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THE EFFECT OF CROSSBREEDING SYSTEMS ON LAMB MEAT PRODUCTION

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Practical aspects of crossbreeding are discussed to provide guidelines for sheep producers. Serbia disposes with great natural potentials for development of lamb meat production. There are currently more than 10 recognized breeds of sheep in the country. Over the past 20 years, several breeds or strains have been imported from other countries for their favorable performance for specific traits. Crossbreeding systems use breed diversity to increase productivity relative to purebred flocks. The objective of this paper is to present some of the results obtained by introduction of crossbreeding systems for lamb meat production. Researches were carried out on the Stara Planina Mountain. From data presented in this paper it can be seen that result of crossbreeding Pirot pramenka, Pirot improved sheep and Merinolandschaf is increasing the body weight of lambs at weaning. The heterosis effect occurs only in the F_1 generation of crossing, but in the second F_2 generation, it is lost. If differences are compared between twobreed crossing and threebreed crossing we can see that here are very significant influences by using Merinolandschaf as therminal sire breed in the three breed crosing system.

Key words: sheep; crossbreeding; lamb meat production

ЕФЕКТ ОД СИСТЕМИТЕ НА ВКРСТУВАЊЕ ВО ПРОИЗВОДСТВОТО НА ЈАГНЕШКО МЕСО

Разгледувани се практичните аспекти на вкрстувањето, со цел обезбедување на инструкции за одгледувачите на овци. Србија располага со големи природни потенцијали за производството на јагнешко месо. Во моментот, во земјата има повеќе од 10 признати раси на овци. Во текот на изминатите 20 години увезени се неколку раси и соеви од други земји поради нивните високи производни можности по однос на одредени својства. Со помош на системите за вкрстување се зголемува продуктивноста кај животните како резултат на разликите кои постојат помеѓу расите во рамките на чистокрвните стада. Целта на овој труд е да се претстават некои резултати добиени од воведувањето на системите за вкрстување при производство на јагнешко месо. Истражувањата беа извршени на Стара Планина. Од добиените податоци може да се види дека резултатот од вкрстувањето на пиротска праменка со пиротска унапредена праменка е зголемување на телесната маса на јагнињата во моментот на одбивање. Ефектот на хетерозисот се појавува само кај генерацијата F_1, додека кај генерацијата F_2, тој се губи. Доколку се споредат разликите помеѓу дворасното и трирасното вкрстување, може да се забележи значително влијание на расата виртемберг, како терминална татковска раса кај системот на трирасно вкрстување.

Клучни зборови: овци, вкрстување, јагнешко месо, производство

1. INTRODUCTION

Breed diversity is a valuable resource of the sheep industry. Crossbreeding systems use breed diversity to increase productivity relative to purebred flocks. Crossbreeding systems vary in managerial complexity and in the use of beneficial effects due to crossbred ewes and lambs. Crossbreeding offers two distinct advantages over purebreeding: heterosis and breed complementarity.

Efficiency of meat production is maximized in terminal crossbreeding systems by the use of specialized sire breeds to complement characteristics of crossbred ewes (Petrović, 2000; Leymaster, 2002;, Cloete *et al,* 2003; Hoffman *et al.,* 2003). Body weight of lambs at birth has an important role in achieving a good production, because of the initial body mass does not depend only growth, but also vitality and mortality of sheep (Morris *et al,* 2000; Cloete *et al,* 2001; Zapasnikiene, 2002, Berhan and Arendonk, 2006; Petrović *et al.,* 2009). It is known that in the meat production in sheep the effect of heterosis is used. Heterosis or "hybrid vigor" is the superiority of crossbred offspring to their purebred parents. Mathematically, heterosis is the percentage increase in a specific trait (e.g. weaning weight) that progeny have over the average performance of their parents. Heterosis is the highest for traits that do not respond well to selection, e.g. fitness and reproductive traits, and the lowest for traits that respond well to selection, e.g. carcass and fleece characteristics. However, farmers often mistake, and if they desire to increase production, they make losses, because for each breed of sheep a good breeding program is needed (Ugarte, 2007). Petrović says, 2000, one of the important characteristics of heterosis occurs only in the first (F_1) generation of crossing. But the steam "between themselves " ($F_1 \times F_1$) in the second F_2 generation, it is lost. This is explained because, as a result of separation, a significant part of heterozigous gene flows into the homozigous form. The aim of this paper is to determine the effects of different crossing systems on the growth of lambs to 90 days of age.

MATERIAL AND METHODS

Investigations were carried out in the area of Stara Planina. The following populations of sheep are included in these research:

- Pirot pramenka
- Pirot improved sheep
- Merinolandschaf
- Pirot pramenka × Pirot improved sheep
- Pirot pramenka × Merinolandschaf (Pirot pramenka × Pirot improved sheep) × Merinolandschaf.

This study included 1950 sheep during a period of three years. The control of production traits is undertaken using standard procedures. The characteristics of the body development of male and female lambs from birth to weaning, at the age of 90 days were controlled. All sample had equal conditions of accommodation and food care.

The mathematical analysis was done using the model of the Least Squares and Maximum Likelihood computer programme (Harvey, 1991):

$$Yijklm = \mu + Gi + Jj + Fk + Ml + b1\ (x \square x\square_1) + \text{eijklm},$$

where:

Yijklm = Velus of traits of *y*-th animal, *i*-th genotype in *j*-th year, from *k*-th sire and *l*-th dam,

μ = overall population mean,

Gi = fixed effect of *i*-th genotype,

Jj = fixed effect of *j*-th year,

Fk = fixed effect of *k*-th sire,

Ml = fixed effect of *l*-th dam,

b1 = linear regressive coefficient of the age influence in the first conception,

eijklm = undetermined effects,

$x\square$ = average value of the age in the first conception.

RESULTS AND DISCUSSION

The sheep Pirot pramenka had the lowest body weight from birth to the weaning. Differences in he final body weight of lambs at weaning between purebreed populations were statistically very significant ($P < 0.01$). Similar results were obtained by Petrović (2007), Petrović *et al.,* (2009) in their previous research. Table 1 presents the results of crossing and heterosis effect in the first F_1 generation.

Table 1

Average(LSM±SE) values and variability of body weight of purebreed lambs

Population of sheep	Body weight at birth, kg	Body weight 30.day, kg	Body weight 90.day, kg
Pirot pramenka	3.39±0.12	9.71±0.30	22.11±0.96
Pirot improved sheep	4.12±0.10	11.39±0.34	25.55±0.98
Merinolandschaf	4.26±0.11	11.92±0.39	28.13±1.01

Table 2 shows that the body weight of lambs varies depending on the population and system of crossing. Namely, lambs from threebreed crossing F_1 (F_1 Pirot pramenka × Pirot improved sheep) × Merinolandschaf had the highest body weight of 4.24 kg at birth and 12.00 kg with 30 days and 28.07 kg at the weaning at the age of 90 days.

Table 2

Average (LSM±SE) values and variability of body weight of lambs in F_1 generation

Population of sheep	Body weight at birth, kg	Body weight 30. days, kg	Body weight 90. days, kg
F_1 Pirot pramenka × Pirot improved sheep	4.04±0.08	11.18±0.30	24.03±0.99
F_1 Pirot pramenka × Merinolandschaf	4.14±0.11	11.76±0.41	25.58±0.99
F_1(F_1 Pirot pramenka × Pirot improved sheep) × Merinolandschaf	4.24±0.13	12.00±0.39	28.07±1.02

The system of twobreed crossing also shows significant impact. Differences in body weight between Pirot pramenka and crosses of F_1 (Pirot pramenka × Pirot improved sheep) and F_1 (Pirot pramenka × Merinolandschaf) were statistically very significant ($P < 0.01$). If differences between twobreed crossing and threebreed crossing are compared, we can see very significant influences ($P < 0.01$) of terminal crossbreeding by using Merinolandschaf rams in the threebreed crossing system. The results of these investigations findings are confirmed; another, research too *(*El Fadili and Leroy, 2001, Boujenane and Kansari, 2002).

From Table 3 we can see that reproduction of the sheep "between themselves" ($F_1 \times F_1$), in the F_2 generation is coming to a decrease in hybrid vigor and can see that the body weight in all cases significantly stagnated. In spite of that, we can see a positive impact of threebreed crossing, because lambs have the greatest body mass at weaning which is 25.16 kg, and the difference in relation to the combination of both twobreed crossing is statistically very significant ($P < 0.01$). Other authors (Leymaster (2002), Cloete *et al,* 2003) state that the impact of crossing system is of decisive importance.

Table 3

Average(LSM±SE) values and variability of body weight of lambs in F_2 generation

Population of sheep	Body weight at birth, kg	Body weight 30. days, kg	Body weight 90. days, kg
F_2 Pirot pramenka × Pirot improved sheep	3.52±0.06	9.78±0.34	22.98±0.90
F_2 Pirot pramenka × Merinolandschaf	3.61±0.10	10.31±0.21	23.79±0.92
F_2 (F_1 Pirot pramenka × Pirot improved sheep) × Merinolandschaf	3.68±0.10	11.03±0.30	25.16±0.98

CONCLUSION

On the basis of the research conducted, processed and the obtained results, we can conclude the following:

The sheep of Pirot pramenka had the lowest body weight from birth to the weaning. Differences in the final body weight of lambs at weaning between purebreed populations were statistically very significant.

Lambs from threebreed crossing F_1 (F_1 Pirot pramenka × Pirot improved sheep) × Merinolandschaf had. the highest body weight from birth to the weaning at the age of 90 days.

The system of twobreed crossing also shows significant impact. Differences in the body weight between Pirot pramenka and crosses of F_1 (Pirot pramenka × Pirot improved sheep) and F_1 (Pirot pramenka × Merinolandschaf) were statistically very significant.

If differences between twobreed crossing and threebreed crossing are compared we can see very significant influences by using Merinolandschaf as therminal sire breed in the threebreed crosisng system.

The heterosis effect in the F_2 generation is coming to a decrease and it can be seen that the body weight of lambs in all cases significantly stagnated.

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