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### ***SUBSTANTIATION OF THE COMPOSITION OF INTERMIX PREMIX AND ITS PRODUCTIVE EFFECT IN PIG DIETS***

*It is shown that a positive productive effect has been obtained when growing young pigs for meat feeding the diets supplemented with new Intermix premixes. Generalized data on all phases of feeding indicate that the average daily gain of experimental animals exceed their control values by 81 g ( $P < 0.001$ ) under their rate of 700 g per day.*

*In a 146-day growing period, the live weight of pigs in the experimental group was 11.4 kg higher than that of the control animals ( $P < 0.001$ ). Correspondingly, feed consumption increased by 1 kg or 11.54%.*

*The results of the slaughter showed that the probable increase compared with the control value was obtained by the indices of pre-slaughter live weight (by 11.4 kg), slaughter weight (by 16.63 kg), carcass weight (by 14.8 kg), and internal fat weight (by 0.17 kg).*

*The data of the morphological composition of carcasses indicate an increase in the content and output of adipose tissue under almost the same amount of muscle and bone tissue in animals when feeding experimental premix Intermix in the diets.*

**Keywords:** young pigs, premix, Intermix, feeding, productivity, product quality

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**Formulation of the problem.** Implementation of the genetic potential of modern breeds of pigs is possible under complete supply of grown young animals with all necessary elements of nutrition. And this is possible due to application of enrichment mixtures, in particular premixes, for livestock feeding [1]. Supplementation of pig diets with them helps to maximize the use of nutrients, positively affects their digestion and assimilation. In addition, it leads to rational and economical use of feeds, enhancement of livestock productivity and improvement of product quality. Livestock breeding under these conditions is becoming economically feasible [3, 8].

At present, the peculiarity of production of new Intermix premixes is based on the fact that the chemical composition of feeds available in a particular region or farm, current feeding standards with feed estimates in energy feed units (EFU), optimal maintenance conditions as well pig genotype are taken onto consideration when developing premix composition [4, 7].

The carbohydrate component of the feed is provided at the expense of grain of cereal crops, while the protein one is ensured through the introduction of pea, soybean, meal, etc. And the rest of the biologically active substances required are introduced at the expense of additives, i.e. premixes or biological vitamin and mineral additives (BVMA).

When feeding new premixes it is supposed to study the indicators of the performance and quality of the product. This issue was actively studied by the

scientists in the recent past [1, 13], and there are some modern publications [5, 6].

**Analysis of recent research and publications.** Modern trends in the development of scientific substantiation of the composition of vitamin and mineral premixes, the application of which increases biological value of cereal feeds of the diet and effectiveness of their use when growing early weaning piglets and till subsequent feeding for meat are associated with the biological peculiarities of postnatal ontogenesis, since each period is characterized by its metabolism and the rate of weight gain, and hence the need for nutrition elements.

The need for premixes is especially important in modern livestock breeding, when feeding of animals, in particular pigs, tends to be of grain type with a minimal set of ingredients. Preferably, it is grain of barley, wheat and maize of various varieties and hybrids. Under such conditions of feeding it is not possible to provide animals with the necessary nutrients and biologically active substances. Real conditions for pork production also require the improvement of the existing types of premixes and development of new ones taking into account the genetic background of animals, ecological aspect as well as natural and climatic zone of pig breeding. Thus, for the conditions of the Vinnytsia region, which belongs to the right-bank Forest-Steppe, grain diets from barley, wheat and maize cannot be balanced by the content of lysine, methionine, tryptophan, copper, iodine, cobalt and numerous vitamins. Therefore, the diets must be supplemented with them in the form of premixes.

Modern economic and environmental conditions for pork production are raising the requirements for obtaining high quality food products. Therefore, when developing new premixes and other livestock feed additives, their composition is grounded based on the influence of some ingredients on the organism, growth and development of animals as well as product quality. Indeed, the desire to achieve the highest gains sometimes leads to deterioration of pork quality. Most often, it can be a reduction in the hydration ability of the carcass muscle tissue [6].

The use of premixes for livestock feeding enables to increase the production of livestock products by 25-30%, and at the same time to reduce feed consumption almost twice, which indicates their high efficiency [8]. All this can be achieved through premix production by means of a reasonable selection of raw materials.

When developing each new type of premixes, there arises a need to test its effectiveness in livestock feeding. And this is performed through scientific experiments on a limited number of livestock. Therefore, the study of the effectiveness of new Intermix premixes is relevant in terms of the expediency of their future application in feeding pigs [13].

**Materials and methods of research.** The investigated premixes were produced in the production sector of the Ukrainian firm LLC «Interagrotech» (Vinnytsia). This company produces premixes and BVMA for all technological groups of farm animals under the brand «Intermix». Feeding programs for farm

animal are developed on the basis of the up-to-date scientific achievements in collaboration with specialists in livestock breeding. The company's products provide quick growth and effective assimilation of feeds due to optimally balanced nutrients, essential amino acids, vitamins, enzymes and mineral compounds. All products of the company LLC "Interagrotech" are produced of high quality raw materials under constant control of the modern laboratory. A search for cheaper feed ingredients is performed to achieve high production indices under the lowest production cost [2].

The scientific experiment on the theme of work and production testing were carried out on pigs of large white breed under conditions of the breeding farm of the state enterprise «Artemis» of Kalynivka region, Vinnytsia oblast 2017-2018.

The scientific experiment was carried out in two groups of young pigs of the large white breed according to the following scheme (Table 1).

The initial live weight was 14.5 kg. Each group consisted of 12 pigs selected after weaning from sows at a 45-day age.

Young pigs of the second group were fed with Intermix premix PV-4%, Intermix Sun-3% and Intermix Sun-2.5%, respectively, in the feeding phase of the basic period of the experiment. Animals of the first (control) group at different phases of the basic period in the basic diet consumed Euromix-pig premix produced by the company «Eurofeed modern feeding» appointed according to the requirements of each feeding phase [14].

Table 1

Scheme of the scientific farming experiment

Groups	Number of animals, heads	Nature of feeding by the periods and phases of feeding			
		comparative	basic		
		14-20 kg	20-35 kg	35-65 kg	65-110kg
1 control	12	BD*, Intermix premix WP-1.25%	BD, Euromix-pig 35-0.5%	BD, Euromix-pig 65-0.5%	BD, Euromix-pig 120-0.5%
2	12	BD, Intermix premix WP-1.25%	BD, Intermix WP-4%	BD, Intermix FP-3%	OP, Intermix FP-2,5%

Note: \*BD – basic diet; WP – weaned pigs, FP – fattening pigs and growing pigs

The experiment consisted of the comparative and basic periods. The daily set of animal feeds of the second group consisted of the fodder flour of barley (44%), wheat (38%) and soybean meal (18%) and was enriched with the premix according to the experimental scheme. Total nutrition value of the diet in all phases of growth in energy feed units corresponded to the norm. The diets were balanced by 30 indicators, including 10 of energy, mineral and vitamin nutrition elements. Animals were kept in groups in a typical pig breeder. They were fed twice a day with the free access to water during the day. Pigs were weighed taking into account feeding phases. Records of feed consumption were taken every day. Pig maintenance and feeding were organized according to the rules for pig farms. At the end of the

scientific experiment, a control slaughter of pigs (3 heads from each group) was carried out, followed by carcass boning for determination of meat quality indicators – morphological composition of carcasses. Determination of the indicators of slaughter and quality of meat was carried out according to generally accepted methods [12, 15]. The premix effect on the productivity, fattening, slaughter, meat and fat rates were examined in the experiment.

Rationing of feeding was carried out in energy feed units (EFU) in accordance with the new standards, which are given in the relevant guides [3, 13]. Biometric processing of digital material was carried out by M. O. Plokhinskiy [11].

**The purpose of the research** is to study the efficiency of feeding Intermix premix developed for a low-ingredient diet of young pigs grown for meat.

**Research results.** Nowadays, pork production at the farms and households is based on the use of feeds produced at them. As a rule, it is grain forage from barley, wheat and corn. The diet of this grain mixture is inadequate, so there is a need to enrich it with feed additives. While only grain cereals are grown at the farm, it is necessary to supplement pigs diets from these crops with BVMA. However, if soybean or sunflower are grown as protein components, the diet from the farm's feeds is balanced by its supplementation with premixes. It is economical to produce such grain mixtures for feeding pigs directly on the farm.

Supplementation of low-ingredient cereal diet with a small amount of the premix requires a proper mixing with the diet components.

Thus, Intermix premixes are complex preparations for raising young pigs in different phases of feeding, which are the mixture of vitamins, macro- and microelements, active biological additives and filler [15].

They are developed for the diets consisting of the fodder flour of barley, wheat, and soybean meal. Chemical composition of the ingredients as for the need of animals of the corresponding weight group for nutrients and biologically active substances is taken into account. Diet supplementation with enzymes assists in digestive processes, acidifying substances reduce the pH in the stomach, probiotics ensure reconstruction of intestinal villi and protect the gastrointestinal channel from the development of bacteria from the group of *Colima Salmonella*, aromatizers contribute to better feed consumption, vitamins affect the metabolism and strengthen the immune system, etc. All this affects the increase in the productive effect of low-ingredient concentrated diets, as shown by the following studies.

From the standpoint of modern ideas of the complete and balanced feeding of pigs, the need for supplementation of grain mixtures with premixes is sufficiently substantiated and causes no doubt, since a small amount of grain ingredients is used for animal feeding in spite of their sufficient reserves at the farms.

Table 2

**Qualitative composition of the investigated Intermix premix**

Indicator	Intermix premix WP 4%
	FP-1%
Metabolizable energy MJ	6.55
Crude protein, g	370
Crude fat, g	9.3
Calcium, g	104
Sodium, g	19
Phosphorus, g	—
Lizin, g	265
Methionine + Cystine, g	195
Treonin, g	45
Tryptophan, g	—
Iron, mg	11,703
Zinc, mg	11,700
Manganese, mg	6,480
Copper, mg	1,980
Iodine, mg	126
Selenium, mg	39.6
Cobalt, mg	72
Vitamin A, MO	1,340,000
D3, MO	201,000
E, g	5,350
K <sub>3</sub> , mg	202
B <sub>1</sub> , mg	201
B <sub>2</sub> , mg	402
B <sub>6</sub> , mg	302
B <sub>12</sub> , mcg	3,015
Biotin, mcg	13.4
Vitamin C, mg	—
Niacin, mg	3,600
Calcium pantheteate, mg	1,005
Folic acid, mg	278
Choline, mg	20,028

Application of new Intermix premixes when growing young pigs with different live weight within 14-100 kg and more in low-ingredient cereal diets contributes to an increase in the fattening characteristics of animals (Table 3).

Relatively better results were observed in animals of the experimental group that consumed Intermix premix, in particular, average daily gains increased by 81 g or 13.08%, feed consumption per kg of gain reduced by 0.54 EFU or 11.54%.

On average over 146 days of growing, 2.9 EFU per animal were used every day. Under average daily gains of 619 grams, 4.68 EFU were used per kg of young pig gain in the control group. In the control group, feed consumption per kg of gain comprised 4.14 EFU.

Table 3

Performance of young pigs,  $M \pm m$ ,  $n=12$

Indicator	Groups	
	1 control	2 experimental
Live weight, kg:		
at the beginning of the period	14.5±0.29	14.0±0.29*
at the end of the period	104.9±0.30	116.2±0.29***
Duration of the period, days	146	146
Weight gain:		
absolute, kg	90.3±0.13	102.2±0.16***
average daily, g	619±50	700±30
± before control, g	–	+81
± before control, %	–	+13.08
Feed consumption per kg of weight gain, EFU	4.68	4.14
± before control, EFU	–	-0.54
± before control, %	–	-11.54

Consequently, under similar conditions of care and maintenance, the animals of the experimental group were consuming the diet feed by 11.54% better per unit of weight gain due to the use of feed additive Intermix.

Thus, assessing the performance of young pigs grown for meat, it can be concluded that feeding of Intermix premix in the process of growing ensures the level of animal performance in accordance with the requirements of the intensive pig breeding technology.

From the technological point of view, qualitative traits of pork are expressed by quantitative indicators. They are as follows: slaughter weight, carcass weight, slaughter output, mass of internal organs, namely, byproducts, thickness of the pork fat, morphological composition of meat – amount of lean meat, fat and bones – in specific weight and percentage, whereas from the point of view of commodity research, pork quality is characterized by its physical and chemical properties.

Application of Intermix premix for feeding young pigs had a positive effect on the slaughter rates.

They were significantly higher in animals of the second group, which were fed with Intermix premix in their diets in all phases of feeding up to 116 kg. Under these conditions, experimental animals increased their pre-slaughter live weight by 11.4 kg or 10.87% ( $P<0.01$ ), slaughter weight by 16.6 kg or 20.5% ( $P<0.01$ ).

The increase in the carcass weight in the second group was rather significant – by 14.8 kg or 21.9% ( $P<0.01$ ). There was also observed an increase in the weight of by-products in the animals of the experimental group, which had a direct correlation with the live weight increase.

Thus, it can be predicted that consumption of Intermix premix provided a higher level of metabolic processes, which contributed to intensification of the synthesis and accumulation of plastic substances in the pig body, i.e. their growth.

Table 4

Slaughter indicators of pigs,  $M \pm m$ ,  $n=3$ 

Indicator	Групи	
	1 control	2 experimental
Pre-slaughter live weight, kg	104.8 $\pm$ 1.46	116.2 $\pm$ 2.41**
Slaughter weight, kg	80.85 $\pm$ 0.99	97.48 $\pm$ 2.25**
Carcass weight, kg	67.30 $\pm$ 0.92	82.1 $\pm$ 2.17**
Slaughter output, %	77.14 $\pm$ 2.43	83.9 $\pm$ 1.4
Head with ears, kg	5.16 $\pm$ 0.23	5.31 $\pm$ 0.19*
Legs, kg	1.29 $\pm$ 0.77	1.61 $\pm$ 0.09
Skin and tail, kg	6.05 $\pm$ 0.46	7.24 $\pm$ 0.19
Internal fat, kg	1.05 $\pm$ 0.14	1.22 $\pm$ 0.05

Measurement of the thickness of the hypodermic pork fat in different parts of the carcass showed that fat formation was more intensive in pigs fed with Intermix premix (Table 5).

The thickest pork fat was observed in the animals of the second group, especially on the neck and back – by 29.1 and 35.4% ( $P < 0.05$ ), respectively, while the thickening of the pork fat on the shoulder and sacrum comprised 16.6 and 18.6% ( $P < 0.05$ ).

Table 5

Pork fat thickness, cm,  $M \pm m$ ,  $n=3$ 

Indicator	Groups	
	1 control	2 experimental
On the neck	2.27 $\pm$ 0.15	2.93 $\pm$ 0.11*
On the shoulder	2.71 $\pm$ 0.09	3.16 $\pm$ 0.12*
On the back	1.92 $\pm$ 0.19	2.60 $\pm$ 0.07*
On the sacrum	1.77 $\pm$ 0.09	2.10 $\pm$ 0.09*
On the belly	2.11 $\pm$ 0.11	2.28 $\pm$ 0.12
Average	2.15 $\pm$ 0.04	2.57 $\pm$ 0.38

Indicators of the pork fat thickness as well as the mass of internal fat suggest that Intermix premix consumed by the animals of the second group causes the intensification of fat metabolism. Hence, in terms of the absolute live weight gain during the experiment, the fat content of these animals is the highest.

By the indicators of the morphological composition of the carcass, animals of the second group prevail. In absolute terms, they had more muscle tissue ( $P < 0.001$ ) and adipose tissue ( $P < 0.01$ ) under relatively equal number of bones (Table 6).

Table 6

Carcass weight and morphological composition,  $M \pm m$ ,  $n=3$ 

Indicator	Groups	
	1 control	2 experimental
Carcass weight, kg:		
at slaughter	69.93 $\pm$ 0.92	84.0 $\pm$ 2.17**
at boning	67.60 $\pm$ 1.39	81.84 $\pm$ 2.06**
Weight loss: kg	2.33 $\pm$ 0.48	2.16 $\pm$ 0.13
%	3.33 $\pm$ 0.73	2.57 $\pm$ 0.27
Morphological composition, kg:		
muscle tissue	53.56 $\pm$ 0.64	63.85 $\pm$ 0.62***
adipose tissue	4.21 $\pm$ 0.22	7.83 $\pm$ 0.82**
bone tissue	9.83 $\pm$ 0.69	10.16 $\pm$ 0.41
Output, %:		
muscles	79.23 $\pm$ 2.04	78.02 $\pm$ 1.8
fat	6.23 $\pm$ 0.15	9.57 $\pm$ 0.44**

**Conclusions and prospects for further research.** Intermix premix that has been developed to be used for feeding young pig grown for meat in low-ingredient cereal diets of fodder flour of barley, wheat and soybean meal provides animals with essential nutrition elements of energy, mineral and vitamin nature.

Feeding of Intermix premix at the rate of 4%, 3% and 2.5% in accordance with the phases of animal growth during a 146-day period of growing contributes to the increase in average daily weight gains by 81 g or 13.8% compared to control with Euromix-pig premix in the diet.

The use of Intermix premix for young pig feeding causes a reduction in feed consumption by 0.54 energy feed units or by 11.54% per kg of weight gain.

Further scientific research should be targeted at searching for the ways aimed to reduce the cost of some components of Intermix premix and the possibility of changing some components by their synthesized analogues.

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### **АННОТАЦІЯ** **ОБГРУНТУВАННЯ СКЛАДУ ПРЕМІКСА ІНТЕРМІКС ТА ЙОГО ПРОДУКТИВНА ДІЯ** **В РАЦІОНАХ СВИНЕЙ**

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*Показано, що при вирощуванні молодняку свиней на м'ясо на раціонах з новими преміксами Інтермікс одержано позитивний продуктивний ефект. Узагальнені дані за всі фази годівлі свідчать про те, що середньодобові прирости дослідних тварин переважають їх значення у контрольних відповідно на 81 г ( $P < 0,001$ ) при їх рівні 700 г на добу.*

*При 146-добовому періоді вирощування жива маса свиней дослідної групи була на 11,4 кг більшою, ніж у контрольних тварин ( $P < 0,001$ ). Відповідно зменшувались і витрати корму на 1 кг приросту – на 11,54%.*

*Результати забою показали, що вірогідне збільшення в порівнянні з контрольним значенням одержано за показниками передзабійної живої маси (на 11,4 кг), забійної маси (на 16,63 кг) маси туші (на 14,8 кг) та маси внутрішнього жиру на (0,17 кг).*

*Дані морфологічного складу туш свідчать про збільшення вмісту і виходу жирової тканини за практично однакової кількості м'язової і кісткової тканин у тварин при згодовуванні дослідного премікса Інтермікс в раціоні.*

**Ключові слова:** *молодняк свиней, премікс, Інтермікс, згодовування, продуктивність, якість продукції*

**Табл. 6. Літ. 15.**

**АННОТАЦИЯ**  
**ОБОСНОВАНИЕ СОСТАВА ПРЕМИКСА ИНТЕРМИКС И ЕГО ПРОИЗВОДИТЕЛЬНОЕ**  
**ДЕЙСТВИЕ В РАЦИОНАХ СВИНЕЙ**

*Дацюк И.В., кандидат с.-х. наук, старший преподаватель  
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*Показано, что при выращивании молодняка свиней на мясо в рационах с новыми премиксами Интермикс, получен позитивный производительный эффект. Общие данные по всех фазах кормления свидетельствуют о том, что среднесуточные приросты опытных животных преобладают их значение в контрольных соответственно на 81 г ( $P<0,001$ ) при их уровне 700 г на сутки.*

*При 146-суточном периоде выращивания живая масса свиней опытной группы была на 11,4 кг больше, чем у контрольных животных ( $P<0,001$ ). Соответственно уменьшались и расходы корма на 1 кг прироста – на 11,54 .*

*Результаты забоя показали, что достоверное увеличение по сравнению с контрольным значением получено по показателям предубойной живой массы (на 11,4 кг), убойной массы (на 16,63 кг), и массы туши (на 14,8 кг) и массы внутреннего жира на (0,17 кг).*

*Данные морфологического состава туши свидетельствуют об увеличении содержимого и выхода жировой ткани, при практически одинаковом количестве мышечной и костной тканей у животных при скормливании опытного премикса Интермикс в рационе.*

**Ключевые слова:** *молодняк свиней, премикс, Интермикс, скормливание, производительность, качество продукции*

**Табл. 6. Лит. 15.**

**Інформація про автора**

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