Journal of Engineering and Applied Sciences 12 (Special Issue 12): 9337-9340, 2017
ISSN: 1816-949X

The Influence of Tripoli as a Feed Additive on the Growth and Well-being of Suckling Pigs

Evgenia M. Ermolova, Yulia V. Matrosova, Dmitry S. Vilver,
Svetlana A. Gritsenko and Rinat R. Fatkullin
South Ural State Agrarian University, Chelyabinsr, Russia

Abstract: The study describes the use of tripoli as a feed additive in the rations of sows and suckling pigs at the dosages of 0.5, 1.0 and 1.5% in dry matter. The research showed that the dosages studied do not produce a significant effect on the dynamics of the live weight of animals during the gestation period. With the introduction of tripoli as a feed additive at the amount of 0.5, 1.0 and 1.5% of the dry matter into the ration, the best results in increasing the digestibility of crude protein, crude fiber, raw fat and nitrogen deposition in the body were reached with the use of tripoli at 1% in dry matter. The use of tripoli at 0.5% in dry matter increased the multiple births 10.8%, at 1.0% by 25.0% and at 1.5% by 13.0%. The optimal dose of tripoli in the rations of sows and piglets (1.0% in dry matter) ensured an increase in the safety of young animals during the suckling period by 17.1% and in the live weight of piglets by 9.3%. At the same time, the feed costs per piglet of the weaning age when using tripoli at a dose of 1.0% in dry matter decreased by 6.5-20.0% and the payments for food by the produce increased by 25.1-26.7%. The article was prepared within the framework of the state agreement of the Ministry of Education and Science of Russia of 3.10.2017 No. 14.610.21.0018 'development and implementation of the latest competitive domestic technologies in the field of genetics and animal breeding for intensive production of pig farming.

Key words: Sows, piglets, feed additive, tripoli, digestibility of nutrients, live weight, feeding costs

INTRODUCTION

Pig farming of the Russian Federation is a dynamically changing industry in the technological and selective breeding sectors. After poultry farming, it is the second animal husbandry sector designed to solve the main task of providing the country's population with meat (Ovchinnikov and Sitdikov, 2008; Tremasova and Sofronov, 2012; Bollarini, 1982; Rlise, 1982). The Ural Region ranks fourth at pork production in the Russian Federation. At the same time, the number of pig livestock in Chelyabinsk Region only has tripled in the past 5 years, reaching 807,000. The main livestock in the region is concentrated on large pig farming complexes; the animals are full-fed on wholesome mixed feed which makes it possible to fully realize the genetic potential of animals (Rakhimkulov and Ardashirov, 2009; Tomme, 1969; Hours *et al*., 1985). A deterrent factor for increasing pork production both in this country and throughout the world is the presence of mycotoxins in mixed feeds and their species composition and quantitative content is not always determinable. Mycotoxins adversely affect the animal's organism, reducing its immune status and making it susceptible to various diseases of infectious and non-infectious etiology; moreover, they adversely affect the digestibility and use of nutrients in the diet, the livestock well-being and the duration of economic use of animals (Ermolov, 2014; Kondrakhin, 2004; Kornienko and Savina, 2013; Martinez *et al*., 2011; Mysik, 2014).

In the prevention of mycotoxicosis, one of the most radical methods today is the use of mineral feed additives that possess high sorption, ion-exchange and immunostimulating properties. Among these natural aluminosilicates of the Urals Region is the tripoli of the Kamyshlovsky deposit of the Sverdlovsk Region, the reserves of which amount to hundreds of thousands of tons (Ermolov, 2013; Kostenko, 2011; Kramarenko and Ovchinnikov, 2006; Chabaev *et al*., 2013; Sheveleva, 1999).

A distinctive property of natural zeolites is their high sorption and ion-exchange properties. They reduce the antigenic and toxic load on the body and can serve as carriers of many biologically active substances (Gamal *et al*., 1985). These unexplored feed additives include the tripoli of the Kamyshlovsky deposit of the Sverdlovsk Region.

Corresponding Author: Evgenia M. Ermolova, South Ural State Agrarian University, Chelyabinsr, Russia

Aim of research: To study the influence of tripoli on gestating and suckling sows and of suckling pigs on their growth and well-being. The research tasks included:

- Determining the optimal dosage of tripoli in rations of sows and suckling pigs
- Determining the influence of tripoli on the growth and development of suckling pigs
- Comparing hematological parameters
- Calculating the economic indicators of the research

MATERIALS AND METHODS

Object of study: The experience was carried out on the basis of LLC 'Agrofirma Ariant'. Four groups of ten sows (Large White X Landrace) were formed, each at the age of 2 years and with a gestation period of 84 days. During the whole period of the experiment, against the basic diet for animals of all groups, the sows of the second group were getting additional tripoli in the amount of 0.5% while the sows of the third group were getting 1.0% and of the third 1.5% in dry matter. The feed supplement was given once a day in the morning in combination with mixed feed 'SK-1' and 'SK-2'.

Experiment scheme: Piglets obtained from the sows of experimental groups received tripoli together with mixed feed 'SK-3' starting from the 11th day of suckling at the studied dosages 0.5, 1.0 and 1.5% in dry matter. The dynamics of the sows' live weight was monitored by weighing each animal in the experiment on the 84th and 112th day of gestation, on the 5th day of the suckling period and during weaning. The studied reproductive functions of sows were: multiple births, the size of piglets and their safety till the weaning age. In sows of the late gestation period, according to the method of Ersnt State Institute of Animal Husbandry (Ovchinnikov and Sitdikov, 2008), a balance experiment was conducted on the study of digestibility and the use of nutrients in the diet. Biochemical blood tests were carried out sows of the late gestation period, 3 heads from each group, according to standard methods (Ermolov, 2013). From economic indicators, the cost of feeding and the feed payment by produce in both natural and value terms were calculated.

RESULTS AND DISCUSSION

The balance experience on sows of the late gestation period allowed calculating the digestibility ratios of the nutrients (Table 1).

Table 1: The digestibility ratios of the nutrients of sows of the late gestation period (%) ($X \pm S_x$, n = 3)

	Groups			
Indicators	1	2	3	4
Dry matter	72.3±0.64	71.9±0.09	72.9±0.55	72.9±0.13
Organic matter	73.7±0.19	73.4±0.06	74.3±0.05*	74.7±0.05**
Crude protein	72.3±0.25	75.5±0.44***	76.2±0.33***	75.9±0.21***
Raw fiber	27.7±0.41	29.1±0.40	32.1±0.28***	30.3±0.33***
Crude fat	42.3±0.24	43.8±0.84	45.7±0.79**	44.0±0.47*
Nitrogen-Free Extracts (NFE)	78.7±0.36	77.3±0.09*	78.0±0.01	78.9±0.15

*p≤0.05; **p≤0.01; ***p≤0.001

Tripoli in the sow's ration in the amount of 0.5% in dry matter increased the digestibility of crude protein by 3.2% (p = 0.001), in the amount of 1% in dry matter by 3.9%; the digestibility of raw fiber increased by 4.4% and of crude fat by 3.4% (p = 0.001). The amount of 1.5% increased the digestibility of all nutrients except for NFE but it was lower than in the third experimental group. The calculation of nitrogen balance in the organism showed that it was positive (Table 2).

The lowest losses of nitrogen via feces and urine were observed in the third and the fourth and 4experimental groups; as a result, the average daily nitrogen deposition in the body exceeded that of groups 1 and 2 by 2.6-3.4 g (p = 0.01) with higher utilization rates, both from the consumed and the digested amount. The various dosages of tripoli in the sow's ration had no adverse effect the average daily deposition of calcium and phosphorus in the body (the amounts were 5.9-6.4 g and 3.8-4.7 g, respectively).

The periodic blood study of the experimental animals showed that during the gestation period in the animals of the second two experimental groups the most drastic changes in metabolism were observed, expressed in hemoglobin increase by 3.3-6.8%, total protein increase by 8.4 and 14.1% (p<0.001), urea decrease by 0.52-0.55% (p = 0.01) and a decrease in the functional activity of the liver. Similar changes in metabolism were noted in the body of suckling sows, especially in animals that received tripoli at a dosage of 1.0% in dry matter.

Changes in metabolism during the gestation period did not significantly affect the dynamics of live weight which in group 1 on day 112 comprised 211.5 kg in group 2 212.3 kg in group 3 217.0 kg and in group 4 212.9 kg; during weaning it comprised, respectively 168.9, 169.7 173.9 and 169.9 kg, giving the loss of live weight during lactation in the amount of 20.6, 21.1, 19.9 and 21.9 kg.

Loss of live weight of sows during suckling largely depends on the litter size (Table 3) which in group 1 was at the level of 9.2 piglets in group 2,10.2 piglets in group 3,11.5 and in group 4, 10.4. The experimental groups

Table 2: Nitrogen balance in the organism of sows (average per animal a day, g) ($X \pm S_x$, n = 3)

	Groups			
Indicators	1	2	3	4
Consumed with feed	53.7	53.7	53.7	53.7
Excreted via. feces	13.9±0.15	14.8±0.08**	15.3±0.21**	15.2±0.17**
Digested	39.7±0.15	38.9±0.07***	38.4±0.21**	38.5 ±0.17**
Excreted via. urine	21.2±0.34	18.3±0.58**	17.2±0.27***	16.4±0.09***
Total excretion	35.1±0.27	33.0±0.64*	32.5±0.23***	31.7±0.23***
Deposited in the body	18.6±0.27	20.7±0.92	21.2±2.82	22.0±0.85**
Used (%)	34.6±0.50	37.4±0.76*	39.4±0.43**	41.0±0.43***
Of the consumed amount				
Of the digested amount	46.7±0.74	51.7±0.94**	55.1±0.61***	57.3±0.37***

Table 3: Reproductive functions of sows (average per head) ($X \pm S_x$, n = 10)

	Groups			
Indicators	1	2	3	4
Multiple births (piglets)	9.2±0.57	10.2±0.29	11.5±0.60**	10.4±0.60
Group (%)	100.0	110.8	125.0	113.0
Weight of piglets (g)	1085±14.14	1078±10.09	1121±13.37	1096±19.89
Group (%)	100.0	99.4	103.3	101.0

Table 4: Growth and well-being of suckling pigs ($X \pm S_x$, n = 10)

	Groups			
Indicators	1	2	3	4
Live weight at birth (g)	1085±14.14	1078±10.09	1121±13.37	1096±19.89
At 34 days (g)	7314±72.48	7730±38.15***	7925±68.41***	7740±68.64***
Total growth (g)	6229±75.11	6652±39.57***	6804±60.54***	6644±68.18***
Average daily growth (g)	183±2.21	196±1.16***	200±1.78***	195±2.01***
Group (%)	100.0	107.1	109.3	106.6
Number of piglets at birth	9.2±0.57	10.2±0.29	11.5±0.60**	10.4±0.60
During weaning	8.5±0.34	9.2±0.29	11.3±0.29***	9.6±0.40*
Group (%)	100.0	108.2	132.9	112.9
Well-being (%)	72.6	80.0	89.7	83.4

*p≤0.05; **p≤0.01; ***p≤0.001

exceeded the control group by 10.8% (Group 2), 25.0% (Group 3) and by 13.0% (Group 4). Weight of piglets in all groups was similar and varied from 1085 g in group 1-1121 g in Group 3.

Feeding tripoli to the piglets (since, the 11 day's old age) in similar dosages as the sows resulted in the following live weight (per piglet during weaning): in Group 2,7730 g, Group 3,7930 g and in Group 4,7740 g which is higher compared with the control group at 416, 611 and 426 g (p = 0.001) (Table 4).

The highest well-being rate towards the weaning age was observed in the third test group and comprised 89.7% which is 17.1% more than in the first control group. In Groups 2 and 4 the rate was 80.0 and 83.4% and exceeded the first group by 7.4 and 10.8%, respectively.

The calculation of economic efficiency of tripoli (Table 5) showed that the optimal dosage (1.0% in dry matter) reduces the feed costs per piglet of the weaning age by 6.5-20.0%, raises the payment for feed by produce by 25.1-26.7% and the cost of additionally received piglets by 32.9%.

Table 5: Comparative economic indicators of the conducted research

	Groups			
Indicators	1	2	3	4
Fed during the experimental period				
Feeds (kg)	514.20	521.30	546.40	542.90
Energy feed units (kg)	565.60	573.40	601.00	597.10
Feed additives (kg)	-	2.19	4.54	6.71
Feeds costs (RUR)	5656.20	5734.30	6010.40	5971.90
Feed additives costs (RUR)	-	15.30	31.80	46.90
Total costs (RUR)	5656.20	5749.60	6042.20	6018.80
Weaning piglets	8.50	9.20	11.30	9.60
Spent per weaning piglet				
Energy feed units	66.50	62.30	53.20	62.20
Digested protein (kg)	7.83	7.33	6.26	7.32
Piglets				
For each 1000 of energy	15.03	16.04	18.80	16.08
Feed units, percentage of control group	100.00	106.70	125.10	106.90
For each 1000 RUR (feeds cost)	1.50	1.60	1.90	1.60
Control group (%)	100.00	106.70	126.70	106.70
Cost of additionally received piglets (1000 RUR)	-	1.62	6.50	2.55
Control group (%)	-	108.20	132.90	112.90

Low and high dosages of tripoli in the rations of sows and piglets of Groups 2 and 4 are not economically expedient.

The tripoli of the Kamyshlovsky deposit in the Sverdlovsk Region at the optimal dosage of 1.0% in dry matter of the ration of sows and suckling pigs is more biologically effective than the low (0.5%) and high dosages (1.5% in dry matter). In sows of late gestation period it causes an increase in the digestibility of nutrients and the deposition of nitrogen in the body. In addition, the blood of animals showed an increase in the concentration of individual metabolites of protein, lipid and carbohydrate metabolism which significantly increases the anabolic metabolic processes. As a result, the number of births in this group of sows increased by 25.0% (the average daily growth of suckling pigs was 9.3%, higher than in other groups) and the well-being of the livestock increased by 17.1%. The use of tripoli at a dosage of 1.0% in dry matter reduced the feed costs per weaning piglet by 6.5-20% and the payment for feed by produce increased by 25.1-26.7%.

Similar results of high dosage of natural aluminosilicates in rations, reducing animal productivity, are consistent with the studies by Dzhindzhikhadze and Ovchinnikov when a high dosage of glauconite in the rations of piglets during the growing and fattening periods (1.55% in dry matter) reduced the average daily growth of the live weight of piglets by 2.2% in comparison with the control group, due to a decrease in the digestibility of crude protein by 1.9%, crude fat by 7.0% and NFE by 1.5%. At the same time, feed costs for this group of animals were higher by 1.3-3.5%.

CONCLUSION

Thus, the optimal dosage of the tripoli of the Kamyshlovsky deposit in the Sverdlovsk Region in the rations of sows and suckling pigs (1.0% in dry matter) in comparison with the dosage of 0.5 and 1.5%, positively affects the number of births and the live weight of suckling pigs and is therefore, economically profitable.

REFERENCES

Bollarini, G., 1982. [Administration of lactobacilli as a means of prevention of the neonatal pathology of the piglet (In Italian)]. Riv. Suincolt., 22: 43-49.

Chabaev, M.G., M.A. Silin, R.V. Nekrasov and N.I. Anisova, 2013. Increase of nutritive energy of feeds for piglets due to the introduction of the enzyme drug Glucolux-F. Zootechnics, 3: 15-17.

Ermolov, S.M., 2013. Influence of the tripoli of the Kamyshlovsky deposit of the Sverdlovsk Region on the digestibility of nutrients in the diet of sows in the late gestation period. Izv. Orenburgsky SAU., 2: 161-164.

Ermolov, S.M., 2014. Changes in the live weight of gestating sows under the influence of the the tripoli of the Kamyshlovsky deposit of the Sverdlovsk Region. Feeding Anim. Feeds Prod., 1: 35-40.

Gamal, R.F., Ì. El-Sawy and Å.Ì. Ramadan, 1985. Effect of substrate pretreatment on microbial protein production. Egypt J. Microbiol., 1: 81-89.

Hours, R.A., A.E. Massucco and R.J. Ertola, 1985. Microbial biomass product from apple pomace in batch and fed batch cultures. Appl. Microbiol. Biotechnol., 23: 33-37.

Kondrakhin, I.P., 2004. Methods of Veterinary Clinical Laboratory Diagnostics. Koloss Publishing, Moscow, Russia, Pages: 520.

Kornienko, A.V. and E.V. Savina, 2013. Reproductive quality and immune status of sows when used in rations of the silicon-containing preprobiotic drug Biocoretron-forte. Zootechnics, 2: 22-24.

Kostenko, S.V., G.V. Kolmatsky and V.N. Buryak, 2011. Natural clays in the fight against mycotoxins. Pig Farming, 3: 58-59.

Kramarenko, M.N. and A.A. Ovchinnikov, 2006. Effect of glaucarin on the bacterial composition of the intestines of broiler chickens: Actual problems of technology for the preparation of feeds and feeding of farm animals. Sat. Sci. Works Dubrovitsy, 1: 143-145.

Martinez, A., I. Lopez, S.D.L. Questa and L. Munez, 2011. How to protect feeds from mycotoxins?. Pig Farming, 3: 45-46.

Mysik, A.T., 2014. The state of animal husbandry in the world on continents in individual countries and the direction of development. Zootechnics, 1: 2-6.

Ovchinnikov, A.A. and I.R. Sitdikov, 2008. Productivity of suckling calves on rations with dietary supplements. Notes Bauman Kazan State Vet. Acad., 191: 165-168.

Rakhimkulov, D. and S. Ardashirov, 2009. Mycotoxicosis: Assistance to pigs. Pig Farming, 3: 31-32.

Rlise, T., 1982. Probiotics promotes production performance. Poult. Intern, 21: 4-48.

Sheveleva, S.A., 1999. Probiotics, prebiotics and probiotic products. Issues Nutr., 2: 32-39.

Tagirov, H.H., A. Bliznetsov and U. Karnaukhov, 2008. Feeding quality of piglets on glauconite rations. Pig Farming, 4: 20-21.

Tomme, M.F., 1969. Method for Determining the Digestibility of Feed and Rations. Union of International Associations, Brussels, Belgium,.

Tremasova, A.M. and P.V. Sofronov, 2012. Study of the sorption properties of enterosorbents with respect to mycotoxinapatulin. Notes Bauman Kazan State Vet. Acad., 212: 171-174.