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VARIATION IN GRAIN FEED QUALITY OF DIFFERENT MAIZE CULTIVARS

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Abstract
Objectives of the present study were to determine the variations in grain feed quality of different hybrid maize cultivars. Experiments were conducted in randomized complete block design with 3 replications during the cropping year of 2014 under conditions of Bingol province of Turkey. A total of 25 hybrid maize cultivars were used as the plant material of the experiments. Crude protein, crude ash, acid detergent fiber (ADF), neutral detergent fiber (NDF), dry matter digestibility (DMD), dry matter intake (DMI) and relative feed value (RFV) were investigated. The cultivars had significant effects on the grain feed quality (P≤0.01).
Present finding revealed that that crude protein ratios of the hybrid maize cultivars varied between 6.80% and 11.61%, crude ash ratios between 0.30% and 2.85%, ADF ratios between 3.62% and 5.24%, NDF ratios between 11.52% and 19.74%, DMD ratios between 84.82% and 86.08%, DMI ratios between 6.08% and 10.51% and RFV between 401.19 and 698.93 depending on the cultivars. Dian maize cultivar was found to be prominent with crude protein and Eldora maize cultivar was found to be prominent with relative feed value.

Keywords: crude protein, feed value, maize cultivars, relative feed value.

1. INTRODUCTION

Maize grain is mainly consumed by human and animal nutrition, respectively. Maize grain is also used as raw material for starch, sugar, oil, celluloses, biofuel processes and ethyl alcohol production (FAO, 1992; Kirtok, 1998). Maize protein, starch, fiber, oil and minerals production are under effects of genetics and ecological conditions (Dunlap et al., 1995; Baenziger et al., 2001). Moreover, cultivation practice is also another factor affecting maize grain yield and quality.
Chemical composition (protein, oil, ADF, NDF etc.) and digestible nutrients are the important quality indicators for animal feeds (Canbolat, 2012). So different cultural crops should be investigated with regard to not only yield and yield parameters but also feed quality parameters under different regions (Kaplan et al., 2017).
The aim of this study was to determine effects of different grains of maize cultivars to animal feeding parameters.

2. MATERIALS AND METHODS

Experimental Design

Experiments were conducted in Bingol Province of Turkey during the growing seasons of 2014 year. 25 hybrid maize cultivars (31P41, 30B74, 31Y43, 31A34, 12-219, 12-218, 12-231H0, DKC 955, DKC 6903, DKC 6589, DKC 7211, DKC 6590, R.U 4 H.D, Dian, Marvin, Eldora, Wayne, Safak, Batem Efe, Tuono, Burak Semen Kukuruza 877, Semen Kukuruza 873, ADV 2898 and

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Truva) were used as the plant material of the study. Seeds were sown over 5 x 4.2 m plots with 70 cm row spacing and 15 cm on-row plant spacing. Experiments were conducted in randomized blocks design with three replications. During sowing, 10 kg da^{-1} N and 10 kg da^{-1} P_2O_5 were applied to soil as fertilizer. Half of nitrogen was applied at sowing and the other half was applied when the plants had a height of 50 cm (10 kg da^{-1} N). Hoeing and chemical weed control was practiced throughout the growing season. Maize grain harvested at physiological maturity.

Chemical Analysis

All maize grain sample was dried at 70 °C for 24 hours and they were grounded by using 1 mm sieve experimental mill for chemical analyses. Crude ash ratio of maize grain samples was determined by burning at 550 °C for 8 hours. Kjeldahl method was used to determine the nitrogen (N) content of maize grain samples. Crude protein ratio of maize grain was calculated by using the equation of N x 6.25 (AOAC, 1990). Acid detergent fiber (Van Soest, 1963) and neutral detergent fiber (Van Soest and Wine, 1967) ratios were analyzed by using an ANKOM 200 Fiber Analyzer (ANKOM Technology Corp. Fairport, NY, USA).

Relative feed value (RFV), dry matter digestibility (DDM) and dry matter intake (DMI) of maize grains were calculated according to the following formulas (Rohweder et al., 1978).

DMD % = 88.9 - (0.779 x ADF %);

DMI % of BW = 120 / NDF %;

RFV = (DDM % x DMI %) /1.29

Statistical Analysis

Analysis of variance was performed for all data collected during experiments by using SAS (1999) software and then significance of the difference among the means were analyzed by using LSD test.

3. RESULTS AND DISCUSSIONS

Chemical composition of different hybrid maize cultivars was provided in Table 1. The cultivars had significant effects on the grain feed quality as crude protein, ADF, NDF, crude ash, relative feed value, dry matter digestibility and dry matter intake ($P \leq 0.01$). Crude protein ratios of maize cultivars varied between 6.80% and 11.61%. While the lowest crude protein ratio was obtained from R.U4H.D cultivar, the highest value was observed in Dian cultivar. While the lowest crude ash ratio was obtained from Safak cultivars (0.30%), the highest value was observed 12-231H0 (2.85%). The lowest ADF and NDF were seen in 12-231H0 and Eldora cultivars with 3.62% and 11.52%, respectively. The highest ADF and NDF were seen in R.U4H.D and Truva cultivars with 5.24% and 19.74%, respectively. Dry matter digestibility ratio varied between 84.82% and 86.08% with the lowest value in R.U4H.D cultivar and the highest DDM ratio in 12-231H0 cultivar. The lowest dry matter intake ratio was obtained from Truva cultivar (6.08%) and the highest ratio was obtained from Eldora cultivar (10.51%). The lowest relative feed value was observed in Truva cultivar with 401.19 and the highest relative feed value was observed in Eldora cultivar with 698.93 (Table 1).

Crude protein content of the nutrients is one of the most important criteria for the quality evaluation (Assefa and Ledin, 2001). Crude protein ratio of maize grain was in the range of 8.0% and 12.4% (Burešová et al., 2010). The main reason of the differences in crude protein ratio of the varieties could be resulted from the genetic structure of the cultivar and it was reported that it was changed depending on the ripening period, soil, temperature and fertilization process (Ball et al., 2001). The crude protein ratios of the maize grains in this study was found as similar to the results of Idikut et al. (2009), Ali et al. (2010) and Kale et al. (2018). Crude ash is vital especially for cell function in plants and it cannot be synthesized by animals so animal feeds have to be included by crude ash via

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different grains (Genctan, 1998). Crude ash ratios in this current study were in line with the findings of Ali et al. (2010), Kale et al. (2018) and Lee at al. (2017). NDF and ADF ratios are significant quality indicators of animal feeds (Aydin et al., 2010) and such ratios should be low in quality feed since they obstruct the digestibility and consequently decrease the quality of forage (Kaplan et al., 2014). The NDF and ADF ratios of the maize grain in the present study were in accordance with the results reported Jones et al. (2015) and Kale et al. (2018). Relative feed value calculates by ADF and NDF ratios, so ADF and NDF ratios consequently affects relative feed value (Kaplan et al., 2015). Relative feed values and dry matter intake of the present study were higher than the values of Keskin et al. (2018). Dry matter digestibility values of the present study were similar to values reported by Denek and Deniz (2003) and Keskin et al. (2018).

Table 1. Chemical composition of grain of different hybrid maize cultivars

Cultivars	CP%	CA%	ADF%	NDF%	DDM%	DMI%	RFV
31P41	7.65^{o}	0.79^{gh}	3.86^{jkl}	11.77^{g}	85.90^{abc}	10.20^{ab}	679.04^{ab}
30B74	8.66^{jk}	0.62^{ij}	4.44^{c-g}	16.03^{b}	85.44^{g-k}	7.49^{g}	496.01^{hi}
31Y43	8.92^{hi}	0.62^{ij}	4.48cd	15.55^{bc}	85.41^{ijk}	7.72^{fg}	511.01^{gh}
31A34	10.95^{b}	1.09^{cd}	4.45^{c-f}	11.65^{g}	85.43^{h-k}	10.31^{ab}	682.71^{ab}
12-219	9.27^{g}	1.08^{d}	3.76^{kl}	13.96^{de}	85.97^{ab}	8.60^{def}	572.94^{d-g}
12-218	8.24^{mn}	0.90^{fg}	4.44^{c-g}	12.78^{efg}	85.44^{g-k}	9.39^{bcd}	622.20^{b-e}
12-231H0	8.24^{mn}	2.85^{a}	3.62^{l}	18.63^{a}	86.08^{a}	6.44^{h}	429.76^{ij}
DKC 955	9.87^{e}	0.93^{efg}	4.1h	19.29^{a}	85.65^{fgh}	6.23^{h}	413.61^{j}
DKC 6903	9.51^{f}	0.92^{fg}	4.2h	12.35^{fg}	85.61^{e-i}	9.75^{abc}	647.09^{abc}
DKC 6589	6.94^{p}	1.02^{def}	3.8h	13.57^{def}	85.89^{a-d}	8.87^{cde}	590.32^{c-f}
DKC 7211	9.03^{h}	0.93^{efg}	4.46^{c-f}	12.32^{fg}	85.43^{h-k}	9.76^{abc}	646.38^{abc}
DKC 6590	8.89^{hi}	0.83^{gh}	4.55^{cd}	12.37^{fg}	85.36^{jk}	9.74^{abc}	644.74^{abc}
R.U4H.D	6.80^{p}	1.30^{b}	5.24^{a}	12.43^{fg}	84.82^{m}	9.66^{abc}	635.05^{a-d}
Dian	11.61^{a}	0.91^{fg}	4.13^{hij}	11.87^{g}	85.68^{def}	10.15^{ab}	674.41^{ab}
Marvin	8.73 ^{ij}	0.70^{hi}	4.20^{f-i}	13.55^{def}	85.63^{e-h}	8.89^{cde}	590.18^{c-f}
Eldora	8.15^{n}	0.50^{j}	4.04^{ij}	11.52^{g}	85.75^{cde}	10.51^{a}	698.93^{a}
Wayne	9.07^{h}	1.08^{d}	4.17^{ghi}	12.24^{fg}	85.65^{efg}	9.84^{abc}	653.08^{abc}
Safak	10.09^{d}	0.30^{k}	4.65^{bc}	14.14^{cde}	85.28^{kl}	8.52^{d-g}	563.05^{e-h}
Batem Efe	8.83^{ij}	1.11^{cd}	4.01^{ijk}	12.37^{fg}	85.78^{b-e}	9.76^{abc}	648.87^{abc}
Tuono	8.27^{mn}	1.01^{def}	4.24^{e-i}	14.63^{bcd}	85.60^{e-i}	8.27^{efg}	548.75^{fgh}
Burak	11.60^{a}	1.27^{b}	4.47^{c-f}	14.64^{bcd}	85.42^{h-k}	8.27^{efg}	547.92^{fgh}
Semen Kukuruza 877	8.50^{kl}	1.09^{cd}	4.53^{cd}	13.47^{def}	85.37^{jk}	8.99^{cde}	594.77^{cde}
Semen Kukuruza 873	8.42^{lm}	1.08^{d}	4.36^{d-h}	13.56^{def}	85.50^{e-i}	8.88^{cde}	588.52^{c-f}
ADV 2898	10.44^{c}	1.02^{def}	4.25^{e-i}	15.57^{bc}	85.59^{e-i}	7.72^{fg}	512.38^{gh}
Truva	8.64^{jk}	1.23^{bc}	4.85^{b}	19.74^{a}	85.12^{l}	6.08^{h}	401.19^{j}
Sg. Dg.	**	**	**	**	**	**	**
LSD	0.20	0.15	0.28	1.50	0.22	1.04	69.59

*****:** P≤0.01; **Sg. Dg.:** significant degree; **LSD:** least significant difference; **CP:** crude protein; **CA:** crude ash; **ADF:** acid detergent fiber; **NDF:** neutral detergent fiber; **DDM:** dry matter digestibility; **DMI:** dry matter intake**; RFV:** relative feed value*

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4. CONCLUSIONS

This study investigated the effects of genotypes on quality parameters in different maize cultivars. The cultivars had significant effects on the grain feed quality. Dian maize cultivar was found to be prominent with crude protein. Eldora maize cultivar was found to be prominent with relative feed value.

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