

STUDY ON THE FREQUENT REPRODUCTION TECHNIQUES OF THE MEAT RABBIT IN THE COLD REGIONS

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Abstract - In this paper were studied some major factors that affect the FRP (frequent reproduction = *post-partum* mating) of meat rabbits in the cold regions (average annual temperature +2.74°C - 90 to 100 days/year with temperature above 0°C). The rabbit breeds resistant to the FRP in the cold regions were selected out of six, including local breeds. Californian and New Zealand White were the best. The *post-partum* mating time was studied in term of conception rate: the best interval between kindling and mating is 3-10 hours after kindling (53.9%) and the suitable period is 3-15 hours (52.6%) when compared to 0-3 hours (29.0%) or 2-3 days (32.3% of conception rate). The technical means of the WRP (winter frequent reproduction) in the cold regions was acquired with separation of the young placed in a heated room, from the mother kept in their cages, beside the suckling time. The aphrodisiac "*Cuiqingsan*" and the galactagogue "*Ruquanling*" prepared by cautiously making up prescriptions of Chinese medicinal herbs, were able respectively to reduce significantly the anoestus period observed with some does, and to increase milk production by 29.3%. The FRP's techniques in the cold regions were acquired. After widely application, the techniques have produced great economic and social benefit.

INTRODUCTION

The frequent reproduction (i.e. FRP) is a rabbit breeding technique accelerating the reproduction rate of the female rabbit to the fullest possible extent, or a kind of mating system including the nutrition, management and reproduction, etc... It can shorten the interval between the two adjacent kindlings and increase the young number that a female rabbit produces in one year. The FRP's meaning is that the mating of the does is finished within 3 days after parturition, namely the pregnancy and the lactation are in a same period and it will give the next birth when the litter being 28 days old is weaned, such this successive reproduction. At present, there has not been any problem on the theory and the application of the FRP. Some studies (TIAN YUNBO, 1991) showed, the FRP would not affect the survival rate and the growth of the litter in this facing birth or the next one, and the successive FRP wouldn't have bad effect to the reproductive efficiency of the female rabbit as well. Some other (CHEN SHIWEN, 1994) else showed, 1 ~ 2 days after kindling, the female rabbit were mated and the 20 days-old litter were weaned, these would be advantageous to the reproduction of the female rabbit and would make its average number of delivering litters reached eight kindlings annually. So the FRP system is a technique that can rise to higher level in the production of the meat rabbit.

The Zhangbei experimental area, which is a waving plateau in Bashang, lies to the south of the Mongolia Plateau and in the northwest of Hebei province, 40° 51' ~ 42° 10' north latitude, 114° ~ 116° east longitude, an elevation of 1400 metres, 90-100 days frostless period, 2.74°C annual average temperature and 10°C cumulative temperature 1973°C. It is the colder regions. In these regions, the people get into the habit of breeding rabbit and breeding meat rabbit is always one major source of income. Long since, because of careless seeding and management, the level of the production of the meat rabbit was very low, a female rabbit gave only 2 or 3 kindlings annually and 15 to 18 young can survive after weaning, so that a female rabbit only produced 7.52 commodity rabbits annually. To improve the level of production of the meat rabbit in the cold regions, we did a series of experiments, studied some major factors that affect the FRP of the meat rabbit in these regions, acquired some techniques in the FRP of the meat rabbit adapted to the cold regions and gained great economic and social benefit.

MATERIAL AND METHODS

1. Selection of the FRP-resistant meat rabbit breeds

In the practice of the breeding rabbit, it was discovered that the FRP-resistant capability of the meat female rabbits is different from one line to the other. It shows in several respects of their *post-partum* conception rate, number of young born, total of delivered litters and health state after giving the third kindling of the FRP during

a limited period. To determine the variety of the FRP-resistant meat rabbit in this region and increase the FRP's effectiveness, this experiment was done.

53 breedable female rabbits growing well, which were 8-10 months-old and were respectively Californian 12, New Zealand 10, SAB 10, Saibei 11 and native crossbred rabbit 10, were experimented. The experimental time was April 20th 1991-September 20th 1991. In this experimental period, they were bred in their respective cage and were strongly managed. All of them were mated during 3 days after parturition.

The kindling number, the total of young born, the numbers of weaned rabbits and the survival rate of the weaned rabbits were recorded.

2. The effects of time of post-partum mating upon the conception rate of the meat rabbit.

The *post-partum* mating is a necessary technical means put the FRP into effect. The mating must be finished during 3 days after kindling. But it isn't else known at present when the mating will bring about the highest fertility rate during these 3 days. This experiment studied the relation between the time of mating and the conception rate of experimental rabbits mated at different time (hours) after kindling.

21 experimental Californian does, which grew well and were selected from breeding rabbit household in the experimental region, were respectively mated in the following four periods after parturition : 1. 0~3 hours ; 2. 3~10 hours ; 3. 10~15 hours ; 4. 2~3 days. The state of the conception and kindlings were recorded.

3. The winter reproduction (WRP) experiments of the meat rabbit in the cold regions

In these regions, the winter is so cold and so long that the WRP is very difficult. So the native peasants couldn't do it in the past time. This was a important reason why the production of the meat rabbits was low in this region. In view of this situation, it was considered that using the WRP's techniques would greatly improve the level of the production of meat rabbits. And looking for the methods how put it into effect was a key of the WRP. Under the circumstances, the WRP's experiments were done. 35 breedable rabbits with suitable age were chosen to experiment and the following WRP's techniques were used :

3.1. *Improving the conditions of the breeding and the management*

3.1.1. *Making designs for a heat-preserving rabbit house and building it* - In accordance with a lot of reference information of building rabbit houses, three kinds of designs for semi-underground style heat-preserving rabbit house were made and the houses were built. It is noted in these designs that the slope of a roof was lowered (10 ~ 12.5 %), the lightened area of the glass window was enlarged, the doors faced east, the walls were thickened and the cotton or grass curtains were hung over the doors and windows at night. Practise had proved that the advised heat-preserving rabbit house could adapt to the conditions in this region. When the temperature was - 30°C over the house, the temperature in it could maintain above - 0.5°C.

3.1.2. *Fully utilizing the feed source in this region and improving the nutrition of rabbit* - The full formula feed made of naked oats and flax cake as major raw materials not only utilized the feed source in this region but also satisfied the needs of the rabbit for various nutrition materials.

3.2. *Nursing during the female rabbit giving birth and ensuring the health and growth of litter.*

3.2.1. - It is necessary to record the mating time, to examine the state of the foetus by touching it during 8-10 days after mating, exactly to measure the expected date of litter birth and to show it by a card.

3.2.2. - 2-3 days before parturition, the female rabbits are put into the delivery boxes with salt grass in the rabbit house. They are observed in order to help them and humanly tear off the down of the rabbits which can't do so and bed down them in the boxes. The house must be quiet, otherwise they will be alarmed. The fine formula feed mingled with warm water is put into the feed-pot and the carrot is provide. After delivering, the female rabbits are immediately fed naked oats paste in order to prevent them from eating their kits because of lacking in water.

3.2.3. *Separate kits from their mother and feed them on time* - Though the house can preserve heat, the lowest temperature is still below 0°C in it and the kits can be frozen to death. So the nest boxes should be moved into the warm room with mankind living in at once after the female rabbits have given births and the nest boxes are covered with cloth. The young are put into their mother's cage for feeding once every day on time, then moved back the warm room and settled down. As well as the application of living with a relative to kits can ensure their growth balance and decrease their death rate. They are weaned at once when they are 28 days old.

3.3. Epidemic prevention and eliminating the disease

In order to completely eliminate the disease of the rabbits, it must be done on time to sterilize the rabbit cages, additionally feed the disease-preventing medicines and inject the vaccines to the 40 days old rabbits during spring and autumn, etc...

4. Preparation of the "Cuiqingsan" aphrodisiac in order to cure oestrus retardation

In the course of executing the FRP, sometimes, a few of female rabbits appeared the oestrus retardation or anoestrus. Thus it caused them pregnancy failure though they were mated again and again, further affected the total achievement to the reproduction. To solve the problem, in accordance with the theory in Chinese veterinary science, the "Cuiqingsan" aphrodisiac was prepared of Chinese medicinal herbs cautiously made up a prescription. The Chinese medicinal herbs ground into powder was mingled into fine feed. The rabbit was fed with 10 g powder per rabbit every day. Keep doing it for 7 successive days. The anoestrus time after female rabbits kindling, oestrus time after female rabbits fed medicines, mating time and the number of delivered litter, etc... were recorded

5. Preparation of "Ruquanling" galactagogue

Improving the milk production of the rabbit does is a key that increase the survival rate of young and accelerates their growth rate in the FRP. In accordance with the theory in Chinese veterinary science, the Chinese medicinal herbs, which can improve nutrient ingredient digestion and absorption, blood recycling and hormone secretion, was ground into powder, sieved and put into bag for use in the future. 30 Californian does were chosen and divided into three group. The first group and the second one were fed the full formula feed respectively added 1 % and 2 % Chinese medicinal herbs additives. The contrast one was only fed full formula feed. The full formula feed provided was limited to 100 g per female rabbit every day, the fresh grass was fully provided. The female rabbits were fed with full formula twice a day and provided with enough water every day. The litter were weaned when they were 30 days old. The weight of litter and the weight of young were got at birth, 21 days old and 30 days old. The numbers of delivered litter, the numbers of 21 days old litter, the numbers of the weaned litter, the weights of the female rabbit after giving birth and after weaning were recorded.

RESULTS AND DISCUSSION

1. Choice of the best breed

The FRP's results of different breeds of female rabbits are shown in Table 1. The results show that the breeds of meat rabbit which were best adapted to the FRP in the cold regions are Californian and New Zealand White .

Table 1 : The FRP's result of different breeds of female rabbits

Variety	Numbers	Birthes	Kits	Weaned kits growth	Rate (%)
Californian	12	3.9 ± 0.7 ^a	24.83 ± 5.16 ^{ab}	23 ± 4.02 ^a	92.6
New Zealand White	10	3.9 ± 0.7 ^a	26.1 ± 4.9 ^a	24.5 ± 4.5 ^a	93.9
SAB	10	3.0 ± 0.77 ^b	18.2 ± 5.33 ^c	17.4 ± 4.9 ^b	95.6
Saibei rabbit	11	3.1 ± 0.9 ^{ab}	20.54 ± 6.74 ^{abc}	19.27 ± 6.25 ^{ab}	93.8
Native crossbred	10	3.7 ± 0.9 ^{ab}	24.6 ± 6.7 ^a	23 ± 6.78 ^a	93.5

2. Kindling to mating interval

The time of mating after kindling and the state of the conception and delivery of the experimented female rabbits are shown in Table 2.

In accordance with the statistical analysis, the conception rate following a *post-partum* mating 3-10 hours after kindling is slightly different from that obtained 10-15 hours after kindling; but it is significantly different from the results obtained 0-3 hours or in 2-3 days after kindling. So the best delay for *post-partum* mating is determined as 3-10 hours after kindling and the acceptable period is 3-15 hours. If the mating is effective within this period, the conception rate will be increased by 20 % approximately.

Table 2 : Conception rate after mating at different times after kindling

Mating time	Mating numbers	Conception numbers	Conception rate (%)
0-3 hours	31	9	29
3-10 hours	39	21	53.9
10-15 hours	37	19	51.4
2-3 days	31	10	32.3

3. Results of the Winter production technique

By utilization of the winter reproduction techniques, the WRP's experiments have been done with success. The results are shown in the Table 3.

Table 3 : The WRP's results of female rabbits

Dams	Total litters	Litters per dam	Total kits	Litter size	Weaned kits	Survival rate
35	96	2.74	748	7.8	705	94 %

The result showed not only the WRP but also the FRP in winter can be executed as long as the feasible measures are utilized in the producing course of rabbits in the cold regions.

4. Results of the oestrus retardation treatment with "Cuiqingsan"

The results that cured the oestrus retardation of female rabbit 57 cases of sick female rabbits were cured in the experiment. Their average anoestrus time after parturition was 50 ± 31 days (including 30 days of lactation period). After fed medicine 5.1 ± 4.3 days, they all appeared with oestrus symptoms. The conception rate reached 98.2 % for once mating and the average number of delivered young was 7.9 ± 0.94 per litter.

5. The results of the galatogogue experiment

The results was shown in Table 4.

Table 4 : The results of the galatogogue experiment

Group	1	2	3
Content	1 %	2 %	0 %
Numbers of litter	10	10	10
Litter weight at birth	356 ± 89.44	352.78 ± 98.78	354 ± 63.06
Litter weight at 21 days	1303.5 ± 302.97	1575 ± 474.2	1218 ± 265.4
Litter weight at weaning	2301 ± 643.5	2670 ± 815.5	2202.5 ± 844.9
Added weight of litter in lactation period	1945 ± 70.47	2317.2 ± 85.97	1846.5 ± 772.8

The results showed that adding 2 % "*Ruquanling*" into the full formula feed could increase by 29.3 % the milk production of female rabbit and by 25.49 % the weight of litters at weaning ($P < 0.05$), but there was not notable difference of the survival rate of the litter during the lactation period.

CONCLUSION

On the basis of the experiments above and absorbing advanced technical experiment, the FRP's technique of meat rabbit was gained in the cold regions. The major content include :

1. Choosing the FRP-resistant meat rabbit breeds Californian and New Zealand white. Their idiophase is one year beginning at first kindling.
2. Being mated during 3-15 hours after the female rabbits give birth and taking the WRP.

3. Building the heat-preserving house, feeding the full formula feed in order to satisfy the nutritive requirements of the rabbit, adding the "*Ruquanling*", "*Cuiqingsan*", etc... medicines into the feed.
4. Strengthening the management of the breedable doe rabbits, breeder male rabbits and litters, and separating the litter from their mother after kindling.
5. Strengthening the preventing disease and curing, sterilizing the cage and house on time and strictly executing the epidemic prevention procedure.

The FRP's experimental results in Zhangbei experimental region are shown in Table 5.

Table 5 : The results of the meat rabbit FRP in Zhangbei experimental region.

Rabbits	51
Average number of delivery per rabbit annually	7.24 ± 1.24
Weaned kits	46.4 ± 7.94
Survival rate	93.2 %
Number of annual slaughter rabbits	41.9 ± 7.3
Survival rate of slaughter rabbit	90.4 %

This technique was spread and applied in Zhangjiakou region and country. The production achievement of meat rabbits was very satisfactory. In the application , 91000 breedable rabbits were spread. The increased output value is 11.466 millions yuan and the net income is 7.77 millions yuan.

This technique adapts to be spread and applied in the regions around the Mongolia Plateau or the same regions.

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