Meat Production in Sheep Hybrids in Agro-Ecological Feeding and Growing System

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Abstract
Research points out the effect of feeding young hybrid sheep (Black-faced German x Ţurcană) in the conditions of permanent hill grasslands with two technological systems of improving grasslands: the conventional chemical (NPK) fertilisation system and the agro-ecological organic fertilisation (sheep folding and over-sowing) system. Studies show that the changes in the floristic structure of the grasslands have influenced both fodder yield and quality and meat production and quality. Meat production depending on experimental factors ranged between 189 and 393 kg/ha in the grasslands improved conventionally and between 191 and 461 kg/ha in the grasslands fertilised organically.

Keywords: permanent grassland; improvement methods; young hybrid sheep; meat production.

1. Introduction

Producing organic meat supposes the introduction, in the animal feed, of a special fodder system based mainly on organic input technologies that ensure the most effective performance level compared to the traditional system. Present trends, particularly in sheep breeding, concern the increase of meat and milk productions from agro-organic farms as a response to the increasing demand on the food market [1, 2, 3, 4]. This paper presents the influence of the technological system of improving permanent hill grasslands on lamb production in hybrid sheep.

2. Materials and methods

To reach this goal, we applied a polyfactorial experimental setting with the following structure of the trial factors:

A – Fertilisation type of the permanent grassland:
a_1 = grassland fertilised conventionally ($N_{150}P_{70}K_{70}$)
a_2 = grassland fertilised organically (sheep folding for four nights)
B – Supplementing young sheep with concentrated feed:
b_1 = no concentrated feed
b_2 = concentrated feed
C – Genotype of young sheep:
c_1 = young sheep of the Ţurcană breed (TA)
c_2 = young sheep of the F1 (Black-faced German x Ţurcană) breed (OGCN x TA)
Fertilisation in the conventional technology system (a_1) with NPK was done starting with the spring of 2012: basic fertilisation was done in early spring with a rate of $N_{100}P_{70}K_{70}$, applying the difference of N_{50} after the first harvest. In 2013, we applied only nitrogen fertilisers at rates of N_{150} in two phases: N_{100} in early spring and N_{50} after the first harvest. Organic fertilisation of the permanent grassland (a_2) was done by sheep folding with adult sheep in the spring of 2012, with a load of 12 sheep/1.5 m^2 for four nights.

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After sheep folding, when the natural vegetation of the permanent grassland was almost entirely destroyed and after slight soil working with a disc harrow and a coulter harrow we super-seeded with a complex mixture of perennial gramineae and legumes with the following structure: Lolium perenne (8 kg/ha), Festuca pratensis (6 kg/ha), Festuca arundinacea (2 kg/ha), Lotus corniculatus (2 kg/ha), and Trifolium repens (2 kg/ha). In each of the eight experimental variants, we located a lot of 10 lambs each from two different categories of genotypes: 40 lambs of the native Ţurcană breed (TA) and 40 hybrid lambs (F_1) resulted from the Black-faced German x Ţurcană breeds (OGCN x TA).following types: sisters – brothers (R = 0.5) and half-brothers (R = 0.5).

3. Results and discussions

Tables 1 and 2 present growth rates in lambs in the experimental lots on conventional grassland and on sheep-folded agro-ecological grassland. On cultivated grassland, no matter the experimental variant (with or without supplement of concentrated feed), the daily weight gain in the hybrid lambs of the genotype F1 OGCN x TA was significantly higher ($p \leq 0.05$) than in the Ţurcană lambs in the control lots. Feeding the lambs daily with concentrated feed (300 g/day/head) had a statistically significant daily weight gain ($p \leq 0.01$) in the lambs included in the experiment. Thus, mean differences between hybrid lambs F_1 OGCN x TA reached 102.67 g/day, and in the Ţurcană lambs, 82 g/day.

Table 1. Growth rates in experimental lambs on conventional grasslands

Lot	Genotype	Experimental variant	Initial weight (kg)	Final weight (kg)	Total gain (kg)	Daily mean gain (g)
Lot 1 [A]	F_1 OGCN x TA	No concentrate feed	25.68±0.483	30.34±0.475	4.66±0.577	155.33±0.190
Lot 2 [B]	F_1 OGCN x TA	Concentrate feed	25.87±0.461	33.61±0.718	7.74±0.366	258.00±0.122
Lot 3 [C]	TA	No concentrate feed	22.98±0.465	26.70±0.716	3.72±0.605	124.00±0.202
Lot 4 [D]	TA	Concentrate feed	23.08±0.424	29.26±0.465	5.73±0.294	206.00±0.149
Difference testing (Non-parametric Mann-Whitney Test)						
	A vs. B		*0.19 kg NS*	*3.27 kg***	*3.08 kg***	*102.67 g***
	C vs. D		*0.10 kg NS*	*2.56 kg**	*2.01 kg**	*82 g***
	A vs. C		*2.7 kg***	*3.64 kg****	*0.94 kg**	*31.33 g**
	B vs. D		*2.79 kg****	*4.35 kg****	*2.01 kg***	*52 g***

*Note: NS when p≥0.05; * when p≤0.05; ** when p≤0.01; *** when p≤0.001*

As for the data concerning the lambs on agro-ecological grassland, mean daily weight gains had very significant differences ($p \leq 0.001$) between both genotypes and experimental variants. Mean differences between the two experimental variants (with and without concentrate feed) were the most prominent. Thus, the difference in daily weight gain between the hybrid lambs F_1 OGCN x TA was 108.9 g/day and in the lambs of the Ţurcană breed, 88.3 g/day.

To evaluate the influence of the grassland type on growth rate in the hybrid lambs F_1 OGCN x TA and in the lambs of the Ţurcană breed, we tested the differences between the eight experimental lots using the non-parametric Mann Whitney test. In the hybrid lambs F_1 OGCN x TA on natural grassland vs. conventional grassland with no concentrate feed, the differences were statistically distinctly significant ($p \leq 0.01$). In the experimental variant with supplement of daily concentrate feed, the differences were statistically significant ($p \leq 0.05$). In the four lots of lambs of the Ţurcană breed, the differences between the four experimental variants were statistically distinctly significant ($p \leq 0.01$), with differences of 29.6 g/day in the variant with no supplement of

concentrate feed and 23.2 g/day in the supplement of 300 g of concentrate feed (Table 3).

Table 2. Growth rates in experimental lambs on agro-ecological sheep folded grasslands

Lot	Genotype	Experimental variant	Initial weight (kg)	Final weight (kg)	Total gain (kg)	Daily mean gain (g)
Lot 5 [E]	F_1 OGCN x TA	No concentrate feed	25.88±0.426	29.43±0.395	3.55±0.244	118.33±0.081
Lot 6 [F]	F_1 OGCN x TA	Concentrate feed	26.49±0.590	33.31±0.766	6.82±0.366	227.30±0.122
Lot 7 [G]	TA	No concentrate feed	22.75±0.332	25.58±0.436	2.83±0.256	94.33±0.085
Lot 8 [H]	TA	Concentrate feed	23.48±0.336	28.96±0.551	5.48±0.400	182.70±0.133
Difference testing (Non-parametric Mann-Whitney Test)						
	E vs. F		*0.61 kg NS*	*3.38 kg***	*3.27 kg****	*108.9 g****
	G vs. H		*0.73 kg NS*	*3.38 kg***	*2.65 kg****	*88.3 g****
	E vs. G		*3.13 kg****	*3.85 kg****	*0.72 kg***	*24.0 g****
	F vs. H		*3.01 kg****	*4.35 kg****	*1.34 kg***	*44.6 g****

Table 3. Testing the differences in growth rates of the lambs in the experimental lots on conventional grassland compared to the agro-ecological sheep-folded grassland

Genotype	Experimental variants	Differences of daily weight gain
F_1 OGCN x TA	Conventional grassland vs. Natural grassland (no supplement of concentrate feed)	37 g **
F_1 OGCN x TA	Conventional grassland vs. Natural grassland (supplement of concentrate feed) (300 g/day)	30.7 g *
TA	Conventional grassland vs. Natural grassland (no supplement of concentrate feed)	29.6 g **
TA	Conventional grassland vs. Natural grassland (supplement of concentrate feed) (300 g/day)	23.2 g **

Figure 1. Lamb lots on conventional grassland (left) and agro-ecological natural grassland (right)

Table 4. Amount of lamb depending on experimental factors (in relation to the green yield of the grassland)[1]

Experimental variants			kg/ha	dif. kg/ha	%
Type of grassland	Type of feed supplement	Genotype			
Permanent grassland fertilised with $N_{150}P_{70}K_{70}$	No concentrate feed	TA[2)]	283	-	100
		F_1(OGCN x TA)[3)]	355	72	125
	Concentrate feed	TA	470	187	166
		F_1(OGCN x TA)	589	306	208
Permanent grassland fertilised by sheep-folding (4 nights) and super-seeding	No concentrate feed	TA	275	- 8	97
		F_1(OGCN x TA)	345	62	122
	Concentrate feed	TA	533	250	188
		F_1(OGCN x TA)	663	380	234

Note: [1)]CP = 3.23 UVM/ha (sheep folding); CP=2.50 UVM/ha (NPK); [2)]TA=Țurcană lambs; [3)]F_1(OGCNxTA)=hybrid lambs

Table 5. Amount of lamb depending on experimental factors (in relation to the floristic structure of the grassland)[1]

Experimental variants			kg/ha	dif. kg/ha	%
Type of grassland	Type of feed supplement	Genotype			
Permanent grassland fertilised with $N_{150}P_{70}K_{70}$	No concentrate feed	TA[2)]	189	-	100
		F_1(OGCN x TA)[3)]	236	47	125
	Concentrate feed	TA	314	125	166
		F_1(OGCN x TA)	393	204	208
Permanent grassland fertilised by sheep-folding (4 nights) and super-seeding	No concentrate feed	TA	191	2	101
		F_1(OGCN x TA)	240	51	127
	Concentrate feed	TA	372	183	197
		F_1(OGCN x TA)	461	272	244

Note: [1)]CP = 3.23 UVM/ha (sheep folding); CP=2.50 UVM/ha (NPK); [2)]TA=Țurcană lambs; [3)]F_1(OGCNxTA)=hybrid lambs

Tables 4 and 5 present data regarding the amount of lamb per ha depending on the grassland green fodder yield and floristic structure. To compare the data, we used the yield of permanent grassland fertilised with NPK, the experimental variant with no supplement of concentrate feed. Compared to this type of grassland, the lamb production per ha was higher in the other experimental variants, except for the permanent sheep-folded grassland with no supplement of concentrate feed (only 97% of the lamb production per ha). The highest yield was in the experimental variant on the sheep-folded permanent grassland with supplement of concentrate feed (380 kg/ha). There were similar results in the floristic composition of the grasslands.

4. Conclusions

Improving permanent hill grasslands only through organic fertilisation (sheep folding) and super-seeding has a strong influence on the growth performances in meat lambs. Compared to the variants fertilised in the conventional system ($N_{150}P_{70}K_{70}$), lamb production in hybrid lambs (Black-faced German x Țurcană) was higher in the variants fertilised organically (7-11%).

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