.74 D
Mean	30.71 B**	31.41 A	31.44 A	31.19	49.30	49.81	49.75	49.30

¥AR: Annual ryegrass, AC: Anatolian clover, BC: Berseem clover. * Statistically significant at P≤ 0.05 level. ** Statistically significant at P≤ 0.01 level.

Conclusions

Our research has shown that the legume ratio in the mixture, or the crude protein content, is a significant factor in determining forage quality. We recommend the 25% RG + 75% AC mixture for high yield and quality roughage production, mainly when harvested during the full flowering period. This recommendation offers the potential for significant benefits in forage production, providing an advantage in feeding ruminants.

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