Influence of Pasture Composition and Weather Conditions on the Productivity and Behavioral Reactions of Pigs of East Balkan Breed

Nadezhda PALOVA[1,*], Dimitrinka KRUSHEVA[1], Radka NEDEVA[2], Yordan MARCHEV[2]

[1]Agricultural Academy Bulgaria, Experimental Station of Agriculture – Sredets
[2]Agricultural Academy Bulgaria, Agricultural Institute - Shumen
*Corresponding author: nadejda_palova@abv.bg
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In the Agricultural Experimental station- Sredets, in Strandzha region, a study was conducted with two groups of 10 pigs of East Balkan breed. The experiment began after weaning at 60 days of age (8,91 and 8,81 kg) and continued to the age of 123 days (28,02 and 26,48 kg live mass). The period from May (spring) to the end of August (summer) was covered. The purpose of this study was to investigate the productivity and some behavioral reactions of East Balkan pigs depending on the composition of the pasture and weather conditions. The pastures in Strandzha are not highly productive - from 890 to 1320 kg/daa and with low nutritional value - the protein content ranges from 8,89 to 12,1 % in the spring and from 5.53 to 5.91% during the summer. Growing pigs in the control group have achieved average daily gain of 0.155 kg throughout the whole period and the pigs from the experimental group 0.144 kg. This indicating that the various chemical and botanical composition of the herbageas well as herbage yield did not significantly affect the live weight of animals. Major influence on the productivity and behavior of piglets from the East Balkan breed have weather conditions during the season. The behavior of the two groups of pigs was observed for two consecutive days for 8 hours during the spring season (May) and summer (July). In the spring, the activity of the animals of both groups (83% and 89%), was higher compared to the summer (62% and 73%).

Keywords: East Balkan swine, grassland, climatic factors, growth, etology.

Introduction

The relationshipland - animals is twofold. The natural pastures are a single source of cheap and complete fodder for livestock, and they in turn enrich the soil with natural fertilizers, which determines the positive effect of this interaction (Horsted et al., 2012). Fertile and clean land, grass composition of pastures, diverse chemical composition and variation of nutritional value are factors that determine their behavior and productivity. Kirilov et al. (2013) indicate that by the eating behavior of animals one can judge for the preservation of pasture grass - if most of the animals are lying down two hours after putting them out to pasture, that means there is enough grass. According to other authors practically the complete feeding of animals can be determinedby their behavior - when they start to slow their movements and start looking for a place to lie down and rest, that means that they are completely fed and should be taken out from the pasture and brought to their place for rest (Slanev et al ., 2006). The nutritional contribution made by pasture will depend on the availability, nutrient composition, grazing intake and digestive utilisation of herbage(Edwards, 2003). A number of authors have found that the quantity and quality of herbage and climatic factors determine the behavior of pigs on pasture and their productivity (Andresen and Redbo, 1999; Olczak et al., 2015; Horsted et al., 2012; Velazco et al., 2013; Allwin et al., 2016; Palova, 2006; Palova, 2008.

East Balkan pig is the only preserved until now in a clean condition Bulgarian pasture aboriginal breed of pigs. Hlebarov (1922) and Danchev (1984) stated that it has the ability to utilize different trophic sources with low nutritional value. Vittoz and Hainard (2002) reached the conclusion that pigs should use pastures with less sensitive plant communities. Ivanova-Peneva (2010) conducted a study on the behavioral responses of pigs of free-range East Balkan breed and results obtained are similar to the behavior of feral pigs atthe pasture.

Objective

To explore some behavioral reactions and productivity of pigs from East Balkan breed depending on the composition of the pasture and weather conditions.

Materials and Methods

The study was conducted in the Agricultural ExperimentalStation – Sredetsfor a period of four months during the spring-summer season. Two groups of animals were formed– control group (n=10) and experimental group (n=10), each of them contains 5 male and 5 female, equalized by

gender, age, body weight. The animals were taken daily to controlled grazing in the forests of Strandzha. The animals use every day different pasture from 8:00am to 16:00 pm. and after return they were fed with 0.500 kg/head of milled barley. The pigs had unlimited access to drinking water. The weight development of pigs was observed during adolescence. The average live weight and average daily gain by months in different seasons were registered. The climatic factors air temperature (t^0C) and rainfall mm/sq.m were reported, taking into account their impact on the growth of animals and their behavior during the study. Natural pastures were used, wherethe botanical composition was studied in terms of cereals, legumes and weeds. When examining the chemical composition of herbage, dry and organic matter, crude protein, fat, fiber, minerals, Ca and Pwere defined. Protein was determined by the Kjeldahl method, Soksle fat, fibersas perWeende (methods described by Sandev, 1964). Herbage yield wasdetermined by the method of Shanin (1977). Observations were carried out using the method of group timingon two consecutive days. The parameters standing, grazing, rest (lying), movement were controlled in 10 minutes and deviations from the actual values did not exceed 2%.

The results obtained were processed by modules of a computer program for statistical analysis StatSoft 6 (Microsoft Corp.1984-2000Inc.). The options ANOVA and Other Significance Test were used.

Results and Discussion

Data for the change of botanical composition of pastures as well as the yield from it are shown in Table 1 and the chemical composition of herbage - in Table 2. Herbage yield of the pasture used by the first group is 1320 kg/daa, and drymass yield - 570 kg/daa. In the pasture used by the second group herbage yield is 890 kg/daa and dry mass yield is 360 kg/daa. Palova et al., (2011) obtained results that are closed to our results. They found that the pastures used by the East Balkan swine in the area ofAgricultural ExperimentalStation - Strandzha mountain are not highly productive- from 550 kg/daa to 840 kg/daaof herbage. Protein content ranges from 8.60 to 13.76%. The herbage contains cereal (twitch grass, poa bulbous panicle, false sheep's fescue, common bent, perennial ryegrass,cocksfoot), legumes (species of clover, yellow alfalfa, trefoil, wild vetch) and other grass families (mullein, green shield bug, dandelion, plantain etc.). The botanical composition of herbage in the first pasture is as follows: grasses - 57.2%, beans - 25% other grass families - 17.8%. Less weeds contentis due to the greater amount of benign cereal and leguminous grasses. The second pasture has a more balanced composition of herbage: cereal grasses - 41.1%, bean grasses - 12.5% other grass families - 46.4%.

It was found that the grass composition of natural pastures in Strandzha used by East Balkan pig breed is characterized by a low nutritional value-protein from 8,89 to 12,1%, fat from 1,61 to 2,78%, fiber from 23,09 to 25,57 and minerals from 6,54 to 7.94%. Our data is similar to that derived by Nedev et al., 2009; Stoeva and Vateva, 2008. Based on the results of the chemical composition of herbage the conclusion is that the nutritional value of pasture is higher during May-June and it is decreased in July-August. We think this is due to the period in the development of grasses, as well as more favorable weather conditions-temperature and rainfall in the spring, predisposing the development of rich grass cover.
The values of temperature and rainfall during the studied period are shown in Fig1. The results indicate that the weather conditions determine the herbage condition of pastures. Climatic conditions during the spring were suitable for development of pastures. The amount of rainfall during the period was 113,2 mm/sq.m., in May the rainfall was 24.5 mm/sq.m., and in July -the least amount - 0.9 mm/sq.m. The average monthly air temperature was highest in July 24.2 ^0C, with deviation from 11.8 to 37.3^0C. The lowest average monthly temperature was recorded in May18.3^0C, ranging from 6.0 to 30.5^0C. The combination of rainfall and temperatures in the different months determines the productivity of pastures. During the months of May and June the rainfall was high and temperatures were lower than in July and August, and July is determined as the most unfavorable month. During this month herbage is poor in nutrients and digestion is more difficult for pigs, because vegetation has passed pasture maturity.

Table 1. Botanical composition, %, green and dry mass yield kg/dasward from natural pastures in Strandzha

Indicators	Pasture 1	Pasture 2
Green mass yield kg/dasward	1320	890
Dry mass yield kg/dasward	570	360
Cereal, %	57,2	41,1
Legumes,%	25,0	12,5
Weed,%	17,8	46,4

Table 2. Chemical composition of the nature sward from Strandzha

Indicators	Sward 1 Spring	Sward 2 Spring	Sward 3 Summer	Sward 4 Summer
Water, %	74,81	74,92	7,15	7,96
Dry matter,%	25,19	25,08	92,85	92,04
Crude protein, %	12,1	8,89	5,91	5,53
Crude fat,%	2,78	1,61	1,93	2,69
Crude fiber,%	23,09	25,57	30,81	27,55
Mineral traces,%	7,94	6,54	12,23	8,04
Crude ash, %	7,68	7,31	6,52	6,70
NFE	54,35	56,62	54,83	57,53

Table 3. Average live weight of pigs in the control and test group by months

Group	Control group			Test group		
Month	n	X	±SX	n	X	±SX
1 May	10	8,92	±1,40	10	8.81	±1.63
1 June	10	14,73	±2,09	10	14,01	±1,63
1 July	10	19,96	±1,64	10	18,48	±2,71
1 August	10	23,52	±1,64	10	21,93	±1,79
1September	10	28,02	±2,10	10	26,48	±3,04

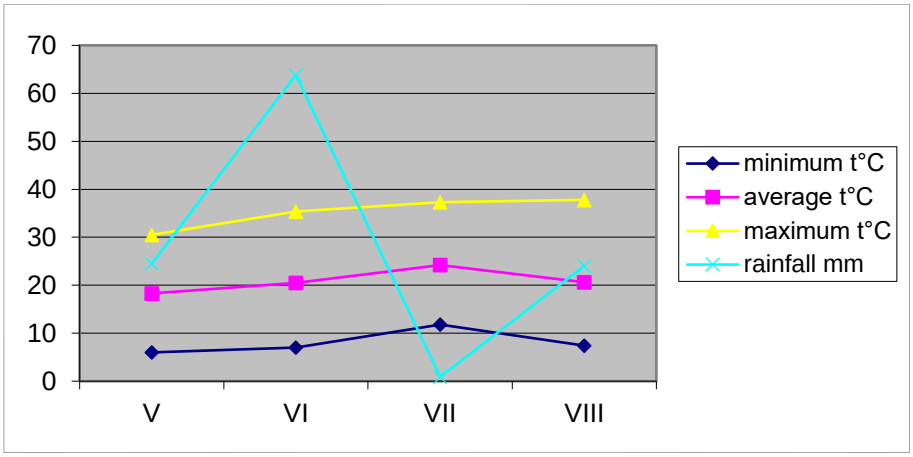

Fig.1 Weather conditions during the period of study

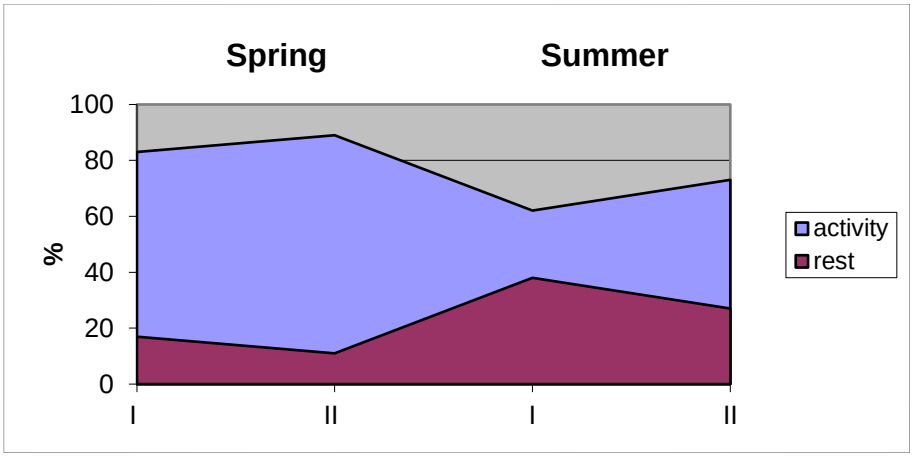

Fig.2 Behavior of pigs from East Balkan breed depemding on the season

Data on weight development of the pigs are shown in Table 3. Average live weight kg and average daily growthrate during the individual months were registered. The influence of climatic factors and pasture composition on pigs growth was determined. A trend was found for lower average live weight of pigs in the experimental group compared with the control group, but statistically proven differences between the two groups were missing. The average live weight at the end of the test period (123 days) reached 28,2 $\pm$ 2,10 for the control group and 26,48 $\pm$ 3,04 for the experimental group. These differences are insignificant and reliable influence of the pasture on average live weight was not registered. The data obtained show that the major influence on the average daily gain for pigs ofthe East Balkan breed have the climatic factors. The values in different seasons differ at $p < 0.05$. The lowest average daily gain in both groups received in July was 0,115 kg for the control groupand 0,111 for the experimental group and the highest in May –0,187 and 0,168 kgrespectively. The higher average daily gain in May may result from a combination of favorable agro-meteorological conditions and the availability of abundant grass cover. The development of most types of plants in the herbage depends mainly on the presence of rainfall–they require higher moisture and lower temperaturesfor their development. In the spring grasses are in the most favorable phase of development for the utilization by animals - beginning of tasseling in wheat and budding to beginning of flowering in beans. The negative correlation between temperature and rainfall during the summer months justify the insufficient pasture with poor quality of herbage, increasing the proportion of its indigestible or difficult to digest components (lignin and cellulose). This respectively results in a low average daily gain during this period. Marchev and Nedeva (2003) also came to the conclusion that the deteriorating agro-meteorological conditions have an unfavorable impact on average daily gain.

There have been observations on the behavior of pigs of East Balkan breed according to the nutritional resources of the area and weather conditions. The term "Activity" includes active movement such as walking, standing, grazing, digging, waterdrinking, excretory and sexual behavior, which inherently represent the changes in body position or part of the body in space. The social behavior (aggression) and hierarchical relationships between animals in the herd are also attributed to activity. Tranquility and rest contain the elements lying and sleeping. In all cases of studying animal behavior thequantitative assessment method was used to quantify the behavior reactions,different in duration, recorded in 10 minutes. Above all the duration of the underlying behavior was covered - activity and rest, including all their elements, measured with a stopwatch in minutes. Observations were carried out in spring and summer for two consecutive days in both groups of animals. According to the results, both groups of animals showed a similar pattern of behavior depending on the preservation of pasture and weather conditions.

The summarized results in Fig.2 show that in the spring (May) the animals from both groups have spent in movement 83% and 89%, and this includes walking, standing, grazing, digging, drinking water,

excretory behavior, mudding (some movements are performed simultaneously - such as standing, digging, eating). The rest that involves lying under the shade and in mud is 17% and 11% for both groups. In the summer (July) the movement in both groups was 62% and 73% and rest time 38% and 27%. The activity was mainly in the morning, and lying mostly in the afternoon and it is probably due to the higher temperatures. It is quite possible that this was due to the grazing up. Actually, the grazing up of animals was found in their behavior - slow movement and they were seeking a place to lie down and rest. Slanev et al. (2006) also came to the same conclusion.

In terms of territory that pigs walk to meet theirfeeding needs we can say that it is highly dependent on the availability of pasture during the relevant period and the weather conditions of the environment. Movement and feeding in the spring is more intensive, which is probably due to the greater amount of grass cover and acceptable temperatures for normal thermoregulation in pigs. In July pigs spend more time lying in the shade and in mudding in wet areas and less time in feeding, which we believe is due to the high temperatures and depletion of of pastures from green mass. Our results are similar to those of Andresen and Redbo (1999). They found that the length of time for feeding in adolescents is associated with the quantity and quality of herbage and it increases in good preservation of pasture. The authors register decrease infeeding activity at elevated temperatures. Olczak et al. (2015) reached the conclusion that weather conditions (temperature, humidity, solar radiation, atmospheric pressure, wind strength, wind direction and rainfall) have a significant impact on the behavior of pigs. With increasing temperature the most characteristic behavior of pigs is reduced activity and seeking places for mudding.

Conclusions

The pastures in Strandzha used by the East Balkan swine are not highly productive - from 890 to 1320 kg/daaherbage yield and low nutritional value - the protein content ranges from 8,89 to 12,1 % in spring and to during the summer.

Adolescent pigs in the control group have achieved average daily gain of 0.155 kg throughout the period and the experimental group 0.144 kg, which indicates that various chemical and botanical composition of herbage and herbage yield did not significantly affect weight development and behavior of the animals from both groups.
Weather conditions during the relevant season have basic impact on productivity and behavior of adolescent pigsof East Balkan breed.

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