

## THE EFFECTS OF COMPLETE MIXTURES FROM VARIOUS DOMESTIC PRODUCERS IN NUTRITION OF GROWING PIGS

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*SUMMARY: The effects of nutrition using complete mixtures from five producers on production performance, digestibility of nutrients and cost of 1 kilogram of gain in nutrition of growing pigs were investigated. Obtained results showed that: the best pig production is realized using control mixture A, slightly lower results with diet B, followed by mixtures C, D and E. Degree of utilization of dry, organic matter and protein was best in diets A and B, and slightly lower in remaining C, D and E diets. The cheapest gain was realized by using mixtures A and C, followed by mixture B, and the least favourable cost of gain was recorded in pigs fed diets D and E, without any established differences between them. In general, obtained results showed that by using the mixtures from various manufacturers certain differences in production performance were established, also in the degree of utilization of nutrients and cost of kilogram of gain in growing pigs.*

**Key words:** quality of mixtures, various producers, pigs, growth.

### INTRODUCTION

For extensive, efficient and economical production, as well as preservation of pig health, the requirements for about 40 different nutrients, where in addition to energy, also requirements for 10 amino acids, 15 vitamins, 15 mineral substances have to be fulfilled, and also use of additives is desirable. One part of the nutrient requirements animals meet by consuming natural food, but some have to be added in form of synthetic substances.

Previous researches of the quality of vitamin-mineral pre-mixtures showed the

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presence of differences in production of sows and piglets (Živković et al., 2010) and fattening pigs (Živković et al., 2010).

Objective of this paper was to study comparatively quality properties of complete mixtures from various manufacturers in nutrition of growing pigs.

## MATERIAL AND METHODS

The study which included total of 108 growing pigs of Swedish landrace breed, and initial body mass of approx. 30 kg, was carried out on Experimental pig farm of the Institute for Animal husbandry, Belgrade-Zemun.

Based on standard criteria, origin, sex and initial mass, piglets were distributed in groups taking into consideration the uniformity of their age and body masses, and also to avoid placing siblings in same groups. Every group contained 24 animals, with even sex ratio.

Animals were fed flour mixtures and had access to water ad libitum. First, control group, was fed farm mixture produced in the feed mill of the Institute for Animal Husbandry. The remaining four groups of animal (the exception for E group) were fed mixtures produced by four different animal feed producers in Serbia.

In addition to production performance, in the trial also the utilization of nutrients in pig nutrition was studied. Digestibility of nutrients was analyzed using the direct method with  $Cr_2O_3$  markers, when pigs reached body mass of around 50 kg.

In evaluation of obtained results the following parameters were considered: average daily gain, use of food per feeding day and per animal and use of food per 1 kg of gain, utilization of dry, organic matter, ash, crude proteins, ether extracts, fibre and NFE (nitrogen free extracts) in the diet. At the end of fattening, based on the cost of mixtures and realized feed conversion ratio, the cost of 1 kilogram of gain of pigs in trial was calculated.

Obtained pig growth results, coefficients and digestibility of nutrients were statistically processed by variance analysis and average values, by using t-test.

## RESULTS AND DISCUSSION

In the trial, the effect of nutrition using the mixtures from five animal food manufacturers on production performance, digestibility of nutrients and the cost of kilogram of gain in growing pigs was studied.

### *a) performance*

Obtained results (tab. 1) showed that the first, control group of pigs (producer A), in the initial fattening period, realized the best daily gain, with good daily food intake and the lowest use of food per 1 kg of gain. Use of other mixtures lead to lower gain, in average by 8.8% in case of food producer B, by 12.6% in producer C, by 24.5% in producer D ( $P < 0.01$ ). The lowest gain was recorded in group of pigs fed mixture from E producer, which was by 25.4% lower compared to the control mixture.

Table 1. Performance of growing pigs in the experiment  
 Tabela 1. Proizvodni pokazatelji kod svinja u porastu u eksperimentu

Group/Grupa	Growing Pigs, 30-55 kg/Svinje u porastu, 30 – 55 kg				
	1 control/ kontrola	2	3	4	5
Feed producer/Proizvođač hrane	A	B	C	D	E
Av. daily gain/Pros dnevni prirast, %	100.0 <sup>A*</sup>	- 8.8 <sup>b</sup>	- 12.6	- 24.5 <sup>Ab</sup>	- 25.4
Daily Feed Intake/Dnevna konzum., %	100,0	+ 11.0	+ 9.8	0	- 7.5
Feed conversion/Konverzija hrane, %	100.0	+ 23.1	+ 26.3	+ 20.2	+ 21.5

\* The small letter over the average value designate the statistical difference on the level  $P < 0.05$ , and the big one on the level  $P < 0.01$ /Ista mala slova iznad redova označavaju statistički značajnu razliku na nivou  $P < 0.05$ , a velika slova na nivou  $P < 0.01$ .

Animals fed mixtures produced by B and C producers consumed by 11.0% and 9.8%, respectively, more food than the control group and the group of pigs fed mixture D, for which no differences were established. Lower food intake by average 7.5% compared to the control group was established in the group of pigs fed mixture of the producer E.

The best feed conversion ratio was realized by animals fed the control mixture, whereas the remaining four pig groups consumed from 20.2 to 26.3 (respectively 20.2% - D, 21.5% - E, 23.1% - B and 26.3% - C producer).

#### b) digestibility of nutrients

Table 2. Digestibility of nutrients in the experiment, %  
 Tabela 2. Stepen iskorišćavanja hranljivih materija u eksperimentu, %

Group/Grupa	Growing Pigs, 30-55 kg/Svinje u porastu, 30 – 55 kg				
	1 control/kontrola	2	3	4	5
Feed producer/Proizvođač hrane	A	B	C	D	E
Dry matter/Suva materija	75.9	77.4	75.2	74.4	72.5
Organic matter/Organska materija	80.8	81.2	78.6	77.9	77.0
Ash/Pepeo	27.0 <sup>ABC*</sup>	38.6 <sup>A</sup>	24.8 <sup>BDE</sup>	34.6 <sup>DF</sup>	16.7 <sup>CEF</sup>
Crude protein/Sirovi protein	72.3 <sup>a</sup>	72.1	70.3 <sup>b</sup>	70.6 <sup>c</sup>	62.7 <sup>abc</sup>
Ether extract/Sirove masti	64.5 <sup>ab</sup>	66.1 <sup>c</sup>	71.3	72.1 <sup>ad</sup>	77.7 <sup>bcd</sup>
Fiber/Celuloza	43.1 <sup>A</sup>	47.3 <sup>B</sup>	29.4 <sup>C</sup>	45.1 <sup>ABCd</sup>	35.3 <sup>d</sup>
N. F. E./B. E. M.	85.8 <sup>a</sup>	87.9 <sup>BC</sup>	86.3 <sup>BD</sup>	84.2 <sup>CD</sup>	85.4

\*The small letter over the average value designate the statistical difference on the level  $P < 0.05$ , and the big one on the level  $P < 0.01$ /Ista mala slova iznad redova označavaju statistički značajnu razliku na nivou  $P < 0.05$ , a velika slova na  $P < 0.01$ .

Degrees of utilization of dry and organic matter, as well as proteins, were according to following order: animal food producers A and B followed by C, D and E (tab. 2). In regard to ether extracts, the utilization was according to following order: E, D, C, followed by A and B without established differences. In regard to ash, the best use was recorded in group of pigs fed diet D, followed by pigs fed diets B, A, C and E, and in fibre, the order was following: B, D, A, E and C. Nitrogen free extracts were best used

by pigs fed diet B, followed by C, and A and E without significant differences, and the lowest degree of utilization of these nutrients was determined in mixture D.

c) economical indicators

The calculation of cost of mixtures showed (tab. 3) that the mixtures C, B and D were cheaper and the mixture E more expensive than the control diet. Taking into consideration the food intake per 1 kg of realized body gain, it was established that the cost of 1 kg of gain was the most favourable when the diet A was used (control), and slightly more expensive gain (by 1.1%) when the diet C was used, whereas the remaining mixtures, B – by 17.1%, E – by 23.2% and D – by 23.8% caused increase of cost of gain compared to the cost of gain in animals fed the control mixture.

Table 3. The price of 1 kg gain of growing pigs in the experiment

Tabela 3. Cena 1 kg prirasta kod scinja u porastu u eksperimentu

Group/Grupa	Growing Pigs, 30-55 kg/Svinje u porastu, 30 – 55 kg				
	1 control/kontrola	2	3	4	5
Feed producer/Proizvođač hrane	A	B	C	D	E
The price of mixture/Cena smeše, %	100.0	- 4.9	- 20.0	- 3.0	+ 1.4
Feed conversion/Konverzija hrane, %	100.0	+ 23.1	+ 26.3	+ 20.2	+ 21.5
The price of 1 kg of gain/ Cena 1 kg prirasta, %	100.0	+ 17.1	+ 1.1	+ 23.8	+ 23.2

In regard to the quality of studied mixtures in fattening pigs, in present research, even though all nutrients are important, the attention of researchers is mainly focused on energy, proteins, vitamins and micro elements, as well as additives. It was established long time ago (Braude et al., 1960) that different proteion levels in the mixtures can have impact on economical results in fattening of pigs. Other studies (Miller and Keith, 2011) do not suggest gradual increase of crude protein content by 17% to 27% in mixtures. It is desirable to combine the positive properties of feeds, for instance soybean meal and fodder peas (Chrenková et al., 2011) or use of sorghum (Hale and Lyman, 1961).

It is not necessary to increase protein content in the mixtures (Sokha et al., 2008) but it is necessary to increase dietary amino acid levels in concept with increase in energy content (Chiba et al., 1991; Mitchell et al., 2011). Provided that energy requirements are met, better production in the optimum environment temperatures can be expected (Noblet et al., 1985), and in the mixtures the content of lysine can slightly be reduced (Jin et al., 2010) with maximum share of this amino acid in synthetic form of up to 0.3% in the mixtures (Hale and Lyman, 1961). Interaction between energy level and sex of fatteners was observed for voluntary feed intake, daily gain and final body weight (Fagunes et al., 2009). Role and importance of the quality of vitamin- mineral pre-mixtures (Zlatic, 1983; Živković and Kovčín, 1983) depend on the genetic potential, housing and environment conditions, health, etc. (Uremović et al., 1985; Kovčín, 1992; Kasalica et al., 1995; Pomar et al., 2009). The optimum nutrient density of the feed chosen will depend upon the efficiency of feed utilization, the cost of the feed and the income derived from the end product (Ferguson et al., 1999).

In general, results obtained in this study showed that use of mixtures manufactured by five different producers resulted in differences in the performance, degree of utilization of nutrients and the cost of kilogram of gain of growing pigs.

## CONCUSLION

The effects of nutrition of growing pigs with the mixtures produced by five different producers on production performance, digestibility of nutrients and cost of kilogram of gain were studied.

Obtained results showed that:

- The best production is realized in pigs fed control mixture A, slightly lower production with mixture B, followed by mixtures from producers C, D and E.
- Degree of utilization of dry organic matter and proteins was the best in mixtures A and B, and slightly lower in remaining mixtures C, D and E.
- The cheapest gain was realized in pigs fed mixtures A and C, followed by mixture B, and the least favourable cost of gain in pigs was recorded in group of pigs fed mixtures D and E, without any established differences between the two groups.

In general, results obtained in this study showed that use of mixtures manufactured by different producers resulted in differences in production performance, degree of utilization of nutrients and cost of kilogram of gain of growing pigs.

## REFERENCES

- BRAUDE, R., TOWNSEND, M. Jill, HARRINGTON, G., ROWEL, L: Effect of different protein contents in the rations of growing-fattening pigs. *The Journal of Agricultural Science*, 55:175-181, 1960.
- CHIBA, L., LEWIS, A.J., PEO, E.R. Jr.: Amino Acid and Energy Interrelationships in Pigs Weighing 20 to 50 Kilograms: 1. Rate and Efficiency of Weight Gain. *Journal of Animal Science*, 69:694-707, 1991.
- CHRENKOVÁ, M., FORMELOVÁ, Z., CHRASTINOVÁ, L., F'LAK, P., ČEREŠŇÁKOVÁ, Z., LAHUČKÝ, R., POLÁČIKOVÁ, M., BAHELKA, I.: Influence of diets containing raw or extruded peas instead soybean meal on meat quality characteristics in growing-finishing pigs. *Czech- J. Anim. Sci.*, 56(3)119-126, 2011.
- FAGUNDES, A.C.A., GOMES da SILVA, R., GOMES, J.D.F., SOUZA, L.W. de O., FUKUSHIMA, A.: Influence of environmental temperature, dietary energy level and sex on performance and carcass characteristics of pigs. *Braz. J. Vet. Res. Anim. Sci.*, 46(1)32-39, 2009.
- FERGUSON, N.S., GOUS, R.M., NELSON, L.: Determination of responses of growing pigs to dietary energy concentration. *S. Afr. J. Anim. Sci.*, 29(3)222-236, 1999.
- HALE, F., LYMAN, C.M.: Lysine supplementation of sorghum grain-cotton-seed meal rations for growing-fattening pigs. *Journal of Animal Science*, 20(4)734-736, 1961.
- JIN Y.H., OH H.K., PIAO, L.G., JANG, S.K., CHOI, Y.H., HEO, P.S., JANG, Y.D., KIM, Y.Y.: Effect of Dietary Lysine Restriction and Energy Density on Performance, Nutrient Digestibility and Meat Quality in Finishing Pigs. *Asian-Aust. J. Anim. Sci.*, 23(9)1213-1220, 2010.
- KASALICA, T., ŽIVKOVIĆ, B., POPOV, D., MILIDRAGOVIĆ, N., JERKOVIĆ, B.: Uloga, značaj i potrebe vitamina u ishrani svinja. IX Savetovanje agronoma i tehnologa, Smederevo, pp. 118-123, 1995.
- KOVČIN, S., GAGRČIN, M., JOKIĆ, Ž.: Značaj sadržaja vitamina u premiksi krmača. III Savetovanje o primeni premiksa u stočnoj hrani, Donji Milanovac, 1992.
- LY, N.T.H., LOC, N.T., HANG du T., THUAN, T.H. : Effect of dietary protein level on

the performance of growing pigs under village conditions in Central Vietnam. [www.mekarn.org/sarec03/lyhue.htm](http://www.mekarn.org/sarec03/lyhue.htm) - Cached - Similar.

MILLER, R.C., KEITH, T.B.: The growth and fattening of swine. *Journal of Nutrition*, 419-429, 2011..

MITCHELL, J.R. Jr., BECKER, D.E., JENSEN, A.H., NORTON, H.W., HARMON, B.G.: Caloric density of the diet and the lysine need of growing swine. Downloaded from [jas.fass.org](http://jas.fass.org) by guest in October 20, 2011.

NOBLET, J., DIVIDICH, Le j., BIKAWA, T.: Interaction between energy level in the diet and environmental temperature on the utilization of energy in growing pigs. *Journal of Animal Science*, 61(2)452-459, 1985.

POMAR, C., HAUSCHILD, L., ZHANG, G.H., POMAR, J., LOVATTO, P. A.: Applying precision feeding techniques in growing-finishing pig operations. *R. Bras. Zootec.*, Vol. 38, N° spe Viçosa, 2009.

REA, J. C., VEUM, T. (1993): Evaluating vitamin Premixes for Swine. University of Missouri.

SOKHA, T., PRESTON, T.R., BORIN, K.: Effect of different protein levels derived from mixtures of water spinach and fresh sweet potato vines in basal diets of broiler chickens or cassava root meal and rice bran for growing pigs, *????*, *Livestock Research for Rural Development*, 20, 2008.

UREMOVIĆ, M., ŽIVKOVIĆ, S., KOVČIN, S., BEUKOVIĆ, M.: Efekat premiksa različitog porekla uz dodatak holina i biotina na reproduktivnu proizvodnju krmača. VII Skup svinjogojaca Jugoslavije. Cetinje, 45-49. *Agroznanje* 3, 1985.

ZLATIĆ, H.: Značaj i uloga premiksa u ishrani stoke i proizvodnji stočne hrane. *Krmiva*, 1-2:8-10, 1983.

ŽIVKOVIĆ, B., KOVČIN, S., GLUHOVIĆ, M., KOSOVAC, O., VLAHOVIĆ, M., FABJAN, M.: Značaj i primena premiksa u proizvodnji svinjskog mesa. V savetovanje o primeni premiksa u stočnoj hrani, Velika Plana. Veterinarski Zavod, Zemun, 12-18, 1996.

ŽIVKOVIĆ, B., RUSMIROVIĆ, D., STANOYLOVIĆ, R.: Efekti premiksa sa povećanim koncentracijama vitamina i mikroelemenata u ishrani svinja u tovu. *Euro Farmer*, 5-6:26-30, 2005.

ŽIVKOVIĆ, B., MIGDAL, W., OLGA KOSOVAC, RADOVIĆ, Č., PEJČIĆ, S., DELIĆ, N.: The effects of different pre-mixtures in nutrition of sows and piglets. *Biotechnology in Animal Husbandry*, 26(1-2)47-55, 2010.

ŽIVKOVIĆ, B., W. MIGDAL, W., KOSOVAC, O., RADOVIĆ, Č., PEJČIĆ, S.: The effect of different pre-mixtures in nutrition of fatteners. *Biotechnology of Animal Husbandry*, 26(5-6)353-360, 2010.

ŽIVKOVIĆ, S., KOVČIN, S.: Vitamini i mikroelementi u ishrani svinja. *Krmiva*, 1-2, 26-30, 1983.

## EFEKTI POTPUNIH SMEŠA RAZLIČITIH DOMAĆIH PROIZVOĐAČA U ISHRANI SVINJA U PORASTU

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### Izvod

Ispitivani su efekti ishrane smešama od pet proizvođača na proizvodne rezultate, svarljivost hranljivih materija i cenu kilograma prirasta u ishrani svinja u porastu. Dobijeni rezultati su pokazali da se: najbolja proizvodnja kod svinja postiže ishranom kontrolnom smešom A, nešto slabiji obrokom B, pa smešama C, D i E proizvođača. Step en iskorišćavanja suve, organske materije i proteina je bio bolji kod obroka A i B a nešto slabiji kod preostalih C, D i E obroka. Najjefiniji prirast je ostvaren kod A i C smeša , zatim sledi kod smeše B a najnepovoljnije cenu prirasta svinje su bile na obrocima D i E između kojih nije bilo razlika. U celini dobijeni rezultati u ovom radu su pokazali da se, korišćenjem smeša različitih proizvođača u Srbiji ostvaruju razlike u proizvodnim rezultatima, stepenu iskorišćavanja hranljivih materija i ceni kilograma prirasta svinja u porastu.

**Ključne reči:** kvalitet smeša, razni proizvođači, svinje, porast.

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