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EFFECTS OF THE USE IN RATIONS FOR GROWING LAMBS OF THE COMBINATION ALFALFA HAY + COMPOUND FEED

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Abstract

In our experience, with a duration of 12 weeks, were used 48 lambs, Merino breed, after weaning, the mean weight of 14 kg. The lambs were divided into 4 groups, each fed a proper diet with different ratios between the alfalfa hay and compound feed as follows: group 1 (80/20), group 2 (60/40), group 3 (40/60) and group 4 (20/80).
*Complete rations compacted were used, size of 2.5*1.5 cm, clear consisting of alfalfa hay (chopped before) and compound feed. The rations, administrated ad libitum, were izo-nitrogenous (179 g CP/kg DM) and different energy values.*
Total feed intake (alfalfa hay + compound feed) decreased almost linearly with increasing proportion of concentrates in the rations, being in the order of 4 groups: 1242, 1205, 1155 and 928 g DM/day, between the first and the last value being a difference of 34%, the difference being assessed as significant for P<0.01.
Average daily gains evolve quadratic, the highest recorded to the intermediate groups, and lowest at extreme groups. Therefore, the average weight gains were the highest recorded on groups G 60/40 and G 40/60, 250, or 267 g/day, and the small on G 80/20 and G 20/80, 222, or 227 g/day (mean difference between intermediate and extreme groups were 15%).
The best yields are obtained at slaughter (dressing) of the groups G 60/40 and G 40/60, 57.2% and 57.8%. Share empty digestive tract and digestive content diminishes with increasing participation of alfalfa hay in rations. A significant increase in live weight of subcutaneous fat was observed, of from 3 to 4.1%, as a result of increasing quantities of concentrate consumption.

Keywords: alfalfa hay, compound feed, growth, lambs

INTRODUCTION

Alfalfa hay is forage widely used in winter rations of ruminants due mainly high productivity, relatively high protein content and favorable effects on the functioning of the rumen. Not recommended, however, to be used alone, because productive performance from animals is limited, due to the low energy content (becomes limiting factor) and an excess in protein, beyond the requirements of the animals (is wasted).
Therefore, alfalfa hay should be combined in rations with some complementary feed with higher consumption, higher nutritive energy value. Among such feed sources can enunciate silos (particularly maize) and compound feed (mostly cereals).
The combination of alfalfa hay + corn silage + concentrate feed proved to be successful in ruminants, including young sheep fattening, allowing high production performances. In small herds of sheep, corn silage is used, unfortunately, less, because it requires a specific production technology. In these circumstances the question arises whether, using only alfalfa hay + mixed concentrates can achieve comparable results to the triple combination mentioned. Were made in this regard, some studies have aimed at finding optimal solutions, which are but a few of the more recent, signed Fimbres et al., 2002, Haddad and Hussain, 2004, Ponnampalam et al., 2004, Turner et al., 2005, Tripathi et al., 2007, Wildeus et al., 2007, Saiady et al., 2010, Papi et al., 2011.
In the present study we aimed to quantify the effects of using sheep fattening rations of alfalfa hay and some complementary concentrates, to varying degrees on consumption, weight gain, efficiency of feed utilization and some features obtained slaughter.

MATERIALS AND METHODS

In experience, lasting 12 weeks, were used 48 lambs from Merino breed, after weaning, the average weight of 14 kg.
The lambs were divided into 4 groups (G), each fed with a proper diet with different ratios of alfalfa hay and compound feed (CF), as follows:

- G 1 (80/20), 80 % alfalfa hay and 20 % CF;
- G 2 (60/40), 60 % alfalfa hay and 40 % CF;
- G 3 (40/60), 40 % alfalfa hay and 60 % CF;
- G 4 (20/80), 20 % alfalfa hay and 80 % CF.

Complete rations were used (the single mixtures), alfalfa hay obvious formed (pre- shredded) and the combined feeds compacted dimension of 2.5 x 1.5 cm, given *ad libitum*. Rations were iso-nitrogenous (179 g CP/kg DM and 155 g CP/kg "as basis") and different energy nutritional value (which is inevitable). Compound feed were designed in such a way as to be complementary in terms of nutritional value with alfalfa hay. So, choosing each ingredient has a clear logic.

Food consumption was measured daily, each batch of animals.

Of the four complete rations samples were taken in order to carry out primary chemical analyses: Dry Matter (DM), Organic matter (OM), Crude Protein (CP), Cellulose (C), Calcium (Ca) and Phosphorus (P).

Based on data analysis and others taken from the literature we calculate the energy nutritive value in Meat Feed Unit –MFU- (1 MFU = 1820 kcal net energy - NE) and protein nutritive value in g Intestinally Digestible Protein, Nitrogen permitted –IDPN- and g Intestinally Digestible Protein, Energy permitted –IDPE- (Nicolae, 1997, 1999).

The animals were weighed at the beginning and at the end of the experience. Accommodation was made semi - open sheds with concrete slats.

At the end of the experience from each group were sacrificed four animals, in order to perform analyzes body. Slaughter took place 12 hours after the last weighing, during which the animals were not fed.

Statistical analysis was performed using a linear model ANOVA.

RESULTS AND DISCUSSION

Structure, composition and nutritive values

In the four rations used, the share of alfalfa hay was 80%, 60%, 40% and 20%, and the compound feed reverse, as emerges from Table 1.

By reference to the full rations, from G 80/20 to G 20/80, the main components of compound feed have a share increasingly, corn from 8.3% to 25%, and soy bean meal from 5 to 14%.

With reference only to the compound feed, the situation is changing, in the sense that decreased the percentage of corn (from 41.5% to 31.2%), barley increase (from 0% to 25%) and wheat bran increase (from 0% to 23.3%).

Wheat bran have not plugged in the ration for group G 80/20, and their share of participation in the ration increased from 8% to group G 60/40 to 14% to group G 40/60.

Table 1. Structure complete rations (%)

	G 1 80/20	**G 2 60/40**	**G 3 40/60**	**G 4 20/80**
Alfalfa hay	80	60	40	20
Corn	8.3	12.9	18	25
Barley	-	5	10	20
Soya bean meal	5	7	10	14
Wheat bran	-	8	14	12
Molasses	5	5	5	5
Calcium carbon.	-	0.4	1.2	1.8
Di-calcium phosp.	0.7	0.3	-	-
Salt	0.5	0.5	0.5	0.5
Bicarbonate	-	0.4	0.8	1.2
Premix V-M	0.5	0.5	0.5	0.5

Molasses was included in rations as a binder and as an energy source, and sodium bicarbonate to buffer the rumen acidity increase that followed the increasing amounts of concentrates.

In terms of chemical composition, are observed the same level of protein content of all rations, 179 g CP/kg DM (made to the experimental condition) and the falling cellulose between the extreme groups, 286 to 111 g/kg DM, as shown in Table 2.

Table 2. Chemical composition and nutritional values of complete rations

	G 1 80/20	**G 2 60/40**	**G 3 40/60**	**G 4 20/80**
Chemical composition				
DM (g/kg)	851	854	858	862
CP (g/kg DM)	179	179	179	179
Cellulose (g/kg DM)	286	231	174	111
Nutritive values				
MFU (/kg DM)	0.68	0.77	0.86	0.96
IDPN (g/kg DM)	120	120	122	125
IDPE (g/kg DM)	98	101	105	113
Ca (g/kg DM)	12.3	10.4	10.4	10.4
P (g/kg DM)	4.1	4.1	4.2	4.4

Also in Table 2 we presents the nutritive energy value, with obvious tendency of increase from 0.68 MFU/kg DM for G 80/20 to 0.96 MFU/kg DM for G 20/80 (with intermediate values for intermediate groups) and nutritive protein value, values quite close IDPN, 120-125 g/kg DM and 100-110 g IDPE/kg DM.
Calcium content was highest (5.1%) in the first group (G 80/20), and tended to decrease slightly in the other 3 groups. The phosphorus content was 4.4% in group G 80/20, 4.9% in groups G 60/60 and G 40/60 and 4.1% in group G 20/80.

Consumption and nutrient intake by ratios

With *ad libitum* feeding, total consumption (alfalfa hay + compound feed) decreased almost linearly with increasing proportion of concentrates in the rations, being in order, from left to right, 1242, 1205, 1155 and 928 g DM/day, between the first and last value being a difference of 34%, as shown in Table 3, the differences being considered significant between all four groups, for P <0.01. As a consequence from the experimental protocol, hay consumption decreases dramatically and compound feed consumption increases spectacular.
In group G 80/20 returned a consumption of 92 g alfalfa hay/ $kg^{0.75}$, and in group G 60/40 was registered 68 g alfalfa hay/ $kg^{0.75}$.
When given *ad libitum* alfalfa hay alone, Wildeus et al., 2007, the average weight of the sheep to a 30 kg (24-25 kg compared to this experiment) were found consumption 67-74 g/kg $kg^{0.75}$, therefore comparable results.
The same conditions, to increase the share of concentrates in rations, in the lambs of 20 kg Archimede et al., 2008 disclose an increase in total consumption from 82 to 97 g / $kg^{0.75}$.
Haddad and Husein, 2004 given they used iso-nitrogenous rations for lambs average weight of 27 kg, with 15% and 60% alfalfa hay (the difference was the compound feed) found that consumption was not significantly influenced for P> 0.05, different situation that provided by us in this paper.
Using different proportions between alfalfa hay and concentrates, Papi et al., 2011 found that the dry matter intake decreased quite linear with increasing proportion of concentrates in the ration (from 2.33 kg DM/day to 1.75 kg DM/day, for lambs with 38 kg), similar situation with that we presented.

Table 3. Nutrient intake and consumption

	G 1 80/20	**G 2 60/40**	**G 3 40/60**	**G 4 20/80**
Intake (g per day)				
Total DM intake	1242^{a}	1205^{b}	1155^{c}	928^{d}
Hay DM intake	994	723	462	186
CF DM intake	248	482	693	742
Contribution				
MFU (/day)	0.84^{d}	0.93^{b}	0.99^{a}	0.89^{c}
IDPN (g/day)	149	145	141	116
IDPE (g/day)	122	122	121	105
Ca (g/day)	15.3	12.5	12.0	9.7
P (g/day)	5.1	4.9	4.9	4.1

Values across rows with different superscript are considered statistically different (P<0.01)

Highest energy intake was recorded at G 40/60, 0.99 MFU/day and the lowest at G 80/20, 0.84 MFU/day, between the two values there is a difference of 18%. It is noteworthy the relevant differences in energy intakes for P <0.01.
After Tripathi et al., 2007 energy intake was significantly higher in the ration with concentrate 25 g/$kg^{0.75}$ to 15 g/$kg^{0.75}$ and to the management of ad libitum (dry forage was always given *ad libitum*). Therefore, as in this case, also an intermediate solution gave the best results.
IDPN intake (about 145 g/day) and IDPE intake (about 122 g/day) is very similar among the first three groups and obviously lower in the last batch (G 20/80).
Calcium intake falls evident from G 80/20 to G 20/80, and the intake of phosphorus decreases, too, but with a reduced slope.

Weight gain

The average daily gains, shown in Table 4, was calculated on the basis of body weights at the beginning and at the end of the experience, evolves as energy intake, the high loads will be registered at the intermediate (without significant differences between them for P<0.01) and the lowest at extreme loads (also no significant differences).

Table 4. Body weights and average daily gains

	G 80/20	G 60/40	G 40/60	G 20/80
Initial weight (kg)	14.23	15.12	14.54	13.83
Final weight (kg)	33.88	37.22	38.14	33.91
Gain (g/day)	222^{b}	250^{a}	267^{a}	227^{b}
Dev. St. gain	12.9	10.9	8.4	9.2
CV(%) gain	7.1	5.7	4.3	4.8

Values across rows with different superscript are considered statistically different (P<0.01)

Thus, the average weight increases were the highest recorded in the groups G 60/40 and G 40/60 , 250 g/day respectively 267 g/day and the lowest at G 80/20 and G 20/80, 222 g/day respectively 227 g/day (mean differences between intermediate and extreme loads of 15%).

Saiady and al., 2010 on lambs averaging 24 kg weight, fed with alfalfa hay, weight comparable to that of animals that experience, communicated an average daily gain of 240 g, result similar to that provided by us in this paper.

Manage weight lambs averaged 25 kg fed with alfalfa hay *ad libitum* and concentrates, 0.5% of body weight, Turner et al., 2005 communicated an average gain of 103 g/day, almost 2 times less than that determined in this experience.

Specific consumptions and feeding efficiency

Specific consumptions shown in Table 5 refer to the dry matter, energy and protein.

Specific consumption of dry matter in kg DM/kg gain significantly decreases with increasing proportion of concentrates in the ration is in order: 5.59, 4.82, 4.33 and 4.09.

Haddad and Husein, 2004 a share of 60% alfalfa hay in ration communicated specific consumption of 5.4 kg DM/kg gain, related to 4.82 kg DM/kg gain in this paper.

Table 5. Specific consumptions and feeding efficiency

	G 80/20	G 60/40	G 40/60	G 20/80
Specific consumption				
DM (kg/kg gain)	5.59^{a}	4.82^{b}	4.33^{c}	4.09^{d}
MFU (/kg gain)	3.80^{b}	3.71^{c}	3.72^{c}	3.92^{a}
IDPN (g/kg gain)	671^{a}	578^{b}	528^{c}	511^{c}
IDPE (g/kg gain)	548^{a}	487^{b}	454^{c}	462^{c}
Feeding efficiency				
On DM (kg gain/kg)	17.9^{c}	20.7^{b}	23.1^{a}	24.5^{a}
On MFU (kg gain/MFU)	26.3	26.9	26.9	25.5

Values across rows with different superscript are considered statistically different (P<0.01)

As weight increases, the best specific energy consumption are recorded at intermediate loads, 3.71 to 3.72 MFU/kg gain and lots worst extreme, from 3.80 to 3.92 MFU/kg gain.

Specific consumption of protein, both IDPN (g/kg gain) and IDPE (g/kg gain), decrease with the decreasing share of alfalfa hay in rations as a result of the wording of recipes compound feed. Therefore, the most favorable are those recorded in group G 20/80.

Efficacy was expressed as the feeding carried out by the animal weight gain at the expense of drying and energy consumption of the substance. In the expression kg gain/kg DM intake, feeding efficiency improves with increasing proportion of concentrates in the rations, and the expression kg gain/MFU consumption remains relatively the same.

Body composition

Some data on body composition obtained by slaughter at the end of the experience are outlined in Table 6.

The best yields were obtained at slaughter from groups G 60/40 and G 40/60, ie the intermediate groups, 57.2% and 57.8%. Between these two groups and others are significant differences for P < 0.01.

Share empty digestive tract and digestive content decreases with increasing participation of alfalfa hay, from 6.9 to 5.9%, to extreme groups (from intermediate groups were 6.6 and 6.2%).

Table 6. Results obtained at slaughter

	G 80/20	G 60/40	G 40/60	G 20/80
Slaughter weight (kg)	33,96	38,05	39,16	34,14
Cold carcass (kg)	17,79	21,76	22,63	18,91
Dressing (%)	$52,4^{c}$	$57,2^{a}$	$57,8^{a}$	$55,4^{b}$
Empty digestive tract (kg)	2,36	2,51	2,42	2,02
Empty digestive tract (%)	$6,9^{a}$	$6,6^{b}$	$6,2^{c}$	$5,9^{d}$
Digestive contents (kg)	3,27	2,56	2,51	2,14
Digestive contents (%)	$9,6^{a}$	$6,7^{b}$	$6,4^{c}$	$6,2^{c}$
Subcutaneous fat (kg)	1,02	1,38	1,54	1,41
Subcutaneous fat (%)	$3,0^{d}$	$3,6^{c}$	$3,9^{b}$	$4,1^{a}$

Values across rows with different superscript are considered statistically different (P<0.01)

Cases with greater weight at slaughter (P <0.0001) in the same experimental conditions as in the present work were communicated and Jacques et al., 2011, mainly on account of lower weight of the digestive tract.

A significant increase in live weight percentage of subcutaneous fat, 3 to 4.1%, as a result of increasing the amount of concentrates consumption.

Therefore with increasing quantities of concentrates in rations, beyond improving average daily gain, specific consumption and slaughter yield, is reduced carcass quality, as confirmed by Papi et al., 2011.

CONCLUSIONS

With *ad libitum* feeding, total consumption (alfalfa hay+compound feed) decreased linearly with increasing proportion of concentrates in the rations, being in the order of 4 groups (G 80/20, G 60/40, G 40/60 and G 20/80) of 1242, 1205, 1155 and 928 g/day (P <0.01).

Highest weight gains were recorded at intermediate groups (250 and 267 g/day) and lowest at extreme groups (222 and 227 g/day) (P <0.01).

Specific consumption of dry matter and energy are more favorable there were still intermediate groups.

Digestive content decreases (from 9.6 to 6.2%) and subcutaneous fat weight increase (from 3 to 4.1%) with increasing proportion of concentrates in the rations.

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