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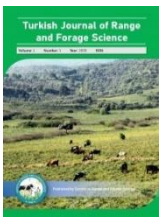

Determination of Leaf Yield and Quality Features Different Fodder Beet (*Beta vulgaris* var. *rapacea*)

Kağan KÖKTEN[1*] **Ayşe Merve ÖZDEMİR[1]**

[1]Department of Field Crops, Faculty of Agriculture, Bingöl University, Bingöl, Turkey

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A B S T R A C T

The aim of study was to compare the yield components of 5 different fodder beets (Rota, Brigadier, Feldherr, Nedimbey, Rekord poly) under Bingöl ecological conditions. The experiment was established in the trial area of the Genç Vocational School Application and Research area in Genç district of Bingöl province in 2018 growing period. The research was conducted with randomized block design with four replications. In this study, leaf posture, green leaf yield, dry leaf yield, crude ash ratio, crude protein ratio, crude protein yield, acid detergent fiber (ADF), nötral detergent fiber (NDF), dry matter digestibility (DMD), dry matter intake (DMI), relative feed value (RFV) of fodder animal varieties were examined. According to the results of the research; the highest green leaf yield (1748.0 kg da^{-1}), dry leaf yield (197.7 kg da^{-1}), crude protein yield (27.19 kg da^{-1}) in Brigadier cultivar; the highest crude ash ratio (7.55%), DMD (74.14%) in Rota cultivar; the highest crude protein ratio, DMI and RFV (14.48%, 3.27% and 187.9, respectively) in Feldherr cultivar were recorded.

1. Introduction

One of the indispensable parts of animal feeding is roughage, and roughage deficit is a very important problem in our country. Compared to other forage crops, fodder beet is of great importance in the feeding of dairy animals in terms of its nutrient, digestibility, high energy supply rate, it can be fed to animals at the end of harvest as well as preserving it for a long time.

The types of forage crops grown in our country for many years are vetch, alfalfa, vetch and sainfoin. In addition to these forage crops, silage corn and fodder beet have gained importance in recent years and they have taken place in field agriculture enough to be included in statistics. Animal beet, which has been produced in our country for many years, is an important forage plant especially for dairy farming. Animal beet production was made in 2012 on an area of 30,397 decares and 125,610 tons (TÜİK, 2012).

Animal beet is an important fodder plant with a high digestibility rate of 80-90%, providing the most nutrients and energy from the unit area compared to other fodder plants (Çetin, 1998). Fodder beet leaves are high in protein, but rich in Mg, Fe, K, Ca, Na, Cl and Mn (Ergül, 1988). Since the root-stem part develops above the ground compared to sugar beet, it is easier to remove it and keep it in winter for its durability. It is also content in terms of soil demands and is resistant to

*Correspondence author: kahafe1974@yahoo.com
[1*]ORCID: 0000-0001-5403-5629

salinity (Sağlamtimur et al., 1995). Feeder beet tubers, which are used especially for dairy farming, are a very tasty and nutritious feed source (Albayrak and Çamaş, 2005). The aim of this research is to determine the leaf yield and quality characteristics of different fodder beet varieties in Bingöl province.

2. Material and Method

The research was carried out in 2018 cultivation period in the field of Application and Research in Bingöl University Genç Vocational School. The average height of the research area above sea level varies between 1100-1180 m. When the climatic data of Bingöl province are examined, it has been determined that the average monthly temperature for the 6-month period (between April and September) is 19.8 °C, total precipitation amount is 488 mm and the average relative humidity value is 45.2%. It is understood that the 2018 cultivation period in which the research was conducted is warmer (21.7 °C), less rainy (281 mm) and the relative humidity value (43%) is lower than the average of many years. Representative soil sample was obtained by mixing the samples taken from 0-30 cm soil depth from various parts of the cultivation area where the experiment was conducted. The analysis of the soil sample was done in Bingöl University Faculty of Agriculture, Department of Soil Science and Plant Nutrition. According to the analysis result; the soil structure of the research area was found to be sandy clay loam. The soil is poor in terms of organic matter content (1.88%), slightly basic in pH (7.41), less lime (0.22%), potassium (47.55 kg da^{-1}) and phosphorus (5.19 kg da^{-1}) was not sufficient in terms of content.

In the study, fodder beet varieties named Rota, Nedimbey, Feldherr, Brigadier and Rekord Poly were used as materials. The research was set up with 4 replications according to the randomized block design. The parcel area consists of 5 m length and 4 rows. Sowing was done in a row spacing of 40 cm and using 3 kg of seed per decare. DAP fertilizer was given to the soil where the experiment was carried out, with 4 kg nitrogen and 10 kg phosphorus (P_2O_5) per decare. After planting, when the rows are fully clear and the plants have 3-5 leaves, hoeing, singing and fertilizing were done as 5 kg pure nitrogen per decare. Plants were irrigated when needed by drip irrigation method.

Leaf posture patterns of the plant were determined according to 1-5 leaf posture scale (1-Vertical, 2-Semi-vertical, 3-Medium, 4-Semi-widespread, 5-Widespread) of 10 plants randomly selected from each plot. In the experiment, after the outermost row in each parcel and 0.5 m from the parcel heads, the leaves of the plants were cut from the root-stems in the remaining area and the weights of the green parts were taken and the weights obtained were converted into decares. After the 500 g leaf sample taken from each parcel was left to dry at 70 °C for 48 hours, the dry matter ratio was determined by weighing. Then, dry matter ratios and green leaf yield were multiplied by each other and dry leaf yield was determined. The nitrogen (N) content of the ground dry leaf samples was determined by Kjeldahl method. Crude protein ratio is obtained by multiplying the obtained nitrogen ratio by 6.25. (Anonymous, 1995). Crude protein yield per decare was obtained by multiplying the crude protein ratio in dry leaf with the dry leaf yield. ADF and NDF ratios were obtained using ANKOM 200 Fiber Analyzer (ANKOM Technology Corp. Fairport, NY, USA) device (Van Soest et al., 1991). Dry matter digestibility (DMD = 88.9- (0.777x% ADF)) amounts with the help of the obtained ADF ratio, dry matter intake (DMI = 120 / (% NDF)) with the help of NDF ratio and relative feed value with the help of DMD and DMI values (RFV = DMD x DMI) / 1.29) calculated (Morrison, 2003).

The data obtained in the study was analyzed by JUMP statistics package program in accordance with the random blocks experiment pattern. The comparison of factor averages that were statistically significant as a result of variance analysis was made with the Tukey test (Kalaycı, 2005).

3. Results and Discussion

Leaf Posture

Considering the leaf postures of fodder beet varieties, according to the scale of 1-5 (1. Vertical, 2. Semi-vertical, 3. Medium, 4. Semi-widespread, 5. Widespread) Rekord poly and Nedimbey types are semi-widespread, Rota and Feldherr types are semi-vertical and Brigadier variety is observed to have a medium leaf posture. In the study carried out by Güleş (2009) in Ankara conditions in some types of fodder beet, it was determined that Rota variety has a semi-widespread leaf and Feldheer variety has a widespread leaf posture. Although some of the varieties used in the experiments are the same, it can be said that the reason for the different leaf postures of the fodder beet varieties is due to the different ecological conditions such as soil and climate.

Table 1. Leaf postures determined in fodder beet varieties

Varieties	Leaf Postures (1-5 Scale)
Rekord poly	4
Rota	2
Nedimbey	4
Brigadier	3
Feldheer	2

Green Leaf and Dry Leaf Yields (kg da^{-1})

The difference between the green leaf and dry leaf yields of fodder beet varieties was found to be significant at 1% level.

When Table 2 is examined, the highest green leaf yield is obtained from Brigadier (1748.0 kg da^{-1}) variety, followed by Rekord poly (1661.0 kg da^{-1}) variety in the same statistical group. The lowest green leaf yield was obtained from Rota (1215.5 kg da^{-1}) cultivar. The average green leaf yield of fodder beet varieties was determined to be 1462.4 kg da^{-1}. When we look at the table, the highest dry leaf yield was obtained from Brigadier (197.7 kg da^{-1}) cultivar, as in green leaf yield, followed by Rekord poly (185.35 kg da^{-1}) which is in the same statistical group. The lowest dry leaf yield was obtained from Nedimbey (140.08 kg da^{-1}) variety. The average dry leaf yield of fodder beet varieties was determined to be 168.47 kg da^{-1}.

When studies on leaf yield are examined; Güleş (2009) reported that it varied between 1200-1514 kg da^{-1}in Ankara conditions, Erdoğdu et al. (2011) between 1436-1676 kg/da. These results are similar to results obtained. On the other hand, Acar (2000) reported that green leaf yield varied between 1316.3-3189.2 kg da^{-1} under Konya conditions, Albayrak and Çamaş (2006) between 1190-1230 kg da^{-1} in the Central Black Sea Region, Özaslan Parlak and Ekiz (2008) between 1763-2060 kg da^{-1} in Ankara conditions, Karadağ et al. (2014) between 2913-3270 kg da^{-1} under the conditions of Tokat-Kazova and Yilmaz (2018) reported that the green leaf yield varied between 1760-2548 kg da^{-1} and dry leaf yield between 218-344 kg da^{-1} under the conditions of Sakarya-Pamukova. It was determined that the results obtained were different from the findings obtained by the above researchers. The reason for the different results regarding the green and dry leaf yield is different; It can be said that the varieties used, the ecological conditions, the cultural processes applied and the cultivation times may be different.

Table 2. Average values of green leaf and dry leaf yields in fodder beet varieties

Varieties	**Green Leaf Yield (**kg da^{-1}**)**	**Dry Leaf Yield (**kg da^{-1}**)**
Rekord poly	1661.0 A**	185.35 A**
Rota	1215.5 C	154.18 B
Nedimbey	1257.0 C	140.08 C
Brigadier	1748.0 A	197.7 A
Feldheer	1427.5 B	165.05 B
Average	**1462.4**	**168.47**

**) Values shown with the same letter are statistically different from the LSD test within the error limits of 1% (P≤0.01).

Crude Ash and Crude Protein Ratios (%) and Crude Protein Yield (kg da^{-1}**)**

It was determined that the difference between crude ash ratio and crude protein yields of fodder beet varieties was significant at 1% level and crude protein ratio was insignificant.

When Table 3 is examined, the highest crude ash ratio was obtained from Rota (7.55%) cultivar. The lowest crude ash ratio was obtained from Rekord poly (6,65%) variety. The average crude ash ratio of fodder beet varieties was determined to be 7.4%. Regarding the crude ash ratio in the leaf, it was determined as 19.7% in the study conducted by Dündar (2013), and 19.67% in the study conducted by Karadağ et al. (2014). These values obtained by the researchers are quite higher than the crude ash rate in the study.

Table 3. Average values of crude ash and crude protein ratios and crude protein yield in fodder beet varieties

Varieties	**Crude Ash Ratio (%)**	**Crude Protein Ratio (%)**	**Crude** kg da^{-1}**)**
Rekord poly	6.65 B**	14.40	26.66 A**
Rota	7.55 A	13.05	20.17 B
Nedimbey	7.05 B	14.30	20.04 B
Brigadier	6.95 B	13.78	27.19 A
Feldheer	6.97 B	14.48	23.83 B
Average	**7.03**	**14.00**	**23.58**

**) Values shown with the same letter are statistically different from the LSD test within the error limits of 1% (P≤0.01).

When we look at the table, the crude protein ratios of the varieties ranged from 13.05% to 14.48%. The average of crude protein ratio of fodder beet varieties was determined as 14.00%. In the studies on the crude protein ratio of the leaves of fodder beet varieties, it was found to be 16.51% by Karadağ et al. (2014) and 22.2% by Yılmaz (2018). The findings of the researchers regarding the crude protein ratio were higher than the findings obtained in the study. When Table 3 is examined, the highest crude protein yield was obtained from Brigadier (27.19 kg da^{-1}) cultivar, followed by Rekord poly (26.66 kg da^{-1}) cultivar in the same group. The lowest crude protein yield was obtained from Feldherr (23.83 kg da^{-1}) variety. The crude protein yield average of fodder beet varieties was determined to be 23.58 kg/da. In studies conducted in different ecologies; Crude protein yield of fodder beet was determined as 15.3 kg da^{-1} by Özen et al (1981), 13.6 kg da^{-1} by Özgen (1993), 16.3 kg da^{-1} by Yazgan and Bahtiyarca (1996), 60.8 kg da^{-1} by Yılmaz (2018).

ADF, NDF, DMD and DMI ratios (%) and RFV

The difference between ADF, NDF, SKM and KMT ratios and NYDs of fodder beet varieties was found to be statistically insignificant.

When Table 4 is examined, ADF ratios of fodder beet varieties vary between 18.95-19.68%. The average ADF ratio of fodder beet varieties was determined to be 19.28%. NDF ratios vary between 36.70-38.28%. NDF average of fodder beet varieties was determined to be 37.58%. In studies conducted on ADF and NDF ratios of fodder beet leaves, Dündar (2013) reported 26.6% and 43.1%, Karadağ et al. (2014) 26.54% and 43.08%. The results obtained from the study were lower than the findings of the researchers.

When we look at the table, DMD ratios of varieties vary between 73.73-74.14%. The average DMD ratio of fodder beet varieties was determined to be 73.88%. In the studies on the ratio of dry matter digestibility in fodder beet, Özen et al. (1981) found 78.0%, Dündar (2013) 68.2%, Karadağ et al. (2014) 68.23%. The DMI ratio of fodder beet varieties varies between 3.14-3.27%. The average DMI ratio of fodder beet varieties was determined to be 3.20%. Relative feed values are between 179.51-187.92. The average of relative feed value of fodder beet varieties was determined to be 183.10. Karadağ et al. (2014) determined the relative feed value of fodder beet leaves as 147.32 in their study under Tokat-Kazova conditions.

Table 4. Average values of ADF, NDF, SKM and KMT ratios and RFV determined in fodder beet varieties

Varieties	**ADF (%)**	**NDF (%)**	**DMD (%)**	**DMI (%)**	**RFV**
Rekord poly	19.25	36.83	73.91	3.26	186.83
Rota	18.95	38.28	74.14	3.14	180.33
Nedimbey	19.68	37.85	73.58	3.17	180.93
Brigadier	19.48	38.23	73.73	3.14	179.51
Feldheer	19.05	36.70	74.06	3.27	187.92
Average	**19.28**	**37.58**	**73.88**	**3.20**	**183.10**

4. Conclusions and Recommendations

According to the results of this study conducted in the ecological conditions of Bingöl province, when the feeder beet is considered in terms of wet leaf, dry leaf and raw protein yields, Brigadier and Rekord poly varieties will be suitable for the region conditions, however, it was concluded that it would be more appropriate for us to reach definitive judgments by repeating this study for a few more years under the same conditions

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