



DETERMINATION OF YIELD AND NUTRITIONAL VALUE OF POKUT PLATEAU PASTURE (RIZE)

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Abstract: This study was conducted in 2023 and 2024 to determine the plant productivity and nutritional value of Pokut Plateau pasture, located in the Çamlıhemşin district of Rize province in the Eastern Black Sea Region, known for its natural beauty. As a result of analyzing plant samples collected by the quadrat method from 12 different points selected in July, the average green herbage yield was determined to be 1034 kg/da. A statistically significant decrease ($P<0.05$) in green herbage yield was observed between the two years. The average dry herbage yield was determined as 194 kg/da and did not show a significant change between years. When the nutrient contents were examined, the average crude protein ratio was found to be 11.17%, and this value also showed a significant difference between years ($P<0.05$). The digestible dry matter ratio was found to be 56.64 and the relative feed value was 68.54. Mineral matter contents (P 0.20%, K 0.87%, Ca 0.88% and Mg 0.33%) indicate that the grasses are at a level to meet the basic mineral needs of animals. Statistically significant differences ($P<0.05$) were found between years in calcium content and K/(Ca+Mg) ratio. While this study reveals that the Pokut Plateau pastures are an important resource for livestock activities in the region, it supports the conclusion that grass quality and productivity can be increased by improving pasture management strategies. This study, carried out in Pokut Plateau in Çamlıhemşin district of Rize province, is important in terms of forming a scientific basis for pasture management practices in the region and can contribute to the sustainability of livestock activities in the region.

Keywords: Pokut Plateau, Pasture, Nutritional value, Rize, Eastern Black Sea

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1. Introduction

Meadows and pastures hold paramount importance as primary sources of roughage for animal nutrition (Aydın and Uzun, 2005). These ecosystems are crucial for maintaining biodiversity, preventing soil erosion, and providing vital habitats for wildlife, while also offering valuable genetic resources for agricultural crops (Çomaklı and Menteşe, 1999; Carlier et al., 2005). In Türkiye, approximately 70% of livestock activities rely on meadows and pastures, which fulfill a significant portion of animals' annual nutritional requirements, particularly essential nutrients such as crude protein and starch (Gökkuş, 1994; Okatan and Yüksek, 1997; Çomaklı, 2018).

The investigation of meadow and pasture vegetation primarily serves two fundamental objectives. Firstly, it aims to collect quantitative and qualitative data on meadows and pastures in regions where their vegetation characteristics are not adequately understood. Secondly, it seeks to evaluate the impacts of various improvement and management techniques applied to meadows and pastures on their vegetation (Cerit, 1999).

Numerous studies have explored the effects of different factors on meadow and pasture yield and quality. For instance, Öner (2016) conducted a study in the

Palandöken pastures of Erzurum province at an altitude of 2400 meters, determining that dry matter yield was 134.83 kg/da in ungrazed areas and 68.21 kg/da in grazed areas. Furthermore, crude protein content was higher in ungrazed areas (12.89%) compared to grazed areas (11.59%). Analysis of Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) contents revealed lower values in ungrazed plots (NDF: 56.01-57.04%; ADF: 36.53-39.90%) than in grazed plots. Sürmen and Kara (2018) investigated the effect of slope on pasture yield in Aydın province, performing analyses across five different slopes (2%, 8%, 15%, 25%, and 30%). They reported that dry matter yield ranged from 114.54 kg/da to 223.03 kg/da, with the highest yield observed at an 8% slope. The highest NDF content was found in pastures with a 30% slope, while the lowest was at a 2% slope. The highest crude protein content (10.64%) was recorded at an 8% slope, and the highest Relative Feed Value (RFV) (101.35) was at a 2% slope. Similarly, Severoğlu (2018) demonstrated a significant impact of slope on forage quality parameters, observing a decrease in quality as the slope increased. In this study, dry matter yield was determined to be 56.43 kg/da, crude protein content 8.14%, ADF content 45.11%, and NDF content 64.30%. These findings underscore the importance of considering slope, grazing regimes, and botanical



composition in pasture management and improvement initiatives.

This study aims to assess the forage potential and overall pasture quality of Pokut Plateau in Çamlıhemşin district, Rize province, through a detailed analysis of forage yield and quality characteristics. The insights gained from this research are expected to provide valuable information contributing to the sustainable management of livestock activities in the region. Furthermore, this investigation seeks to offer a comprehensive understanding of the plateau's ecological and productive attributes, laying a foundation for future studies and informed decision-making in regional agricultural practices.

2. Materials and Methods

2.1. Research Area: Location, Soil, and Climate Characteristics

This research was conducted in Pokut Plateau, located approximately 20 km from the district center of

Çamlıhemşin, Rize province, at an elevation of roughly 2000 meters above sea level. The study spanned two years, 2023 and 2024. Figure 1 illustrates the study area's geographical position, while Figure 2 presents photographs of the site. Pokut Plateau serves as a significant representation of the region's characteristic highland ecosystem.

Soil analyses performed on samples from Pokut Plateau revealed a clay-loam texture (81.4% saturation) and a strongly acidic reaction (pH 4.35). The soil exhibited low salinity (0.08% total salts) and low lime content (0.10% lime). Organic matter content was moderate (2.68%), while available phosphorus (P_2O_5 10.94 kg/da) and potassium (K_2O 55.14 kg/da) levels were found to be sufficient. According to long-term meteorological data for Rize province, the average temperature is 14.5 °C, with an annual total precipitation of 2301.2 mm (Anonymous, 2025).

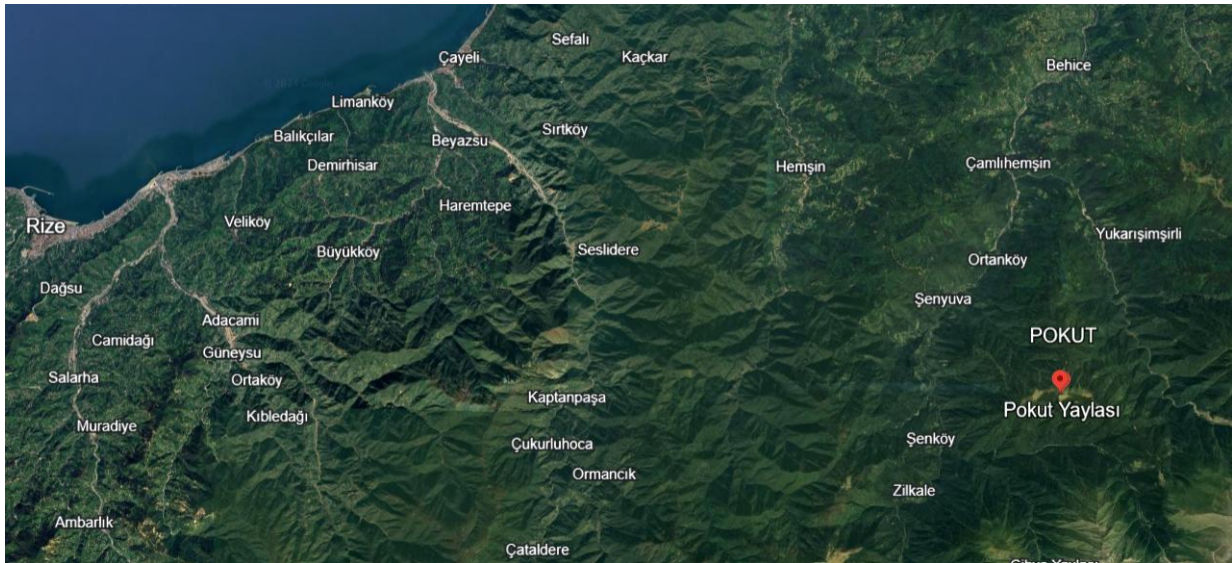


Figure 1. Location of the study area on the map (Google Earth).



Figure 2. Some photos were taken from the study area.

2.2. Methodology

This study involved the collection of plant samples from 12 distinct locations within the Pokut Plateau pasture area during July of both 2023 and 2024. Samples were harvested from the soil surface using 50x50 cm quadrats. The fresh weights of the collected samples were measured on-site using a precision balance. Subsequently, samples were oven-dried at 70°C for 48 hours to determine their dry weights, which were then converted to yield per decare (kg/da).

After drying, plant samples were ground in a 1 mm sieve mill to achieve homogenization. The homogenized samples were then analyzed using a Foss NIR Systems Model 6500 Win ISI II v1.5 NIRS device to determine concentrations of crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), acid detergent protein (ADP), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg).

Dry matter intake (DMI), digestible dry matter (DDM), relative feed value (RFV), digestible energy (DE), and metabolizable energy (ME) values were calculated from the ADF and NDF concentrations using established formulas (equations 1-5) from the literature:

$$\text{Digestible Dry Matter (DDM)} = 88.9 - (0.779 \times \% \text{ADF}) \quad (\text{Oddy et al., 1983}) \quad (1)$$

$$\text{Dry Matter Intake (DMI)} = 120 / (\% \text{NDF}) \quad (\text{Sheaffer et al., 1995}) \quad (2)$$

$$\text{Relative Feed Value (RFV)} = (\text{DDM} \times \text{DMI}) / 1.29 \quad (\text{Sheaffer et al., 1995}) \quad (3)$$

$$\text{Digestible Energy (DE)} = 0.27 + 0.0428 \times (\% \text{DDM}) \quad (\text{Fonnesbeck et al., 1984}) \quad (4)$$

$$\text{Metabolizable Energy (ME)} = 0.821 \times \text{DE (Mcal/kg)} \quad (\text{Khalil et al., 1986}) \quad (5)$$

Finally, to assess the relationships among macroelement contents, Ca/P and K/(Ca+Mg) ratios were computed.

Statistical analysis of the parameters investigated in this study was performed using JMP 13 statistical software. Analysis of Variance (ANOVA) was applied, and for statistically significant differences identified by ANOVA, Least Significant Difference (LSD) multiple comparison tests were conducted ($P < 0.05$) to pinpoint differences between groups.

3. Results

Table 1 presents the nutritional values derived from analyses of forage samples collected over two years from the pastures of Pokut Plateau. These analyses elucidate the overall nutritional quality of the pasture forages and highlight potential inter-annual variations.

Table 1. Yield and nutritional value of Pokut Plateau pasture

Features Analyzed	1.Year	2.Year	Average
Green Herbage Yield (GHY) (kg/da)	1168±272 a	900±113 b	1034
Dry Herbage Yield (DHY) (kg/da)	208±30	180±12	194
Crude Protein (CP) (%)	11.64±2.04 a	10.70±1.59 b	11.17
Acid Detergent Fiber (ADF) (%)	42.11±4.36	40.72±2.90	41.42
Neutral Detergent Fiber (NDF) (%)	76.72±3.69	77.58±4.17	77.15
Acid Detergent Protein (ADP) (%)	1.42±0.21 a	1.33±0.18 b	1.38
Digestible Dry Matter (DDM) (%)	56.10±3.40	57.18±2.26	56.64
Dry Matter Intake (DMI) (%)	1.57±0.08	1.55±0.07	1.56
Relative Feed Value (RFV)	68.28±7.18	68.80±6.10	68.54
Digestible Energy (DE) (Mcal/kg)	2.67±0.15	2.72±0.10	2.69
Metabolic Energy (ME) (Mcal/kg)	2.19±0.08	2.23±0.12	2.21
Phosphorus (P) (%)	0.20±0.05	0.19±0.04	0.20
Potassium (K) (%)	0.83±0.17	0.91±0.21	0.87
Calcium (Ca) (%)	0.94±0.22 a	0.82±0.19 b	0.88
Magnesium (Mg) (%)	0.34±0.17	0.32±0.10	0.33
Ca/P	4.70±0.31	4.32±0.21	4.51
K/(Ca+Mg)	0.65±0.04 b	0.79±0.07 a	0.72

Upon examining Table 1, the average green herbage yield of the pasture was determined to be 1034 kg/da. A green herbage yield of 1168 kg/da recorded in the first year significantly decreased to 900 kg/da in the second year ($P<0.05$). This observed reduction can be attributed to various environmental factors, including but not limited to variations in annual precipitation, temperature fluctuations, and grazing intensity. Conversely, the dry herbage yield exhibited no statistically significant difference between years, averaging 194 kg/da. The dry herbage yield is a crucial indicator as it represents the actual nutritional intake available to grazing animals and thus provides valuable insights into the pasture's forage production potential.

The average crude protein content of the studied grasses was determined to be 11.17%, indicating that pastures serve as a moderate protein source. A statistically significant difference ($P<0.05$) in crude protein content was observed across years, likely influenced by seasonal variations in plant species, soil nutrient availability, or environmental stress factors. Furthermore, the acid detergent fiber (ADF) and neutral detergent fiber (NDF) values were 41.42% and 77.15%, respectively, while digestible dry matter was 56.64%, suggesting moderate digestibility of the forage. The high NDF value, in particular, may limit feed intake in animals. The average acid detergent protein (ADP), which represents indigestible protein, was found to be 1.38%, with statistically significant variations ($P<0.05$) observed over the years. The relative feed value (RFV) averaged 68.54, further supporting the moderate overall nutritional quality of the grasses. Similarly, digestible energy (DE) at 2.69 Mcal/kg and metabolizable energy (ME) at 2.21 Mcal/kg were also moderate, providing insight into the potential of these grasses to meet animal energy requirements.

Analysis of the mineral content in the forage (P: 0.20%,

K: 0.87%, Ca: 0.88%, and Mg: 0.33%) indicates that it is sufficient to meet the essential mineral requirements of animals. A statistically significant difference ($P<0.05$) in calcium content was observed across different years. The average Ca/P ratio was determined to be 4.51, a crucial value for the efficient utilization of calcium and phosphorus by animals. Furthermore, the K/(Ca+Mg) ratio was found to be 0.72, with a statistically significant variation ($P<0.05$) noted between years. Fluctuations in this ratio may impact mineral balance and overall animal health.

Overall, the data from this study suggests that the pastures of Pokut Plateau provide sufficient nutritional value for animal grazing. However, observed variations in certain parameters across different years underscore the critical role of pasture management strategies and grazing practices. A more detailed investigation into the causes of these differences is essential for ensuring the sustainable management of these pastures.

4. Discussion

This study analyzed the nutritional values of forage samples collected from Pokut Plateau pastures. The findings, presented in Table 1, reveal both similarities and differences when compared to results from similar studies conducted in various regions across Türkiye.

The average dry herbage yield of 194 kg/da observed in our study is considerably lower than the 827.3 kg/da reported by Kılıç (2018) for the Düzköy rangeland. This discrepancy can be attributed to various regional factors, including climatic conditions, soil characteristics, prevalent plant species, and grazing management practices. The comparatively low dry herbage yield in our study suggests that the forage production potential of the Pokut Plateau rangelands may be more limited than that of other regions.

The average crude protein content of hay in our study, determined to be 11.17%, was observed to be lower than values reported in several previous studies. For instance, Şahinoğlu (2010) found higher protein levels ranging from 16.33-18.64% in the Bafra rangeland, while Nadir (2010) reported 16.48-18.81% in Tokat rangeland. Similarly, Çağan and Kökten (2014) recorded 16.08% in Bingöl rangeland, Aydın and Başbağ (2017) found 19.19% in Karacadağ rangeland, and Kökten and Tanrıverdi (2020) reported 14.37% in Muş rangeland. However, our findings align closely with those of Güllap (2010), who noted 8.26-13.12% in Erzurum rangelands, and Parlak et al. (2015), who reported 9.10-13.18% in Çanakkale rangelands. Furthermore, the values are comparable to those reported by Taşdemir and Kökten (2015) in Elazığ rangelands (12.2%) and Cacan and Kokten (2019) in Bingöl rangelands (12.8-14.1%). This suggests that the protein content of rangelands in Pokut Plateau is lower than in some regions but similar to others.

Our study revealed average ADF and NDF values of 41.42% and 77.15%, respectively, which are higher than those reported by Şahinoğlu (2010) (ADF: 29.82-31.99%; NDF: 46.39-55.21%), Nadir (2010) (ADF: 24.38-26.84%; NDF: 34.59-36.32%), and Aydın and Başbağ (2017) (ADF: 29.78%, NDF: 47.46%). This suggests that the digestibility of fodder from Pokut Plateau may be lower compared to the forage in these regions. However, significant regional variations are evident, as demonstrated by Güllap (2010), who found ADF values in Erzurum pastures reaching up to 51.35% in some samples, and Tutar and Kökten (2019), who reported NDF values in Bingöl pastures as high as 62.7%.

In this study, the average Relative Feed Value (RFV) was determined to be 68.54, which is notably lower than values reported in previous literature. For instance, Kılıç (2018) found an RFV of 112.9, while Nadir (2010) reported values ranging from 174.96 to 189.77. Similarly, Taşdemir and Kökten (2015) observed RFVs between 103.0 and 118.4, Aydın and Başbağ (2017) recorded 137.7, and Kökten and Tanrıverdi (2020) presented values from 102.0 to 112.5. Furthermore, the RFV found in this study was considerably lower than the 85.0-92.8 range reported by Cacan and Kokten (2019) and the 91.8 to 109.4 range found in the work of Tutar and Kökten (2019).

In terms of mineral content, phosphorus (P) levels in Pokut Plateau (0.20%) are comparatively lower than values reported in the literature, which include 0.40-0.43% by Şahinoğlu (2010), 0.34% by Aydın and Başbağ (2017), 0.34-0.39% by Kökten and Taşdemir (2023), and 0.26% by Saygın and Kökten (2024). Similarly, potassium (K) content (0.87%) is also lower compared to reports by Şahinoğlu (2010) (2.32-2.60%), Aydın and Başbağ (2017) (2.42%), Kökten and Taşdemir (2023) (2.44-3.00%), and Saygın and Kökten (2024) (1.51%). The calcium (Ca) content (0.88%) likewise falls below the ranges documented by Şahinoğlu (2010) (0.90-1.33%),

Aydın and Başbağ (2017) (1.09%), Çağan and Kökten (2023) (1.14%), Kökten and Taşdemir (2023) (1.06-1.20%), and Saygın and Kökten (2024) (1.21%). Conversely, magnesium (Mg) content (0.33%) appears consistent with values presented by Şahinoğlu (2010) (0.26-0.36%), Aydın and Başbağ (2017) (0.31%), Kökten and Taşdemir (2023) (0.26-0.33%), and Saygın and Kökten (2024) (0.31%). Furthermore, the K/(Ca+Mg) ratio (0.72) is markedly lower than the 1.61-2.13% range reported by Şahinoğlu (2010). These observed variations in mineral composition may be attributable to differences in soil mineral composition, prevailing plant species, and local environmental factors.

Comparisons of the nutritional value of Pokut Plateau pastures with those from other regions of Türkiye reveal notable differences. Specifically, Pokut Plateau exhibits lower dry matter yield coupled with higher fiber content. Conversely, crude protein and mineral content in these pastures are found to be comparable to those in other areas. These variations are likely attributable to a confluence of factors, including diverse ecological conditions, distinct plant species composition, and differing grazing management practices across regions. Therefore, developing region-specific strategies is crucial for the sustainable management of Pokut Plateau pastures.

5.Conclusion

This two-year study (2023-2024) assessed the vegetative productivity and nutritional value of pastures in Pokut Plateau, a significant highland in Türkiye's Eastern Black Sea Region. Analysis of plant samples, collected using the quadrat method from 12 distinct points each July, revealed an average green herbage yield of 1034 kg/da. A statistically significant decrease ($P<0.05$) in green herbage yield was observed between years, likely attributable to variations in annual climatic conditions. Dry herbage yield remained consistent, averaging 194 kg/da. Nutritional analysis showed an average crude protein content of 11.17%, which also varied significantly ($P<0.05$) between years. Parameters such as ADF (41.42%), NDF (77.15%), digestible dry matter (56.64%), and relative feed value (68.54) indicate a moderate nutritional quality for the pasture grasses. Mineral content (P 0.20%, K 0.87%, Ca 0.88%, and Mg 0.33%) suggests the grasses adequately meet the basic mineral requirements of livestock. Statistically significant differences ($P<0.05$) were found in calcium content and the K/(Ca+Mg) ratio across the years, potentially due to annual climate variations, seasonal shifts in plant species composition, and regional differences in soil properties. The findings underscore the importance of Pokut Plateau pastures as a vital resource for regional livestock farming, while also suggesting that improving pasture management strategies and grazing practices could enhance forage quality and productivity. This research stands as one of the initial detailed studies on the nutritional value and productivity of Pokut Plateau

pastures, providing a scientific foundation for regional pasture management and potentially contributing to sustainable livestock practices and ecosystem preservation in the area.

Author Contributions

The percentages of the author' contributions are presented below. The author reviewed and approved the final version of the manuscript.

	M.İ.Ç.
C	100
D	100
S	100
DCP	100
DAI	100
L	100
W	100
CR	100
SR	100
PM	100
FA	100

C= concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management, FA= funding acquisition.

Conflict of Interest

The author declared that there is no conflict of interest.

Ethical Consideration

Ethics committee approval was not required for this study because there was no study on animals or humans.

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