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COMMERCIAL RABBIT PRODUCTION

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INTRODUCTION

The domestic rabbit, *Oryctolagus cuniculus,* is a descendent of wild rabbits of southern Europe and North Africa. The rabbit is thought to have been discovered by Phoenecians when they reached the shores of Spain about 1000 BC. During the times of Roman the rabbit was still emblematic of Spain. It appears that the Romans spread the rabbit throughout the Roman Empire as a game animal. The Romans, like Spaniards of that time ate foetuses or newly born rabbits, which they called laurices. In their natural environment, rabbits are gregarious and prolific. They are completely herbivorous (eat only plants) and most actively forage in the twilight or in the dark. The average lifespan of a rabbit is 5-10 years (potential life span of 15 years is possible).

Rabbits are ideal small livestock project for peri-urban or rural areas, especially in developing countries such as Botswana with a significant proportion of citizenry living below poverty datum line. Rabbits are quite clean and relatively odourless. The raising of rabbits can be anything from a profitable hobby to a full-time living. Rabbits fit well into a balanced farming system. They complement well with vegetable growing. Excess and waste from vegetable gardens and kitchen goes to feed the rabbits, whereas their manure is used to fertilize gardens, thus forming a profitable cycle and aiding the balance of nature.

The reasons for raising rabbits are manifold. Rabbits are an important source of food, particularly in Europe and Asia. They produce white meat that is fine-grained; high in protein, low in fat, highly palatable, low in cholesterol, and that can be substituted for poultry in most recipes. Rabbit carcasses are only 20% bone. In the United States, rabbits are raised mainly for non-food purposes. High quality rabbit skins are used in fur garments (clothing, hats), to cover bicycle seats, etc., and their use could spark a village industry/crafts projects. Another significant use of rabbits is in cosmetic, medical and pharmaceutical research laboratories. Therefore, a rabbit producer must establish credibility with each laboratory and know what the needs are so that orders can be filled. Rabbits are also raised for show or as pets.

World Production

In 1994, world's production of rabbit meat was estimated to be 1.5 million tons per annum. This would mean *per caput* annual consumption of 280 g per person per year. The five major world's rabbit producing countries are Italy, Commonwealth of Independent States (Russia and the Ukraine), France, China and Spain. In Africa, the leading rabbit producing countries are Morocco and Nigeria and these are reported to produce 20000 to 99000 tons meat per year.

Advantages of keeping rabbits

The advantages of keeping rabbits over other livestock species include:

- Small body size.
- Rabbits do not compete for grains with humans as strongly as chickens.
- Limited cost of the animals and of the housing structures.
- Efficient reproductive ability. Rabbits are prolific in terms of offspring (kg/year/doe) and will breed all year round if well-managed.
- Does (female rabbits) can kindle (give birth to) up to 13 bunnies (young rabbits) at a time, the average being 8. A doe can easily give 25 or more offsprings per year. To estimate the potential of meat production this number (25) is multiplied by 1 or 2 kg.
- Rabbits usually produce 4 to 5 litters in a year. With proper management, rabbits can be kindled intensively.
- Early age of sexual maturity (4-5 months).
- Short fattening period (less than 2 months from weaning). With proper care and feeding they will be 8 weeks old or less at this stage. Young rabbits are ready for market at 1.8 to 2.2 kg.
- Rabbits have an efficient feed conversion ratio (FCR).
- Rapid generation turn over rate. A doe can produce up to 10 times its own weight, or more, in offspring per year.
- Rabbit meat is one of the most nutritious meats available (Table 1).
- Rabbit meat can be prepared in over 300 different ways.
- Unlike wild rabbit, domestic rabbit meat is pearly white, tender, juicy and mild in flavour.
- Rabbits require little space than large livestock. This is important, especially in areas where there is shortage of agricultural land.
- Rabbits are easy to transport and market and the recurrent costs for maintaining animals beyond the optimum are low.

BREEDS OF RABBITS

Rabbits are generally classified according to size, weight and type of pelt. Small rabbits weigh about 1.4-1.8 kg at maturity, medium breeds 4.1-5.4 kg, and large breeds 6.4-7.3 kg. The two most popular breeds for meat production are the New Zealand and the Californian. These breeds are most popular because they combine white fur (preferred by processors) and good growth characteristics.

New Zealand rabbits are slightly larger than the Californian, 4.1-5.9 versus 3.6-4.5 kg. The New Zealand rabbit has a completely white, red or black body, whereas the Californian is white with colored nose, ears and feet.

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The two most popular rabbits for fur production are the Rex and the American Chinchilla. The Rex is slightly smaller (3.2 kg) than the American Chinchilla (4.5 kg). There is a tendency for fur markets to be unstable, so one needs to ensure that market is available before starts production. Examples rabbits are given Figures 1, 2, 3 and 4.

Figure 1 Flemish giant

Figure 2 American Chinchilla

Figure 3 New Zealand White

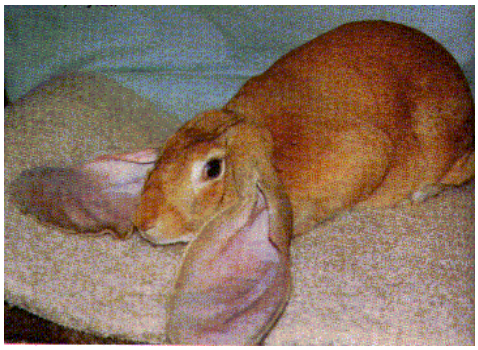

Figure 4 Lop, English

RABBIT MEAT COMPOSITION

In comparison with the meat of other species, rabbit meat has a low cholesterol level (50 mg – 10 gm^{-1}), fewer calories, lower fat content and is richer in proteins than beef, pork, chicken or lamb (Table 1). Rabbit meat is also richer in certain vitamins and minerals, and is relatively rich in essential fatty acids. Rabbit meat

is especially good for babies, elderly people and anyone with stomach disorders because it is easily digested.

As shown in Table 2, rabbit fat contains less saturated fatty acids (stearic and oleic) than other species and higher proportions of the polyunsaturated linolenic and linoleic fatty acids. Unsaturated fatty acids have lower melting points than saturated fatty acids.

Table 1 Nutritional value of rabbit, chicken, veal, beef and pork meats

Animal	Protein (%)	Fat (%)	Moisture (%)	Cal./lb
Rabbit	20.8 – 25.5	10.2	67.9	795
Chicken	20.0 – 21.5	11.0	67.6	810
Turkey	20.1	20.2		1190
Veal	18.8 - 19.1	12.0 – 14.0	68.0	840
Beef	16.3 – 19.0	28.0	55.0	1440
Pork	11.9 – 13.3	45.0	42.0	2050
Lamb	15.7	27.7	55.8	1420

Source: Anon (1997) & Lane (1999)

Table 2 Fatty acids profile of ruminant tallow, pig fat, poultry fat and rabbit fats

Attributes	Fatty acids						
	C14:0	C16:0	C16:1	C18:0	C18:1	C18:2	C18:3
Tallow (ruminants)	4	27	2	24	42	2.5	-
Fat (pigs)	1	27	3	12.5	45	8	0.5
Fat (poultry)	0.1	26	7	7	40	20	-
Fat (rabbits)	3.1	29	6	6.1	28	17.9	6.5

Source: Adrian et al. (1981) cited by Lebas et al. (1997)

MANAGEMENT

Management entails breeding, housing, equipment, feeding, health maintenance, record keeping and marketing. Failure in any one phase will negatively impact other areas.

Feeding

Feed is the single largest operating expense. Feed costs account for 75% of total production costs. Rabbits are herbivores and will consume large quantities of forage (greens), which people do not eat and convert this forage into valuable meat for human consumption. Practically, rabbits can be fed anything from the garden, forest or kitchen including banana and papaya (paw paw) peels, pineapple cores, corn stalks, weeds, vines from pulses, leaves (cabbage, lettuce,

cauliflower, carrots etc.). Although these free or cheap sources of greens form the bulk of the diet, smaller amounts of grains are necessary. If compounded feeds are not used, salt will be a necessary supplement as well. This indicates that unlike chickens, rabbits compete minimally with humans for grains. Rabbit feed should contain 12 to 18% protein. Feeding of additional hay or fibre is not necessary if the rabbit feed contains at least 8 percent crude fibre. Commercial rabbit pellets that meet the nutrient requirements of rabbits in different stages of production are available in the market.

Breeding

a) Selecting rabbit breed

As in any breeding operation, it is necessary that one should always breed from good stock. Select the rabbit breed that suits the purpose of your production. The producer must decide at the start of the business as for what use or market he/she is raising rabbits. The focus of this paper is on rabbits raised for meat. In general, small breeds mature earlier than large ones. Small breeds (Polish) can usually be bred at 4 months; medium weight rabbits (New Zealand Whites and Californians etc.) at 6 to 7 months; and the giants (Flemish giant) at 9 to 12 months. However, many commercial breeders begin breeding successfully at 5 months of age.

Although large breeds are sometimes used for meat, they have a FCR that is less profitable than medium breeds. At maturity most giant breeds weigh 6.4 to 7.3 kg and small breeds 1.4 to 1.8 kg. Small breeds are used primarily for pets, shows and hobbyists, whereas the medium breeds that are considered dual purpose are most commonly used for meat and research laboratories. New Zealand White and Californian, which are the most popular medium breeds, reach a weight of 1.4 to 2.3 kg in 8 weeks of age or less. It is important to use the right animals within the breed for foundation stock. In establishing a rabbit enterprise, it is advisable to purchase animals with records. Factors to consider when purchasing foundation stock include:

- Type
- Vitality
- Breeding efficiency
- Milk production
- Rapid growth
- Longevity
- Disease resistance
- Feed conversion
- Mortality

The doe should always be taken to the buck's hutch for breeding. If the doe fails to mate within a few minutes, she should be removed and returned later. Does will exhibit a false pregnancy following unsuccessful matings. False pregnancy

occurs as a result of sterile or more commonly from stimulation of one doe riding another. It occurs more frequently with does that have not kindled their first litter. This false pregnancy lasts 17 days, and she will not breed in this period. Hence, in most commercial enterprises the doe will be rebred on the 18th day.

Bucks should be used no more than 2 or 3 times per week, although they can be successfully used several times per day for short periods. Generally, one buck should be maintained for every 20 does.

Mating

The first mating of medium size, properly fed does takes place around four months. Bucks are first mated at about five months. If production conditions are not optimum the first mating will be delayed until the animals reach 80% of their adult weight.

In general, a mature buck will service about 8 to 10 does. Bucks and does are housed separately. For mating purposes, the doe should always be taken to the buck's cage and not vice versa. If they fail to mate within a few minutes, the doe should be given to a different buck. Normally a buck should be used once daily. However, some producers use a buck as often as two to three times a day for short periods of time. It has been observed that smaller litters result from too frequent use of a buck.

In intensive breeding one buck can serve seven or eight does. In the extensive system one buck can serve 10 to 15 does. The buck, however, should not be used more than three or four days a week, and not more than two or three times a day, which means no more than six ejaculations per week.

At least 14 hours of light daily have been found to be beneficial. Therefore, artificial light should be provided in winter when shortened daylengths are experienced. A 40-watt bulb every 3 metres works satisfactorily. The lighting program enhances conception rates in winter.

b) Kindling

The normal gestation period of a rabbit is 31 days and the doe will usually eat less 2 or 3 days before kindling (giving birth). The nest box should be placed in the hutch on the 28th or 29th day of pregnancy. The nest is kept out of the hutch until this time to avoid contamination by the doe. Usually litters are kindled during the night and it is necessary that the doe is not disturbed while kindling. If the doe is not accorded the seclusion she will destroy the litter. As soon as kindling has been completed, the doe pulls more fur from her body to prepare a nest. Most breeders will replenish several nest boxes with clean fur for first litter does that do not pull enough fur to make a good nest. Forty-eight hours after kindling, the producer should observe and count the bunnies (kits), removing dead animals.

The average litter is 8, but it can range from 4 to 14 or more. As the average doe is equipped to nurse up to 8 bunnies, it is a common practice to breed several does at the simultaneously, and then transfer bunnies from the large litter to the small ones 2 or 3 days after kindling to even out the milk supply.

b) Weaning

Normal weaning time is at 6 or 8 weeks of age. During the weaning period the young gradually give up milk for solid feed. Weaning is also the time when the breeder separates the young from the doe. An extra litter per year could be gained by rebreeding the doe at 6 weeks (following kindling) while she is nursing her litter, and then weaning at 8 weeks. Sexes should be segregated at the time of weaning.

The breeder may opt for one of the two following weaning methods: all rabbits in the litter are withdrawn at the same time and placed 6 to 8 per cage in the area set aside for fattening. Alternatively, the doe may be removed and young rabbits left, a method which reduces postweaning stress for the young rabbits but does not necessitate the right production equipment. If the young rabbits are moved the cages must be very clean and litters should be kept together, if possible, for uniformity.

Weaning can take place when the rabbit's live weight is over 500g (after approximately 26 to 30 days in rational European production). The young rabbits begin to eat solid feed at 18 to 20 days and at 30 days the doe's milk provides no more than 20 % of the daily dry-matter intake. In practice, young rabbits benefit from the late weaning until the age of six weeks. Does that wean less than 6 bunnies per litter should be culled.

Housing and Equipment

Housing

The cost of housing will vary depending upon the types of building desired and the location. Rabbits must be protected from the extremes of heat, rain, sun, strong drafts and winds. Semi-open, windowed and well naturally ventilated building may be suitable in hot climates.

In constructing a rabbitry, an east-west orientation is preferred. To provide good air circulation, the width of rabbit house must not exceed 8 metres (m). Windows space must represent not less than 25% from rabbitry floor space. The roof should be 3.2 to 3.5 m high, with slopes south-north to avoid exposure to vertical heat of the sun. The top and outer walls of the building should be painted white to reflect heat as much as possible. Planting shade trees around the rabbitry helps to cool the rabbitry in summer as well as reduce drafts.

Equipment

a) Watering systems

Fresh water is a major factor in a rabbit's growth. Water can be made available to the rabbits manually using crocks and cans or by automatic systems (self-watering), the latter being the most efficient system. Drinkers should be regularly cleaned and periodically checked for leaks and blockage to ensure availability of water supply. The self-watering system is completely sanitary and makes water availability 24 hours a day with little or no maintenance. It also plays a significant role in reducing disease.

b) Feeders

In case crocks or cans are used, they should be placed high enough to minimize contamination and fastened to prevent tipping over. Feeder troughs attached to the cages form the outside are the most common type. Metal is a logical choice than wood which can be chewed upon by rabbits. Placing troughs outside the cage makes refilling faster and easier.

c) Cages

Wire cages are recommended over wooden ones because they are durable and are easy to clean and disinfect. Hutches (or cages) with wooden parts are not sanitary and/or convenient to manage. A 76.2 cm x 76.2 cm x 45.7 cm wire cage is large enough for a doe and litter. This cage can be used for each as it allows room for adequate exercise. On the other hand, a 76.2 cm x 91.4 cm x 45.7 cm cage can be used, especially if broilers are left with the doe until 8 weeks of age. If broilers are not removed at 4 weeks and raised separately, the larger cage will support 7-8 broilers to market age (1.8 kg). About 7 grow-out cages are required for every 10 working does.

d) Nest boxes

Nest boxes should give the doe seclusion, provide adequate ventilation and protect litter from drafts. A nest box measuring 30.5 x 30.5 x 61 centimetres (cm), with one side cut down to 15.24 cm should be insulated and filled with straw. The nest box should be insulated and replenished with straw in winter.

HEALTH MANAGEMENT

Diseases

Rabbits are susceptible to several diseases that reduce production to unprofitable levels. The common diseases of rabbits are scours (also referred to as bloat or mucoid enteritis), coccidiosis, ear mange, sore eyes (weepy eyes), sore hocks and vent disease (rabbit syphilis). In addition, the respiratory disease caused by *Pasturella multocida* is responsible for decreased productivity and a high mortality rate in does.

Scours (bloat or mucoid enteritis)

This disease accounts for a high percentage of mortality in young rabbits, with the highest mortality occurring at 4 and 9 weeks of age. The cause of the disease is unknown.

Symptoms and signs

- Lack of appetite (anorexia)
- Below normal temperature of 38.9 – 39.4 ^{o}C
- Animal grits its teeth
- Intense thirst and bloat may occur because of excessive production of gas disease organisms.
- Weight loss of 20 to 25% in 1 or 2 days due to constipation or severe diarrhoea
- The digestive system is usually full of a watery substance
- An excretion of a clear, jelly-like substance

Coccidiosis

This disease is caused by a protozoan, Eimeria sp. Animals that recover from the disease frequently become carriers of this disease. Any rabbit showing signs of coccidiosis should be removed from the herd. The disease is in two forms: liver and intestinal. The so-called nasal coccidiosis results from rabbits contaminating the mucous membranes of their nose while practising corprophagy (eating their faeces). Corprophagy is normal in rabbits and many other animal species as a way of recycling nutrients, especially B vitamins.

Treatment

Use water soluble chlortetracycline or oxytetracyline at a concentration of 4 g per 4.5 litres.

Symptoms

Young rabbits are susceptible to coccidiosis and its symptoms include:

- Diarrhoea
- Poor appetite
- Rough hair coats
- Retarded growth
- Small white spots found on the liver and intestines may be thickened and pale.

Treatment

Coccidiostats are available in the market. For example, sulfaquinoxaline in drinking water at 0.04% continuously for 2 weeks is recommended for the liver type of coccidiosis. Contact your nearest veterinarian for assistance.

To help prevent diseases, observe strict biosecurity. This includes not permitting visitors inside the rabbitry, as they may introduce disease, causing additional stress to the animals. Clean and disinfect the cages regularly to prevent spread of disease. Other steps that help to maintain a rabbit herd's health include:

- Isolate new rabbits (or those returning from shows) for 30 days;
- Quickly dispose of dead rabbits. In case disease is suspected, disinfect cage and all equipment, and burn droppings;
- Clean cages regularly. Especially clean doe cage before the clean nest box is put in and before the litter comes out of the nest (about 2 weeks);
- Vacuum accumulated fur from cages and equipment;
- Keep water clean and periodically flush lines;
- Control flies and vermin.

Sore hocks (ulcerative pododermatitis)

Sore hocks usually occur on wire floor cages. Sores appear on the hocks and rabbits sit humped and listless. This condition is due to an infection and inflammation of the foot pad.

Treatment

Soak hocks in warm, soapy water and/or apply zinc or iodine ointments to prevent secondary infections. Thereafter, place the animal on clean bedding.

Sore eyes (weepy eyes)

Infected animals have a watery, milky discharge around the eyes because of vitamin A deficiency, infection or injury.

Treatment

Bathe eyes in warm boric acid solution and use an antibiotic ointment of 5 percent sulfathiazole.

Vent disease (Rabbit syphilis)

Infected animals have a raw skin around the vent which may be swollen and covered with scabs. The disease causing organism is spread in breeding. Infected animals should be isolated and scabs removed and thereafter an antibiotic ointment applied on daily basis.

Parasites

Rabbits are intermediate hosts for two tapeworms of the dog. Also, the rabbit is an intermediate host of the cat. Dogs and cats should not be allowed near the rabbits' feed, water and bedding as they transmit tapeworm eggs in their faeces. Again, dogs and cats should not eat the intestines of rabbits because they may become infected and continue the cycle of infection.

Ear mites (Ear mange, canker)

This is the common parasite infection of the domestic rabbit. An infected rabbit shakes its head and flops or scratches its ears to rid itself of mites. Thick crusts of mites and serum accumulate inside the ear. In severe cases symptoms include spasms of eye muscles and nerve damage leading to partial paralysis and secondary infections.

Treatment

- Apply mineral oil into ear every 3 to 4 days.
- Swab the ear with a mixture of 1 part iodoform, 10 parts ether and 25 parts vegetable oil. All scales must be removed prior to swabbing.
- Repeat treatment 6-10 days after first treatment.
- Alternatively, apply swabbing solution in 25-30% emulsion of benzyl benzoate in vegetable oil.

RECORD KEEPING

Keeping complete and accurate records is an essential part of herd management, as well as, in the measuring performance of a rabbit enterprise. In the absence of accurate records, it will be extremely difficult for the rabbit farmer to make meaningful management decisions. Therefore, it is important that records are accurate and up to date to guide informed management decisions. Accurate records are used to maximize the efficiency of the enterprise. Records are generally used for the purposes of control, assessment and planning. Everyday management decisions are based on key records. Records of breeding, nesting, kindling, purchases, weight culling, replacement selection, feed conversion, mortality and marketing should be maintained.

MARKETING

Rabbits will reach market age at about 8 weeks of age or less. Rabbits may be sold live or dressed. In most cases producers must develop their own markets. Meat rabbits must have good loins, shoulders, hips and pelts. Rabbits raised for meat are generally marketed as broilers, weighing 2.0 to 2.3 kg liveweight.

The fur market requires that rabbits have meaty carcasses and clean, top quality pelts. To obtain a satisfactory price, a large number of pelts are usually required. The price of pelts depends on quality. For research work, rigid guidelines may be specified such as a specific age, sex, size or breed. The market for rabbits raised for research is generally handled on a contract basis.

RECIPES FOR COOKING RABBITS

Rabbit meat can be prepared in over 300 recipes. Two traditional recipes of preparing rabbit meat in Botswana are discussed in this section.

Traditional recipes

Recipe 1

- After skinning and evisceration, the rabbit carcass would be opened and dried in the sun for the whole day.
- Following drying, it is then cut into pieces and a minimal amount of water added and cooked in a three-legged pot.
- A pinch of salt is added to the meat for taste.
- After an hour of simmering, the meat would be nicely cooked and is then removed from the pot leaving a small amount of gravy (*moro*).
- The meat is then deboned and meat ground.
- The ground meat (*seswaa*) is then taken back into the pot containing gravy and mixed with groundnuts meal or peanut butter to make a very delicious relish (*busebo gwe dobi*). The mixture is allowed to simmer for a few minutes, after which it is now ready to be served with any meal, especially maize meal (*papa*).

Recipe 2

- After slaughter, the rabbit is placed in boiling water and thereafter skin removed by pulling with a hand.
- The carcass is then eviscerated, cleaned and hung to allow blood to drain.
- The carcass is chopped into pieces, placed in the pot, and some water and oil added.
- The pot is placed on fire and meat allowed to cook thoroughly (until flesh begins separate from bones). At this time, the pot is removed from fire. Usually, some gravy should remain before a pot is removed from heat.
- The meat is then ground and mixed with gravy, then served with maize sorghum meal. The meat can still be eaten alone.

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