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Effects of Compound Plant Extract on Growth Performance of Sujiang Pigs

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Abstract The experiment was conducted to investigate the effects of compound plant extract on the growth performance and economic benefits of Sujiang pigs during the fattening period. A total of 50 Sujiang pigs, weighing about 60 kg (there were no significant differences in the weight of the pigs), were selected. They were randomly and evenly divided into five groups: control group, A, B, C and D groups. The pigs in the control group were fed basal diet. For the pigs in the A, B, C and D groups, per kg of basal diet was added with 100, 200, 300 and 400 mg of compound plant extract, respectively. The experimental duration was 44 d. The results showed that in the treatment groups, the average daily weight gains were 15.57%, 20.68%, 17.95% and 7.31%, respectively higher than that of the control group, the feed-gain ratios were 13.29%, 16.92%, 15.11% and 11.48%, respectively lower than that of the control group ($P > 0.05$), and the economic benefits were 62.65, 83.23, 72.50 and 42.11 yuan, respectively higher than that of the control group. In conclusion, the addition of compound plant extract in the basal diet of Sujiang pigs during fattening period can improve the economic benefit, and the economic benefit is best when the addition amount is 200 mg/kg.

Key words Compound plant extract, Sujiang pig, Fattening period, Growth performance, Economic benefit

1 Introduction

Due to the delicious taste and low price of pork, coupled with the traditional consumption of pork in China, the demand for pork is increasing and beginning to diversify^[1]. But with the rapid development of animal husbandry, the problems of residents and drug resistance caused by the use of antibiotics and drugs in pig breeding are becoming more and more prominent. How to ensure the health, ecology and safety of the pig breeding process is getting more and more attention^[2]. Compound plant extract has the characteristics of natural, green, and no drug residue, which can improve the quality of pork, improve production performance, enhance immunity, and improve feed utilization^[3]. In order to investigate the effects of compound plant extract on growth performance and economic benefits of fattening pigs, the extracts of *Eucommia ulmoides*, *Ligustrum lucidum* and *Schisandra chinensis* were added to the basal diet of Sujiang pigs in different proportions to explore the appropriate addition amount of the compound plant extract in the basal diet of Sujiang pigs during fattening period.

2 Experimental animal and methods

2.1 Experimental design According to the principle of uniform parity and similar body weight, a total of 50 Sujiang pigs, weighing about 60 kg, were selected. They were randomly and evenly divided into five groups, control group, A group, B group,

C group and D group. In the control group, the pigs were fed basal diet. In the treatment groups, the pigs were fed compound plant extract, in addition to basal diet, and the addition amount of compound plant extract in basal diet was 100, 200, 300 and 400 mg/kg, respectively. The compound plant extract was provided by the Wuxi Inerte Biological Technology Co., Ltd.

Taixing City has a mild climate with four distinct seasons. Many places are high-sand areas, suitable for planting peanut, sweet potato, and other plants. Each year, a large amount of roughage such as peanut straw is produced^[4]. In order to develop and utilize the unconventional feed resources in Taixing, peanut straw powder was added to the basal diet in this experiment. The composition and nutritional level of the diet are shown in Table 1.

2.2 Feeding experiment The experiment was carried out in the Jiangsu Su Jiang Pig Co., Ltd. One week before the beginning of the experiment, the pre-experiment was carried out for deworming. During the experimental period, feeding was carried out in columns. The pigs were provided with free access to feed and water. The pigs were observed daily. The experiment lasted for 44 d.

2.3 Sample collection and measurement methods At the beginning and end of the experiment, the pigs were weighed on an empty stomach in success. The daily feed consumption, daily weight gain and feed conversion ratio of each pig were recorded, and the economic benefits of each group were calculated.

2.4 Statistics and analysis SPSS software was used to sort out the data and conduct significance analysis for differences. The results are expressed as "mean \pm standard deviation". When $P < 0.05$ or $P < 0.01$, the difference was considered to

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be significant.

Table 1 Composition and nutritional level of experimental diet

Ingredients	Content %	Nutritional level	Content %
Maize meal	59.70	Digestion energy//M J/kg	13.14
Soybean meal	15.00	Crude protein//%	16.05
Bran	8.00	Calcium//%	0.62
Peanut straw powder	12.00	Available phosphorus//%	0.25
Calcium hydrogen phosphate	1.00	Lysine//%	0.62
Salt	0.30		
Premix	4.00		

Table 2 Effects of compound plant extract on growth performance of Sujiang pigs

Group	Initial weight//kg	Terminal weight//kg	Average daily weight gain//g	Average feed consumption per pig//kg	Feed-gain ratio
Control	61.23 ± 13.02	90.21 ± 19.72	658.57 ± 23.15	95.91	3.31
A	60.31 ± 17.57	93.80 ± 24.67	761.08 ± 22.54	96.11	2.87
B	61.84 ± 13.74	96.81 ± 25.61	794.73 ± 28.47	96.16	2.75
C	61.75 ± 16.25	95.93 ± 17.71	776.81 ± 21.75	96.04	2.81
D	61.43 ± 18.31	92.57 ± 21.45	706.74 ± 22.65	91.11	2.93

3.2 Economic benefit analysis According to the average market prices in 2017, the economic benefit was analyzed (Table 3). The prices of pigs, maize, soybean meal, bran, peanut straw powder, calcium hydrogen phosphate, salt and premix were 14.00,

3 Results and analysis

3.1 Effects of compound plant extract on growth performance of Sujiang pigs The effects of compound plant extract on the growth performance of Sujiang pigs are shown in Table 2. As shown in Table 2, the average daily weight gains of the A, B, C and D groups were 15.57%, 20.68%, 17.95% and 7.31%, respectively higher than that of the control group, and no significant differences were found in the average daily weight gain among the groups ($P > 0.05$). The feed-gain ratios of the treatment groups were 13.29%, 16.92%, 15.11% and 11.48%, respectively lower than that of the control group.

2.54, 3.76, 1.93, 0.82, 2.78 and 5.50 yuan/kg, respectively. As shown in Table 3, the total income per pig in the A, B, C and D groups were 62.65, 83.23, 72.50 and 42.11 yuan, respectively higher than that in the control group.

Table 3 Analysis of economic benefits

Group	Total weight gain kg/pig	Price of pork yuan/kg	Total income yuan/pig	Total feed consumption kg/pig	Price of feed yuan/kg	Costs of feed yuan/pig	Net income yuan/pig	Difference yuan
Control	28.98	14	405.68	95.91	2.59	248.42	157.26	0
A	33.49	14	468.83	96.11	2.59	248.92	219.91	62.65
B	34.97	14	489.55	96.16	2.59	249.06	240.49	83.23
C	34.18	14	478.52	96.04	2.59	248.76	229.76	72.50
D	31.10	14	435.35	91.11	2.59	235.98	199.37	42.11

4 Discussions

Adding different levels of compound plant extract to pig basal diets can promote the digestion and absorption of nutrients, and improve growth performance^[3]. Xiao Chuanming *et al.*^[5] added 500 g/t of new plant extract additive for pigs to the piglet diet, and it was found that the diarrhea rate of piglets was significantly reduced, the daily average feed intake and average daily weight gain were increased, the growth and development of the piglets was promoted, and the feed-gain ratio was significantly reduced. Li Le *et al.*^[6] found that the compound extract of garlic and ginger could improve the growth performance of fattening crossbred pigs (Yorkshire × Landrace) × Duroc. It has a certain effect on improving meat quality in storage, and can be used as an alternative to antibiotics in pig production. In this study, the extracts of *E. ulmoides*, *L. lucidum* and *S. chinensis* improved the average daily weight gain of Sujiang pigs during the fattening period, and improved the breeding efficiency of Sujiang pigs. However, the research results of scholars such as Yu Ming^[7] and Tian Yunbo^[8] are inconsistent with the results of this study, which might be related to factors such as plant type, feeding environment, addition amount and feeding method.

5 Conclusions

In this study, the compound extract of *E. ulmoides*, *L. lucidum* and *S. chinensis* can increase the growth rate of Sujiang pigs during fattening period, with outstanding economic benefits. In the process of industrialization of Sujiang pigs, when the amount of the compound plant extract is 200 mg/kg, significant economic benefits can be obtained.

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3.4 Comprehensive evaluation of the tested varieties According to the formula (5), the comprehensive evaluation value of each variety was calculated (Table 1). As shown in Table 1, the performance of comprehensive traits of the tested maize varieties was in the order Heitiannuo 631, Heitiannuo No. 2, Cainuo No. 5, Xinnuo 8601, FYN 1601, Xinnuo 8608, Jindannuo 41, Caitiannuo 1958 (from good to poor). As shown in Table 1, among the tested maize varieties, Heitiannuo 631, Heitiannuo No. 2 and Cainuo No. 5 are excellent varieties, and the rest are good varieties. At the same time, Jindannuo 41 is still a good variety and can be used as a control variety in the regional trials of sweet-glutinous maize.

4 Discussion

Regarding on the research on the comprehensive evaluation method of crop variety, the predecessors have done a lot of work^[3-6]. However, in the evaluation process, there is a subjective limitation that the weight of traits is assigned artificially. The use of the entropy weight method further improves the reliability of the regional test results. The tested sweet-glutinous maize varieties in the regional trials of Shanxi Province basically represent the overall level of sweet-glutinous maize breeding in Shanxi Province. The comprehensive analysis by entropy weight method shows that the comprehensive traits of the sweet-glutinous maize varieties tested in Shanxi Province in 2016 were generally at a good level. It shows that the breeding level of sweet-glutinous maize in Shanxi Province has been continuously improved on the basis of the original, and in particular, the breeding of Heitiannuo maize varieties has reached a high level. In this study, the fertility characteris-

tics, yield and other traits of new sweet-glutinous maize varieties were evaluated using the entropy weight method, but the quality and ease of processing of these varieties were not mentioned. In the future, the selection and comprehensive evaluation of new sweet-glutinous varieties should consider more traits according to the different consumption needs of the market. At the same time, a variety of different evaluation methods should be adopted, in order to make a more scientific and effective comprehensive analysis and judgment.

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