

The Effect of BioAktiv Animal Growth Promoter on Barn-fed Mutton Sheep Production Performance

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Abstract: In order to study the effect of BioAktiv animal growth promoter on the production performance of barn-fed mutton sheep, 32 Australian white sheep and Hu sheep hybrid F₁ generation two-month-old male lambs with similar body weight and good health were selected for comparative experiment. During the experimental feeding period, measurements were taken to calculate the sheep growth performance indicators and economic benefits of using the test product. The results showed that the application of BioAktiv animal growth promoter in the production of barn-fed mutton sheep could effectively increase the average daily gain and reduce the feed conversion ratio of fattening mutton sheep, and increase economic benefits. Therefore, the use of BioAktiv animal growth promoter can be promoted in raising mutton sheep.

Key words: BioAktiv animal growth promoter; production performance; economic benefits; mutton sheep

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Animal growth promoters are widely used in the breeding and production of pigs, chickens, cattle, sheep, fish and other animals. The existing research data show that animal growth promoters can significantly improve the growth performance of farmed animals, and greatly increase the growth rate and feed conversion rate of farmed animals, reduce the cost of feeding, and at the same time greatly improve the quality of animal products. However, for a long time, most of the animal growth promoters used in animal breeding production in this country are added with antibiotics and hormones. After long-term use, the bacteria in the animals will develop drug resistance, and super bacteria will emerge and multiply in the animals and deteriorate the quality of meat products, which directly endanger human health. At present, with the increase in health awareness of people, there are higher requirements for the quality of animal products, and the pursuit of green, healthy and non-drug resistant animal products has become the focus of current social attention. Therefore, the development of antibiotic substitutes, which have no drug residues, non-pollutive, but yet able to improve economic benefits and eliminate or alleviate a series of effects brought by banned antibiotics, has become a problem the animal husbandry industry urgently needs to resolve and a new research direction^[1-2]. Its resolution is also critical for animal husbandry in the country to truly achieve high efficiency, environmental protection, and green health. Studies have shown that

for the mutton sheep breeding industry, Chinese herbal medicine additives are economical, environmentally friendly, residue-free, safe and effective, and have special nutritional and medicinal values, which are in line with the concept of healthy and green mutton sheep breeding. Shao Yan et al.^[3] reported that adding different kinds of Chinese herbal medicines to the diet of mutton sheep not only could meet the daily nutritional needs of mutton sheep, improved the immunity of mutton sheep, but also significantly improved the quality and flavor of mutton. Wang Junxian^[4] reported that adding 1% to 2% Chinese herbal medicine additives to mutton sheep feed could speed up the growth rate of mutton sheep, improved the economic benefits of raising sheep, and enhanced the sheep's disease prevention and disease resistance. Among them, adding 1.5% Chinese herbal medicine had the best effect and the highest economic benefits. Ni Guochao et al.^[5] reported that the average daily gain of fattening mutton sheep was significantly higher than that of the control group by adding trace element functional nutritional additives to the feed.

BioAktiv animal growth promoter is a special animal nutrition additive produced by BioAktiv International GmbH, Germany. It is based on a special bioresonance principle, which makes the oxygen ions in the animal body resonate. It is a feed additive that promotes aerobic metabolism, and indirectly improves animal respiration, digestion, circulation and excretion, enhancing immunity, improving nutrient absorption, and promoting growth. According to the different feeding methods and raw material ingredients, it is mainly divided into two types: one is a feed additive, and its ingredient is calcium carbonate (CaCO_3); the other is a drinking water additive, and its ingredient is natural table salt sodium chloride (NaCl). The raw material calcium carbonate and natural sodium chloride table salt are both neutral and non-toxic, so the animal growth promoter is generally harmless to humans, animals and the environment. At present, the product has been recognized and used in 39 countries and territories around the world. After Gansu Longtai Green Antibiotic-Free Breeding Co., Ltd. introduced this product into the country in 2019, it took the lead in conducting an application test in broiler chicken breeding. The survival rate of broilers increased by 0.18%, the average daily gain increased by 7.15%, the feed-to-meat ratio decreased by 7.38%, the immune organ index increased, the economic benefits increased by 25.42%, and the ammonia and carbon dioxide levels in the chicken house environment decreased significantly^[6]. In this experiment, the production performance and economic benefits of mutton sheep were compared and analyzed through the application of BioAktiv animal growth promoter in the fattening of mutton sheep, so as to provide a scientific basis for the popularization and application of BioAktiv animal growth promoter in mutton sheep breeding.

1 Materials and Methods

1.1 Test time and place

This experiment was conducted from March 18 to May 31, 2021 at Yuzhong Shengyue Mutton Sheep Breeding Professional Cooperative, Xiaokangying Township, Yuzhong County, Lanzhou City. The sheep sheds used for the experiment during sheep fattening period were single-row, facing south, and the area of each sheep pen was the same, 4 m long and 3 m wide. The test period was 75 days, of which the pre-test period was 15 days and the proper test period was 60 days.

1.2 Test materials

- 1.2.1 BioAktiv animal growth promoter:** BioAktiv animal growth promoter is produced by BioAktiv International GmbH, Germany, using bioresonance frequency technology, and its component is natural table salt sodium chloride (NaCl). The animal growth promoter used in this experiment was purchased from Gansu Longtai Green Non-Antibiotic Breeding Co., Ltd.
- 1.2.2 Experimental animals:** The animals used in the experiment with similar weight and of good health were 32 F₁-generation, two-month-old male lambs of Australian white sheep and Hu sheep hybrid breed.
- 1.2.3 Concentrate feeds:** The main concentrate feeds were lamb creep compound feed 2101, lamb nursery compound feed, and sheep breeding compound feed 2803s. The nutritional components are shown in Table 1. They were purchased from Jinchang Bodu Agriculture and Animal Husbandry Co., Ltd.

Table 1: Mutton sheep concentrate feed nutrition composition

Analysis indicator	Creep feed 2102	Lamb nursery feed	Sheep feed 2803s
Moisture (%)	≤ 13.5	≤ 13.5	≤ 13.5
Crude protein (%)	≥ 16	≥ 15	≥ 12.5
Crude fiber (%)	≤ 8	≤ 12	≤ 18
Crude ash (%)	≤ 9	≤ 10	≤ 12
Calcium (%)	0.8-1.5	0.6-2.0	0.8-1.5
Total phosphorus (%)	≥ 0.4	≥ 0.4	≥ 0.4
Sodium chloride (%)	0.3-0.8	0.3-1.2	0.3-0.8
Lysine (%)	≥ 0.70	≥ 0.45	≥ 0.35

- 1.2.4 Silage:** Crop residue of highland summer squash and corncob were used as silage raw materials. The two materials were evenly mixed in a ratio of 7:3 by a TMR (total mixed ration) mixer. A wrapping machine was used to wrap the mixture with a stretch film. It was later fermented (35-38 days in summer and more than 42 days in winter) into silage which had good palatability, juiciness, storability, and rich in nutrition. See Table 2 for its nutritional composition. The silage was produced by Yuzhong Jijiang Animal Husbandry Technology Co., Ltd.

Table 2: Silage nutrition composition

Measurement parameter	Measured value
Moisture (%)	68.8
Crude protein (%)	7.42
Crude fat (%)	2.47
Crude fiber (%)	23.7
Nitrogen-free extract (%)	48.6
Calcium (%)	7.2
Total [phosphorus] (%)	0.25
Lysine (%)	≥ 0.70

- 1.2.5 **Hay:** A mixture alfalfa, corn stalks and wheat straws in a ratio of 1:1:1, crushed into small pieces with a length of 2 cm.

1.3 Test method

- 1.3.1 **Test grouping and method:** After deworming, the test lambs were randomly divided into four groups I, II, III, and IV, with eight animals in each group, numbered by ear tags, weighed and registered one by one. Among them, groups I and III were the test groups, and the drinking water of the test sheep was added with 3.2 g/day of the BioAktiv animal growth promoter; groups II and IV were the control group, and the animal growth promoter was not added to the drinking water.
- 1.3.2 **Dietary composition:** The dietary composition of groups I and II was concentrated feed + 70% silage + 30% hay, and the dietary composition of groups III and IV was concentrated feed + hay. The concentrate feed of each group was adjusted according to different feeding stages, the first stage (1-20 days) was the lamb creep compound feed 2101, the middle stage (21-40 days) was the lamb nursery compound feed, and the final stage (41-60 days) was the sheep breeding compound feed 2803s.
- 1.3.3 **Feeding management:** A specific person was assigned to be in charge. Before the test started, the test sheep underwent deworming, stomach invigoration and routine epidemic prevention, and the pens were stringently disinfected. During the test period, the cleaning of the pens was scheduled, and the troughs and drinking troughs were cleaned every time before feeding the diet and drinking water, so as to make the feeding environment clean and hygienic. The daily ration was evenly mixed before feeding it twice a day during 07:00-08:00 and 17:00-18:00. After each feeding, it was ensured that there was a small amount of leftover feed in the trough, and that the drinking water was clean and sufficient for the test sheep to drink freely.
- 1.3.4 **Determination of fattening performance:** After the proper test period started, the amounts of feed given and left over for each group were accurately weighed and recorded every day to calculate the amount of feed intake by each group of sheep. Weights of the sheep with an empty stomach in each group were taken and recorded on the 1st, 20th, 40th, and 60th day of the test to calculate the average daily gain and feed-to-meat ratio in the first, middle, final stages and the entire fattening period of the sheep in both groups according to the formulas below.
- (1) Average daily weight gain = (average weight at the end of the test - average weight at the beginning of the test)/days of the test
 - (2) Feed-to-meat ratio = average daily feed intake/average daily gain
 - (3) Average daily feed intake = (daily feed amount - leftover amount)/number of sheep in each group

1.4 Data and processing

The measured data were entered in Excel 2007 spreadsheets, and simple calculations were performed to express the data in the form of “average ± standard deviation”. Statistical software SPSS 17.0 was used to analyze the variances, and LSD method was used for the analyses. P<0.05 was used to indicate significant difference.

2 Results and Analysis

2.1 The effect of BioAktiv animal growth promoter on mutton sheep production performance

Table 3 shows that there was no significant difference in the initial weight of the test mutton sheep among the groups ($P>0.05$). In all three stages of the test, the average daily gain of test group I on average was higher than that of control group II by 12.11%, 6.17%, and 14.30% in the first, middle, and final stages respectively. The average daily gain of test group III on average was higher than that of control group IV by 3.51%, 10.26%, 14.19% in the first, middle, and final stages respectively. But there was statistically significant difference between the groups ($P>0.05$). For the whole test period, there was no significant difference in the initial weight, final weight and average daily gain ($P>0.05$) between the groups. The average daily gain of test groups treated with BioAktiv animal growth promoter on average was higher than that of the control groups. In particular, the average daily gain of test group I was higher than that of control group II by 12.92%, the average daily gain of test group III was higher than that of control group IV by 6.41%, but the differences were not significant ($P>0.05$). The feed-to-meat ratios of test groups I and III were lower than those of control groups II and IV by 12.5% and 7.13% respectively, but the differences were not significant ($P>0.05$). The above findings show that the differences in mutton sheep product performance was not only related to the use of BioAktiv animal growth promoter, but also closely related to the roughages in the diet. The two groups fed with silage had higher average daily gain than the groups not fed with silage.

Table 3: Mutton sheep production performance by test stages

Test stage	Parameter	Group I	Group II	Group III	Group IV
First stage (1-20 days)	Start weight (kg)	19.18 ± 2.44	18.99 ± 1.76	19.09 ± 1.90	18.81 ± 1.84
	End weight (kg)	24.61 ± 3.03	23.84 ± 2.73	24.25 ± 2.88	23.80 ± 2.23
	Average daily gain (g/day)	271.88 ± 50.35	242.50 ± 83.79	258.13 ± 62.45	249.38 ± 42.63
Middle stage (21-40 days)	End weight (kg)	31.61 ± 3.94	30.05 ± 4.11	31.36 ± 4.51	30.63 ± 3.01
	Average daily gain (g/day)	349.69 ± 74.19	329.38 ± 92.56	376.25 ± 98.77	341.25 ± 61.40
Final stage (41-60 days)	End weight (kg)	36.65 ± 4.92	34.46 ± 4.70	35.69 ± 4.97	34.41 ± 3.07
	Average daily gain (g/day)	252.19 ± 69.71	220.63 ± 79.30	216.25 ± 59.99	189.38 ± 60.09
Whole test (1-60 days)	Average daily gain (g/day)	291.25 ± 52.47	257.92 ± 63.74	276.67 ± 57.25	260.00 ± 40.12
	Average feed intake (kg/day)	1.61 ± 0.284	1.62 ± 0.288	1.62 ± 0.270	1.64 ± 0.279
	Feed-to-meat ratio	5.53	6.32	5.86	6.31

In addition, irrespective of test or control groups, with an average daily feed consumption of at least 1.62 kg/day, in the test period of 60 days, the average daily gain of all sheep was at least 271.46 g/day, with the highest being 291.25 g/day. The growth rate was clearly higher than that of Hu sheep lambs of the same age. This clearly indicated the benefits of crossbreeding between Australian white sheep and Hu sheep. When the experiment ended, the average weight of the sheep was higher than those of four-month-old male lambs of similar breed in Wenshui County, Taiyuan City, Shanxi Province (Wang Zhiwu et al.^[7]) and Zhangye, Gansu Province (Pan Xiaorong et al.^[8]). This was probably related to the higher nutritional level of the feed used in this experiment.

2.2 The effect of BioAktiv animal growth promoter on the economic benefits of fattening mutton sheep

Table 4 shows that the gross profit of the test group I increased by 20.25% compared with the control group II, and the gross profit of the test group III increased by 9.51% compared with the control group IV. This indicated that although the dietary composition of each group was different, adding BioAktiv animal growth promoter could significantly improve the economic benefits of fattening mutton sheep.

Table 4: Economic benefit analysis

Parameter		Group I	Group II	Group III	Group IV
Total weight gain	kg/sheep	17.48±3.15	15.48±3.82	16.60±3.44	15.60±2.41
Mutton price	¥/kg	32	32	32	32
Income from weight gain	¥/sheep	559.36	495.36	531.20	499.20
Feed price	¥/kg	2.69	2.69	2.92	2.92
Feed cost	¥/sheep	262.75	261.47	283.82	287.33
Additive cost	¥/sheep	15.36	0	15.36	0
Gross profit	¥/sheep	281.25	233.89	232.02	211.87

Note: Pellet feed 1.6 ¥/kg, alfalfa 2 ¥/kg, corn straw 1 ¥/kg, wheat straw 1 ¥/kg, silage 0.38 ¥/kg, BioAktiv animal growth promoter 640 ¥/kg

3 Discussion

The daily gain and feed-to-meat ratio of mutton sheep are important indicators for evaluating the effectiveness of additives. Some studies have confirmed that Chinese herbal medicine additives can effectively increase the average daily gain and reduce the feed-to-meat ratio^[9]. The results of this experiment showed that the BioAktiv animal growth promoter had the effect of increasing the average daily gain of mutton sheep and reducing the ratio of feed to meat, but the effect was not statistically significant. The findings above indicate that BioAktiv animal growth promoter can increase the average daily gain of mutton sheep to a certain extent, reduce the feed-to-meat ratio, and promote the growth of mutton sheep, although the effect has a limit. This is consistent with the results obtained in pilot studies using the same product in broiler chicken farming. Zhang Shanzhi et al.^[10] added Chinese herbal medicine additives to mutton sheep feed, and found that the weight gain of mutton sheep was significantly improved. The results of this experiment were not the same, which might be related to the different types of additives, breeds of test sheep, dietary formula, feeding management and test period. Nevertheless, from the perspective of economic benefits and safety, BioAktiv animal growth promoter has been certified by the EU for being made of neutral, non-toxic materials, it is safe and harmless to the farm workers, mutton sheep and the environment. Its application not only can improve the production performance and economic benefits of fattening sheep, but also can protect the safety of mutton from the unseen dangers brought by the use of antibiotics. Therefore, it is an additive worth promoting to be used in raising mutton sheep.

4 Conclusion

The application of BioAktiv animal growth promoter in the production of barn-feeding mutton sheep can increase the daily gain of fattening mutton sheep, reduce the cost of breeding, and increase economic benefits. Therefore, the use of BioAktiv animal growth promoter can be promoted for use in raising mutton sheep.

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