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Conservative Breeding of Debao Pony in Nanning, Guangxi

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Abstract [**Objectives**] The development of Guangxi Debao pony is very slow, and its quantity and quality have dropped sharply. In order to reduce the deterioration of breeds and the loss of excellent genetic stallions, this study was conducted. [**Methods**] Modern biological reproduction technology was adopted to protect, breed, develop, purify and rejuvenate the germplasm resources of Debao pony, and a conservation farm was constructed for Debao pony to speed up the development of the industrialization of ponies. [**Results**] Debao pony is characterized with strong disease resistance and strong adaptability to other places, and the growth indicators are basically consistent with the origin, which is conducive to market promotion. [**Conclusions**] The start of Guangxi Debao pony *ex-situ* conservation project will accelerate the development of pony industrialization, and it has particularly important practical significance.

Key words Debao pony, *Ex-situ*, Feeding, Experiment

1 Introduction

Debao pony is one of the breeds that maintain the pony germplasm resources in Guangxi. The scientific and technical personnel of the Animal Husbandry Research Institute of Guangxi Zhuang Autonomous Region had conducted a census about the ponies in Debao County, Guangxi. The average body height of 65 ponies was 98.52 cm. The census found that the development of Debao pony had been very slow, and the quantity and quality had dropped sharply. Due to lack of protection measures and funds, the stock of Debao pony in Debao County, the main production area, was only about 2 000 heads, with a danger of extinction. According to analysis, the root causes were as follows. (i) The scientific selection and crossbreeding consciousness was weak. The original single-herd natural grazing was adopted, characterized by natural promiscuity, leading to high inbreeding rate. The statistics of more than 230 ponies in the local conservation farm showed that the deformity rate of offspring of the same year reached 18.75%. (ii) Management was extensive, living environment of ponies was very poor, and feeding methods were primitive. As a result, the production performance of Debao pony had declined, the breed had gradually degraded, and excellent genetic stallions had been lost. To this end, the Aquatic Animal Husbandry and Veterinary Bureau of Guangxi Zhuang Autonomous Region started the construction of Guangxi Debao Pony Nanning *Ex-situ* Conservation Farm in Animal Husbandry Research Institute of Guangxi Zhuang Autonomous Region. Modern biological reproduction technology

would be used to protect, purify and rejuvenate germplasm resources of Debao pony. This has particularly important practical significance for accelerating the industrialization development of Debao pony. In December 2011, the technical staff of Animal Husbandry Research Institute of Guangxi Zhuang Autonomous Region went to Debao County, Guangxi and selected 25 Debao ponies (including 5 stallions and 20 mares) to introduce them into the *ex-situ* conservation farm in Nanning, Guangxi. Thus, the feeding test was conducted.

2 Natural conditions and management situation of the conservation farm for Debao pony

2.1 Environment and natural conditions of the conservation farm Animal Husbandry Research Institute of Guangxi Zhuang Autonomous Region is located in the northern suburb of Nanning City, with an area of 666.67 ha. The texture of the soil is yellow loam, which is acidic. Animal Husbandry Research Institute of Guangxi Zhuang Autonomous Region belongs to South Asian tropical monsoon climate with abundant rainfall (average annual precipitation 1 300 mm), abundant heat (annual average temperature 21.8 – 22.4 °C), high humidity and abundant sunlight (average annual sunshine duration 1 862.4 h). The forage varieties cultivated mainly include Guimu No. 1, teosinte, stylo, ryegrass, cajanus, leucaena, rumex and chicory, as well as urochloa, *Panicum maximum* Jacq, green bristlegrass, *Paspalum wettsteinii* Hack. and various small shrubs^[1]. The natural conditions such as the environment, temperature and climate of the Animal Husbandry Research Institute of Guangxi Zhuang Autonomous Region are quite different from those of Debao.

2.2 Equipment and technical resources in the conservation farm The Debao pony conservation farm is well-equipped. In the core group, there were 33 ponies. The farm had 11 professional and technical personnel and 2 senior experts, which have rich experience in the implementation and management of scientific research projects. The farm has the basic conditions to carry out pro-

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ject research. The technical consultation institutions for project development have the successful experience of animal genetic analysis and genetic testing equipment, and they ever carried out the molecular marker-assisted breeding of sports horses. Endoscopy artificial insemination and other research experience provided technical support for breeding and selection of pony populations.

2.3 Feeding and management methods (i) The original scattered grazing was transformed into captivity. Gramineous and leguminous forage was planted and mixed with fresh feed seasonally (or dried peanut vines, peanut shells, straw litter, crop straws, *etc.*). In the early spring with insufficient forage supply, silage and hay could be used, supplemented by concentrate. (ii) After the foal was born for 1–2 weeks, forage was tried to feed, and an appropriate amount of concentrate was supplemented. The original natural weaning was transformed into weaning at the age of 5 months. (iii) The 25 ponies were coded and bred in separated pens. The feed was dominated by forage. According to the body conditions of the ponies, an appropriate amount of concentrate was supplemented. The movement time of the stallions was increased property, at least 2 h each time and more than 3 times a week. This would help the stallions to maintain normal body condition, fatness, energy and strong sexual desire. At the same time, it was also conducive to ensuring the health of the mares, observing the estrus of the mares and breeding. The production information of the mares was well recorded, so as to avoid mismatching and early mating caused by male and female grazing and polyculture. (iv) Excellent ponies were chosen, which was conducive to breeding. Unqualified stallions were dealt with as soon as possible: castration, fattening or elimination. (v) The ponies were injected with strangles vaccine, pertussis-diphtheria-tetanus triple vaccine, influenza vaccine and Japanese encephalitis vaccine. Strangles vaccine was injected at the age of 3 months. Syphilis vaccine was injected before breeding. Vaccination program was implemented. (vi) The pens were cleaned every morning and afternoon. They were kept ventilated and dry. The environment in the pens was good. (vii) The dynamics of the ponies were observed. Once disease occurred, sick ponies were isolated and treated in time to avoid cross-infection of the disease among the ponies. (viii) The hair of the ponies was combed every day, and their mane was trimmed regularly. Parasites inside and outside the ponies were driven off. The hoofs of the ponies were trimmed normally. The ponies were trained.

3 Observation of feeding effect of test ponies

3.1 Forage intake behavior The feeding situation, feeding time and selective feeding behavior of the ponies in captivity and grazing were observed. It was found that the ponies were affected by age, physiological needs, experience, disease and external stress. The little ponies began to learn to eat tender grass, which was selective, slow, tentative and careful, and they preferred to eat concentrate. The mares did not have much choice. They always took a big bite, and when they were hungry, they ate faster.

The ponies preferred Guimu No. 1. In captivity, feed supplemented with concentrate was eaten faster. In grazing, herd ate faster than single ponies. Guimu No. 1 accounted for 60% of the daily forage intake, and other weeds and small shrubs accounted for the remaining 40%.

3.2 Growth and development

3.2.1 Test preparation. The test began in December 2011, and the entire test period lasted for more than 3 years, involving 46 foals. A total of 20 foals that had been weaned for 10–15 d were selected. They were evenly and randomly divided into two groups, treatment group and control group. All the foals in the treatment group were kept in separated pens, and each pen was equipped with one lick block. The foals in the control group were divided into two pens, and they were grazed during the day. The test period was two months. In the treatment group, the pens were cleaned in every morning and afternoon, the ponies were fed Guimu No. 1 and dried peanut vines (7:3), and each of the ponies was supplemented with 0.50 kg of concentrate. The ponies in the control group were grazed during 10:00–12:00 and 15:00–17:00, respectively, and after grazing, each of the ponies was fed with 0.50 kg of feed. During the feeding process, it is necessary to pay attention to the following points. (i) The ponies were kept in separated pens, and their activity was reduced relatively. Thus, the energy consumption of the ponies was reduced, and the interference from other factors was avoided, which were beneficial to the ponies' growth and weight gain. (ii) Guimu No. 1, in combination with peanut vines, peanut shells, *etc.* was used to feed the ponies to reduce the incidence of intestinal diseases. The protein content of the diet was close to, or met the needs of the pony's growth. (iii) The ponies in the treatment group could not be fed with only Guimu No. 1, and the combination of multiple feeds and forages was emphasized. A certain amount of concentrate was supplemented. Lick block could supplement the trace elements needed by the pony to grow.

3.2.2 Test results. The results showed that in the treatment group, the average weight gain per pony was 22.5 kg (20.5–24.5 kg), the average daily weight gain was 0.75 kg, and for every 1 kg of weight gain, 1.33 kg of feed and about 10.5 kg of forage grass were required; and in the control group, the average weight gain per pony was 16.8 kg (15.6–28.8 kg), the average daily weight gain was 0.56 kg, and for every 1 kg of weight gain, it required 1.79 kg of feed, 0.46 kg more than that in the treatment group. This shows that feeding Guimu No. 1 to Debao ponies in captivity, in combination with peanut vines, peanut shells, *etc.* is feasible. It also shows that the Debao pony is easy to adapt to the captive environment, and its growth rate and weight gain are significantly increased compared with grazing. The growth and development of the Debao ponies at early age (birth to 6 months old) was analyzed. The results show that the foals with initial body weight of 15–18 kg developed quickly before the age of 6 months, and they had one year of continuous growth. When each of them was supplemented with 1.00 kg of formula feed every day, the

body weight at 8 months of age could reach 80–90 kg. The body size of the 45 ponies at the age of one year and adulthood was measured, and the results are shown in Table 1. After introducing

to Nanning, the body weight, body height and body size of Debao ponies could be affected by acquired nutrition, but overall, the growth indicators were basically the same as those of the origin.

Table 1 Growth and development situation of the Debao ponies introduced

Gender	Age	Quantity	Body weight kg	Body height cm	Body length cm	Chest circumference cm	Cannon circumference cm	Body weight in origin kg
Mare	One year	12	90.0–95.0	63.3–75.9	86.6–91.2	85.1–90.4	10.0–11.2	85.2–93.0
	Adulthood	15	120.0–125.0	89.3–96.6	89.6–98.0	103.4–109.0	11.6–12.3	118.0–121.0
Stallion	One year	10	123.7–132.0	92.0–97.0	90.3–93.0	103.4–109.0	11.0–12.7	118.4–125.0
	Adulthood	8	154.1–159.0	94.4–96.0	90.8–92.0	107.0–112.0	11.7–13.2	131.5–142.0

3.3 Occurrence of hoof disease As shown in Table 2, the ponies in captivity were prone to hoof disease. The reason should be not paying attention to the inspection and neglecting the maintenance work of the hoofs of the ponies. The floor of the treatment group was hardened cement, and it was not covered with thick sand. In addition, the activity time of the ponies was not very much, and their hoof nails had not been rubbed effectively. As a result, the incidence of hoof disease in the ponies was 20%–30%, and the hoofs of the ponies needed to be trimmed twice a year. In the control group, the ponies went out to eat grass every day, and their hoof nails were passively rubbed. Consequently, the problem of hoof disease was not very serious, and the incidence was only 16.6%; and the hoofs of the ponies were cared once a year. As the number of ponies in the treatment group was too small to be representative, the relevant conclusions need to be further verified.

Table 2 Incidence of hoof disease in the Debao ponies introduced

Group	Gender	Quantity	Number of hoof disease cases	Deformity rate//%
Treatment	Stallion	5	1	20
Treatment	Mare	5	2	40
Control	Stallion	4	0	0
Control	Mare	6	1	16.6

Table 3 Reproductive performance of the Debao ponies introduced

Group	Number of mares	Number of mares in estrus	Number of mares inseminated	Number of pregnant mares	Number of fetuses	Number of foals born
Treatment	15	13	13	11	11	10
Control	15	15	15	14	13	13

Table 4 Sexual maturity and reproduction age of the Debao ponies introduced

Gender	Quantity	Body weight//kg	Age with first sexual desire performance//month	Reproduction age//month	Reproduction age in the origin//month
Stallion	5	134	24	36	36–42
Mare	15	121	18	24	24–30

3.5 Hybridization test Taking Debao pony as the female parent and Guangxi southwest horse and American pearl pony as the male parent, hybridization was conducted. The filial generation of Guangxi southwest horse was taller. In the crossbred offspring, the average body weight of one-year-old mares was 104 kg, 9 kg higher than that of one-year old Debao mares. The body height was 85 cm, 10 cm taller than that of Debao pony. The offspring of

3.4 Reproductive performance

3.4.1 Measurement method. Estrus synchronization technology was used. Total 16 test mares were selected. The medication procedure and dose were formulated, and the efficacy, conception rate and allergy rate were analyzed. The development and change laws of follicles of the mares were observed using the endoscopic method to achieve timely insemination and improve the conception rate. The mare's estrus lasted 7 d. For mares with delayed follicle development, Cupai No.3 was injected intramuscularly to improve the conception rate. The sperm viability was measured by microscope.

3.4.2 Measurement results. In the treatment group, the estrus rate was 86%, the conception rate was 73.3%, and the reproduction rate was 66.6%. The estrus symptoms of the grazing ponies were obvious, and their estrus rate, conception rate and reproduction rate were 100%, 93.3% and 86.6%, respectively (Table 3). Due to the limited number of test ponies, which were not representative, the conclusions need to be further verified. As shown in Table 4, Debao pony's sexual maturity was earlier. Stallions at the age of 24 months began to show sexual desire, and those at the age of 30 months began to mate. The first mating is recommended to be carried out when mare is 18 months old and stallion is 42 months old. The results of this study show that mares in captivity can also be in heat normally.

American pearl pony showed shorter height, sturdy limbs, equally straight back and waist, plump muscles, compact structure, beautiful appearance and good development. At the age of one year, the body weight ranged from 80 to 86 kg, and the body height reduced by 5–8 cm. In conclusion, better dwarfing result was obtained (Table 5).

Table 5 Body weight, body height and body size of crossbred offspring of the Debao ponies introduced

Variety	Gender	Age	Quantity	Body weight//kg	Body height//cm	Body length//cm	Chest circumference//cm	Cannon circumference//cm	Body weight in the origin//kg
Debao	Mare	One year	12	90.0 – 95.0	63.3 – 75.9	86.6 – 91.2	85.1 – 90.4	10.0 – 11.52	85.2 – 93.0
Debao	Stallion	One year	10	123.7 – 132.0	92.6 – 97.0	90.3 – 93.0	103.4 – 109.0	11.0 – 12.7	118.4 – 125.0
Southwest horse hybrid	Mare	One year	10	96.0 – 104.0	75.3 – 85.4	92.6 – 101.2	93.3 – 98.4	11.0 – 12.8	–
Southwest horse hybrid	Stallion	One year	6	136.7 – 145.0	97.4 – 103.6	93.3 – 99.3	107.1 – 112.0	12.0 – 12.7	–
American pearl pony hybrid	Mare	One year	4	80.0 – 86.5	63.1 – 73.5	82.6 – 89.2	85.4 – 92.4	11.2 – 11.8	–
American pearl pony hybrid	Stallion	One year	5	83.7 – 89.2	79.35 – 85.2	91.3 – 93.5	101.4 – 112.0	11.4 – 12.1	–

4 Conclusions and prospects

4.1 Conclusions (i) Debao pony has the advantages of strong disease resistance, docile temperament, roughage resistance and strong adaptability, which are very conducive to market promotion.

(ii) The estrus rate, conception rate and reproduction rate of the ponies in the treatment group of this study were 86% , 73.3% and 66.6% , respectively. The estrus symptoms of the ponies in grazing were more obvious, and their estrus rate, conception rate and reproduction rate were 100% , 93.3% and 86.6% , respectively.

As hoof disease is prone to occurrence, hoof protection is required 2 times a year. (iii) When choosing a stallion, attention should be paid to the following points. ① Selecting stallions from stud farm which is located in the place with rich germplasm resources. The quality of the large-scale stud farm is guaranteed. Its epidemic prevention measures are comprehensive and proper, and the number is large. Healthy and pure breed stallions can be obtained safely. ② Selecting stallions from household in the mountainous areas where horse breed resources are rich. Stallions selected should be concentrated first and kept on the spot for one month. At the same time, the stallions are vaccinated to ensure that there is no disease and then transported. ③ Before selecting breeds, it should be cleared that horses in local place have a certain stock, and no disease occurs, in order to avoid unnecessary losses. ④ Choosing to introduce in autumn season. Horses in autumn are fat and healthy. Besides, the weather is cool, dry, and the temperature does not change much. In order to reduce the stress response of imported horses, transportation should be carried out on a sunny evening.

4.2 Prospects (i) The large-scale breeding of horses faces problems of forage supply and environmental protection. With the large-scale breeding of horses and the increase in the number of horses, the supply of forage faces certain difficulties. If grazing on a large scale, it will inevitably cause damage to the ecological environment, and the pressure on the environment will become increasingly prominent. With the advancement of the times, horse breeding gradually requires scale, and captivity will become the

main direction for the development of large-scale horse breeding in the future, because captivity can conserve the resources of rocky mountains. In contrast, extensive grazing on a large scale will destroy the vegetation resources in rocky mountains, and the consequences are unbearable^[2]. Large-scale breeding farms should strengthen the feeding and management of horses. In captivity, green fodder and refined fodder should be supplemented in time to meet the growth and production nutrition requirements of horses; and immunization program should be implemented strictly, disease antibody testing should be conducted, and parasites should be expelled to reduce horse morbidity and mortality. (ii) When raising horses on a large scale, consideration should be given to solving the problem of forage supply for the whole year. First, high-quality and high-yielding forage needs to be cultivated according to the number of horses raised. Generally, 15 horse needs to plant a hectare of forage. In addition to Guimu No. 1, ryegrass, silphium, weeds and small bushes need also be cultivated. Special attention should be paid to the diversity of forage grass. The composition of forage grass can refer to the follows: 60% of Guimu No. 1, 10% of teosinte, 5% of stylo and 25% of ryegrass, silphium, weeds, shrubs, *etc.* In rural and mountainous areas, in addition to natural grass, agricultural and sideline products such as corn stalks, corn seedlings, sugar cane bottom leaves, peanut vines and other kinds of vines can be utilized. In the summer and autumn seasons, the forage resources are abundant, and the excess forage can be silaged and dried to supplement the forage supply in winter and spring when the forage is lacking.

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