

A COMPARATIVE STUDY OF THE FEEDING EFFECT WITH HAY FROM VARIOUS ALFALFA VARIETIES IN FATTENING LAMBS

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Abstract

The main aim was to establish some differences in productivity, nutritional value but also in the efficiency in obtaining performances in growing and fattening animals. The following alfalfa varieties were studied: Pioneer PR55 V48, Sandra, Valahia (4AG08), Dobrogea (4AG07), and Dimitra. Five plots were established for the cultivation of alfalfa with an area of 1 hectare each on a farm in Balotesti village following the evolution of plant growth parameters and their chemical composition, especially in year 2, at the 2nd harvest. The green mass obtained was preserved in the form of hay. The animal experiment was organized on a sheep farm in Dambovită County where fattening young sheep from Turcana × Suffolk half-breed were fed with hay for a period of 3 months. Concerning the alfalfa hay, the dry matter ranged between 848 and 861 g, organic matter between 759 and 782 g, and crude protein 65 and 76 g, respectively. Gross energy was similar for all varieties ranging around 18 MJ. Considering the fattening performances, the average daily gain recorded by the fattening lambs, during the experiment ranged between 171.4 and 181.2 g/day. We recommend the use of hay from the Romanian varieties in fattening lamb diets, which demonstrated similar characteristics to the valuable foreign ones.

Key words: *Medicago sativa* L., dry matter, gross energy, crude protein, fattening lambs, gain.

INTRODUCTION

The cultivation of blue alfalfa (*Medicago sativa* L.) has one of the essential roles in re-launching the livestock sector in Romania, which will not be possible without the development of a feed base with fodder to ensure optimal vital functions and the enhancement of the biological and productive potential of farm animals (Pelmuș et al., 2020). However, achieving the cultural performance of alfalfa (useful yield, persistence and high competitive capacity) depends on a multitude of technological, environmental and genetic factors (Dunea et al., 2015; Oprea and Dunea, 2011; Dincă et al., 2017). To these is added the selection of varieties suitable for pure cultivation or for obtaining more perennial and more productive mixtures with other perennial legumes and grasses (Cavero et al., 2017; Dincă et al., 2021). As a general rule, rations for fattening animals cannot even be designed without the participation of alfalfa in various

forms of preparation and preservation (Quick et al., 1986; Lloveras et al., 2008). Most farms are looking for dietary supplement solutions to feed fattening ruminants with different concentrate mixtures that generally have higher energy content by providing a balanced energy-protein ratio and balanced mineral vitamins and alfalfa may provide substantial benefits (Sanderson, 1992; Schitea, 2010).

The significant productive effects of fattening young sheep and other farm animal species are well known when legumes including alfalfa have been included in feed diets. In our case, it was demanded especially by the possibilities of experimental technique, to use a single ingredient (alfalfa hay) to more easily highlight the effect of the ration in feeding lambs, implicitly the effect of the varieties that were the subject of research. It would have been quite difficult to separate the effect of alfalfa hay from the other ingredients if we added a mixture of concentrates or only an assortment (e.g. corn). Certainly, the effect of the

productivity of a complete ration would have been greater (the daily gain).

Studies have shown that the qualitative performance of lambs grazing either legume or grass pasture was better than lambs receiving an all-concentrate diet in dry lot (Wildeus et al., 2007). McClure et al. (1994) observed higher daily gains in dry lot lambs, though the growth of lambs grazing alfalfa approached that of dry lot lambs, while producing leaner carcass with a more desirable yield grade.

Wildeus et al., 2007 noted that the growth rates of the forage-fed lambs were higher than those reported in lambs fed bermudagrass (*Cynodon dactylon*) pellets or in lambs fed tropical Guinea grass (*Megathyrsus maximus*).

The paper presents the results obtained from testing five Romanian and foreign alfalfa varieties to assess the lamb fattening performance fed with hay. Growth of the sheep lambs on an alfalfa hay diet without supplementation is required to be analyzed in the context of obtaining valuable ecological products.

MATERIALS AND METHODS

The study was conducted between 2018 and 2020 with the aim of analyzing the forage quality of several Romanian and foreign alfalfa varieties highlighted the special quality of fodder produced by the tested Romanian alfalfa varieties.

A breeding program for new alfalfa varieties is promoted by S.C. Patru Agro S.R.L. (<https://samantalucerna.ro/>) in cooperation with academic researchers. It is expected that these varieties will be more adapted to the Romanian eco-pedoclimatic conditions (Dincă et al., 2021) having better winter hardiness due to the cold winters with a higher incidence and duration of frost days. The program provided two varieties i.e., Dobrogea and Valahia, which have been included in the national official list of varieties (<https://istis.ro/image/data/download/catalog-official/CATALOG%202020.pdf>), while Dobrogea is included in the OECD list of varieties eligible for seed certification.

The selected varieties presented in Table 1 were grown in a farm from Balotești according to a specific experimental protocol in distinct

plots with an area of 1 ha. Samples were taken from these plots to determine the quality of the feed.

The following alfalfa varieties were studied: Pioneer PR55 V48, Sandra, Valahia (4AG08), Dobrogea (4AG07), and Dimitra. Initially, 5 plots were established for the cultivation of alfalfa with an area of 1 hectare each, following the evolution of plant growth parameters and their chemical composition, especially in year 2, at the 2nd harvest.

The green mass obtained was preserved in the form of hay. The feeding experiment was organized for a period of 3 months in a sheep farm located in Dambovită County for fattening lambs from Turcana × Suffolk half breeds.

A group of 40 individuals was selected being divided into 5 subgroups of 8 lambs, each one being fed with hay originating from a single variety.

Table 1. Alfalfa varieties considered in the experiments (3 Romanian and 2 foreign varieties from U.S.A./Austria, and Italy)

Variety	Maintainer name	Maintainer code*	Country
Sandra	INCDA Fundulea	1562	Romania
Dobrogea	SC Patru Agro SRL	2782	Romania
Valahia	SC Patru Agro SRL	2782	Romania
Dimitra	Continental Semences	724	Italy
PR55V48	S&W Seed Company/Pioneer Hi-Bred Services GmbH	3133	U.S.A., Austria

*<https://www.oecd.org/agriculture/seeds/documents/codes-and-schemes-list-of-varieties-eligible-for-seed-certification.pdf>

During the experimental period, green mass samples (3 replicates) were taken from the field from each plot cultivated with each alfalfa variety by identifying an area of one square meter with an average load of plants in the beginning phase of flowering on the second cut. Alfalfa hay samples were taken from warehouse stocks (3 replicates) to eliminate all factors that could have allowed errors regarding the homogeneity of the sample. For the analysis laboratory at the National Research and Development Institute for Animal Biology and Nutrition (INCDBNA-IBNA Balotești), the square method was applied, finally reaching the

quantities requested for laboratory and calorimetric analysis (1000 g).

The samples were first subjected to dry matter determinations at a temperature of 65 and 103°C to prepare them for the determination of organic matter with the respective ingredients by analytical TECATOR equipment (https://www.fossanalytics.com/en/products/digestor_2508_2520). A series of parameters were determined for green mass and hay of each variety as follows: *DM* - Dry matter; *SO* - Organic substance; *CP* - Crude protein; *CF* - Crude Fat; *Cel. B* - Crude cellulose; *SEN* - Non-nitrogenous extractive substances; *Cen* - Ash; and *EB* - Gross energy. Data were analyzed for the effect of alfalfa hay intake on gain (kg/fattening period) for the five tested varieties. The differences between diets with various alfalfa varieties grouped in Romanian

and foreign groups were determined using the comparative statistics in SPSS software (SPSS Inc., Chicago, IL, 2011) in the presence of a significant *F* value and Levene's test, and values were presented as least squares means. More technical information regarding the project regarding the screening of alfalfa varieties' performances is available in Dincă and Dunea (2018) and Dincă et al. (2021).

RESULTS AND DISCUSSIONS

Following the laboratory experiments, a screening of the chemical composition was performed for establishing important features regarding the forage quality of each tested alfalfa variety. Table 2 shows the average values of the parameters for green mass, and Table 3 for hay, respectively.

Table 2. Chemical composition of the alfalfa varieties (green mass harvested at the 2nd cut in the 2nd year of cropping)

Name of the variety	Dry Matter (DM) g	Organic Substance (SO) g	Crude Protein (CP) g	Crude Fat (CF) g	Crude Cellulose (Cel B) g	Non-nitrogenous extractive substances (SEN) g	Ash (Cen) g	Gross Energy (EB) MJ
PR55 V48	260 1000	229 859	65 281	5 23	38 170	121 385	31 141	17.70
Sandra	280 1000	245 862	70 269	6 24	45 174	124 395	35 138	17.73
Valahia (4AG08)	299 1000	260 870	74 247	8 27	50 167	128 429	39 130	17.28
Dimitra	300 1000	260 867	73 243	8 27	52 173	127 424	40 138	17.84
Dobrogea	310 1000	268 865	76 245	8 26	50 161	134 433	42 135	17.6

Table 3. Chemical composition of the alfalfa varieties (hay resulted from the 2nd cut in the 2nd year of cropping)

Name of the variety	Dry Matter (DM) g	Organic Substance (SO) g	Crude Protein (CP) g	Crude Fat (CF) g	Crude Cellulose (Cel B) g	Non-nitrogenous extractive substances (SEN) g	Ash (Cen) g	Gross Energy (EB) MJ
PR55 V48	861 1000	771 895	210 243	12 14	263 305	286 333	90 105	18.2
Valahia (4AG08)	848 1000	759 895	205 241	11 13	205 243	338 398	89 105	18.0
Sandra	850 1000	765 900	206 242	10 12	233 274	316 372	85 100	18.18
Dimitra	849 1000	772 909	200 235	11 13	219 258	342 403	77 91	18.26
Dobrogea	860 1000	782 909	203 236	13 15	210 244	356 414	78 91	18.3

Table 4. Statistical results from the comparative statistics between Romanian and foreign varieties groups using T-test for Independent Samples (statistical significance $p < 0.05$ was not met)

Group 1 vs. Group 2	Mean	Mean	t-value	df	p	Valid	Valid	Std.D	Std.D	F-rati	p	Leven	df	p
	Group 1	Group 2				N	N	ev.	ev.	o	Varia	e	Leven	Leven
						Group 1	Group 2	Group 1	Group 2	Varia	nces	F(1,df)	e	e
PR55V48 vs. Sandra	16.79	16.66	0.11	14	0.92	8	8	2.40	2.31	1.08	0.93	0.05	14	0.83
PR55V48 vs. Valahia	16.79	16.60	0.19	14	0.85	8	8	2.40	1.51	2.52	0.25	2.88	14	0.11
PR55V48 vs. Dobrogea	16.79	16.10	0.48	14	0.64	8	8	2.40	3.28	1.87	0.43	1.30	14	0.27
Dimitra vs. Sandra	15.90	16.66	-0.61	14	0.55	8	8	2.64	2.31	1.31	0.73	0.31	14	0.59
Dimitra vs. Valahia	15.90	16.60	-0.65	14	0.53	8	8	2.64	1.51	3.07	0.16	3.98	14	0.07
Dimitra vs. Dobrogea	15.90	16.10	-0.13	14	0.90	8	8	2.64	3.28	1.53	0.59	0.63	14	0.44

Dry matter content in green mass varied between 260 and 310 g, *OM* between 229 and 268 g, and *CP* between 200 and 210 g, respectively. Gross energy was similar for all varieties ranging around 17 MJ (Average=17.63 MJ; *St.Dev.* = 0.21). Overall, Dobrogea and Dimitra varieties showed slightly better performances compared to the other varieties.

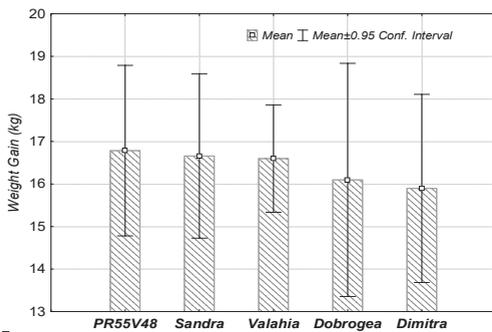


Figure. 1 Weight Gain average (kg) obtained by the lambs fed 93 days with hay from various alfalfa varieties (error bars show the spread within the group)

Concerning alfalfa hay, the *DM* ranged between 848 and 861 g, *OM* 759 and 782 g, and *CP* 65 and 76 g, respectively. Gross energy was similar for all varieties ranging around 18 MJ (Average = 18.18 MJ; *St. Dev.* = 0.11). In this case, PR55V48 and Dobrogea varieties seemed to show improved forage quality within the tested varieties. However, the differences between varieties were lower when considering hay compared to green fodder, and did not show statistical significance. The results regarding the hay quality are in agreement with data reported in the literature (e.g. Yanez-Ruiz and Molina-Alcaide, 2007).

After analyzing the chemical composition of alfalfa hay, the resulting amount of crude protein, which is an important qualitative indicator, was maintained at a good level in the case of the three Romanian varieties (Valahia, Sandra, and Dobrogea). These results support their cultivation in livestock farms from Romania and other regions with temperate climates.

However, an important test that qualitative fodder must pass is the performance of the animal to achieve a significant weight gain in the proper time. The quality of the diet can be considered satisfactory when the animal consuming that fodder achieves the performance desired by the breeder. The results regarding the production increase for the food rations based on alfalfa hay for young fattened sheep in a semi-intensive system were presented in Figure 1.

The weight gains per capita increases recorded by Sandra, Dobrogea, and Valahia varieties at the end of the testing period showed small differences compared to the increases made by the foreign varieties (PR55V48 and Dimitra). However, there were small differences without statistical significance - $p > 0.05$ (Table 4). Valahia variety showed a constant response regarding the weight gain compared to the other varieties (the largest spread occurred for Dobrogea, followed by Dimitra). Based on the average value, the highest gain was reached by PR55V48 (16.8 kg; *St. dev.* = 2.4) followed by Sandra (16.7 kg; *St. dev.* = 2.3), Valahia (16.6 kg; *St. dev.* = 1.5) and Dobrogea (16.1 kg; *St. dev.* = 3.3). Dimitra showed the lowest average weight gain (15.9 kg; *St. dev.* = 2.6).

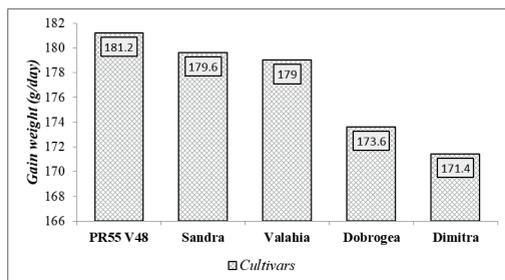


Figure. 2 Daily weight gain (g/day) obtained by the lambs fed 93 days with hay from various alfalfa varieties

Figure 2 shows the daily weight gain for all cultivars that ranged between 171.4 g/day (Dimitra) and 181.2 g/day (PR55V48). The hay from Romanian varieties provided good daily gains that demonstrate useful support in fattening lambs for obtaining ecological products.

CONCLUSIONS

The results of the qualitative analysis of forage together with the weight gains of fattening lambs have positioned the Romanian alfalfa varieties at a very good level for using hay in young sheep diets, comparable to other well-established varieties such as the PR55V48 variety from Pioneer and the Dimitra variety from Continental Semences.

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