RABBIT PRODUCTION

for MEAT

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Oregon State System of Higher Education
Agricultural Experiment Station
Oregon State College
Corvallis

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Rabbit Production for Meat

M. P. Chapman

Jay Long

INTRODUCTION

Since the outbreak of the war there has been an unprecedented demand in Oregon for information on rabbit raising for meat production. The raising of domestic rabbits not only may offer an excellent source of supplementary meat supply for the average family during the present national emergency, but may also help in the war effort by releasing other meat for our armed forces or our allies.

Rabbit furs are particularly in demand by the felting and garment trade as the normal importations of rabbit skins from foreign countries have been curtailed by war conditions. Rabbit fur is used also in lining some of the clothing and equipment needed by the armed forces.

Rabbit raising requires little space, has few objectionable features, and may be practiced almost everywhere, often even in areas where poultry raising is not permitted. Hutch construction need not be unduly expensive and procurement of feed seldom offers a serious problem. Rabbit meat is produced economically and quickly, only 4 to 5 pounds of feed being required to produce 1 pound of live weight, and young rabbits often reaching “fryer size” 90 to 100 days after the doe is mated. A good doe properly managed should produce three or four litters a year, each litter averaging six or seven young. Three or four does and a buck will supply the average family with as much rabbit meat as it will readily use. Any surplus rabbits may be marketed, or if of good quality may be sold as breeding stock. Rabbit meat is light in color, fine grained, nutritious, and palatable.

Rabbit manure has a high nitrogen content and is especially valuable as a fertilizer for garden and truck crops. This should be of interest to potential rabbit raisers who have Victory gardens.

This bulletin is intended primarily for the small unit production of rabbit meat for home consumption. Persons interested in raising fancy or show stock or in large scale commercial production of animals for meat and fur, wool, or laboratory use will perhaps wish to consult the section of this bulletin listing Sources of Rabbit Information and particularly U. S. Department of the Interior, Fish and Wildlife Service, Conservation Bulletin Number 25, Rabbit Raising.
SELECTING BREEDING STOCK

The prospective rabbit raiser is faced first with the problems of choosing a breed and procuring foundation stock. All of the medium and large rabbit breeds are good meat producers. The pelts of white rabbits, however, generally command slightly higher market prices. Breeds of rabbits important in producing meat and fur include the New Zealand, Flemish Giant, Beveren, American, Chinchilla, and Champagne D'Argent.

Selection of a breed has been in the past largely a matter of personal choice. At the present time (1943) it may often be a question of availability, so great has been the demand for breeding stock in many sections.

Figure 1. Satisfactory type of hutch construction using slat flooring.

Generally, best results are obtained by buying foundation stock from neighboring reliable dealers who will give a reasonable guarantee on the rabbits they sell. The animals selected should be vigorous and free from disease, and should possess the ability to reproduce healthy, fast growing offspring of desired quality. The beginner may start with young rabbits from 2 to 6 months old or with mature stock. It is often the practice to purchase does that are already bred and to procure a buck later when needed. In such cases it is well to remember that pregnant does are not as hardy as younger stock and do not as readily withstand transportation for long distances. Addresses of rabbit breeders may be obtained from state and national
rabbit breeders associations. Associations in Oregon include the Oregon Branch of the American Rabbit and Cavy Breeders Association, Incorporated, and the Oregon State Rabbit Breeders Association.

**HOUSING AND EQUIPMENT**

In the construction of hutches, climatic conditions, space availability, ease of feeding and working with the animals, and sanitation should be considered. If space is not a problem, single-tier hutches are generally most desirable. They have the advantage of being portable, and may be moved under trees for shade or near buildings for protection. Hutches should be 4 to 6 feet long, 2½ feet wide, and at least 2 feet high. Hutches having so-called self-cleaning floors are definitely preferable to those having solid floors. Galvanized hardware cloth (wire screen) of ¼- or ⅛-inch mesh makes an ideal floor. If this is not available, floors may be constructed of slats, preferably hardwood, 1 inch wide and spaced ⅛ inch apart. One-inch mesh wire is not satisfactory for hutch floors as young rabbits frequently will catch their hocks and feet in the mesh and in struggling about may become seriously injured.

The two-compartment hutch illustrated (Figures 1 and 2) may be easily and economically constructed. The wide overhanging roof gives protection from rain and snow during the winter, and gives

Figure 2. Roof and slat floor of rabbit hutch removed to show type of construction.
TWO UNIT RABBIT HUTCH

OREGON AGRICULTURAL EXPERIMENT STATION
DEPARTMENT OF FISH & GAME MANAGEMENT
Oregon State College
Feed racks for hay should be large, easily filled without opening the hutch door, and of such construction as to hold hay wastage to a minimum. The wire mesh front of the feed racks, through which the rabbits eat, should be perpendicular so that waste hay will fall into the feeding trough where it will be ultimately consumed. The trough should be narrow and have guards spaced at 3-inch intervals to prevent young rabbits from getting into it and contaminating the food. This type of construction is illustrated in Figure 4.

Feeding crocks or troughs should be large enough to hold sufficient food for a full 24-hour period and of such construction as to make cleaning easy. Self-feeders that hold one to several weeks' supply of food are becoming increasingly popular. One type of self-feeder is illustrated in Figure 5. The over-all dimensions of an

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**LIST OF MATERIALS FOR TWO-UNIT RABBIT HUTCH**

**LUMBER**

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>37 Pcs. 1 x 4 x 4' T &amp; G flooring</td>
<td>Roof</td>
<td></td>
</tr>
<tr>
<td>5 Pcs. 1 x 4 x 8' T &amp; G flooring</td>
<td>Back wall</td>
<td></td>
</tr>
<tr>
<td>14 Pcs. 1 x 4 x 29½” T &amp; G flooring</td>
<td>Ends and partition</td>
<td></td>
</tr>
<tr>
<td>2 Pcs. 1 x 3 x 10' S4S No. 1 Common</td>
<td>Roof stringers</td>
<td></td>
</tr>
<tr>
<td>2 Pcs. 1 x 3 x 8' S4S No. 1 Common</td>
<td>Floor stringers</td>
<td></td>
</tr>
<tr>
<td>2 Pcs. 1 x 3 x 5' S4S No. 1 Common</td>
<td>Front corner posts</td>
<td></td>
</tr>
<tr>
<td>2 Pcs. 1 x 3 x 4'-6&quot; S4S No. 1 Common</td>
<td>Rear corner posts</td>
<td></td>
</tr>
<tr>
<td>3 Pcs. 1 x 3 x 12' S4S No. 1 Common</td>
<td>Doors, frames, etc.</td>
<td></td>
</tr>
<tr>
<td>1 Pcs. 1 x 2 x 18' S4S No. 1 Common</td>
<td>Sway braces</td>
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</tr>
<tr>
<td>1 Pcs. 1 x 2 x 6' S4S No. 1 Common</td>
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</tr>
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<td>52 Pcs. ⅛ x 1” x 29½”</td>
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<td>4 Pcs. ⅛ x 1” x 16”</td>
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</tr>
<tr>
<td>2 Pcs. ⅛ x ⅜ x 10'-4”</td>
<td>Roof strips</td>
<td></td>
</tr>
<tr>
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**ROOFING**

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<tr>
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</tr>
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<tbody>
<tr>
<td>½ Square Med. Standard Roofing</td>
<td>Roof</td>
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**HARDWARE**

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<tbody>
<tr>
<td>2 Pr. 2” hinges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 lbs. 4d smooth box nails</td>
<td></td>
<td></td>
</tr>
<tr>
<td>¼ lb. 8d smooth box nails</td>
<td></td>
<td></td>
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<tr>
<td>8 lin. ft. 1” mesh poultry netting—30” width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 1” x 10 F. H. wood screws</td>
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average size self-feeder of this type are 20 inches high by 20 inches wide by 6 inches thick. The feed trough should be 3 inches high by $\frac{3}{4}$ inches wide. The slanting feed hopper board should be nailed lightly so that by changing the degree of slope the throat opening may be adjusted to accommodate different types of food. Most grains and smaller sized pellets will feed readily through a throat opening of $\frac{1}{2}$ to $\frac{3}{4}$ inches. The feed trough on any self-feeder, too, should be divided into sections for each type of grain or feed. If feeds become mixed in the hopper, the rabbits will scratch out the mixed ration in their search for the most palatable kinds of food.

Nest boxes now in use vary markedly in form and construction. For all but the coldest climates, however, any thoroughly clean, open-topped box at least 12 inches wide and 20 inches long with 8- to 10-inch sides will be satisfactory. A high sided nest box prevents very young rabbits from crawling out and becoming lost, and also tends to scrape off any young rabbits that might be clinging to the breasts of the doe when she jumps out of the nest box. (Figure 6.)

Ample sized water pans or crocks are an important part of the rabbitry equipment. These should hold at least $\frac{1}{4}$ gallon, should not be easily upset, and should have no sharp edges.

Additional information on other types of hutches, self-feeders, and equipment for the rabbitry are given in U. S. Department of the Interior, Fish and Wildlife Service, Conservation Bulletin Number 25, Rabbit Raising.

**BREEDING**

Medium sized breeds may be mated first at 6 or 7 months of age while larger breeds, which mature more slowly, are not usually mated until 8 to 10 months old. Some breeders make a practice of mating does when they reach a certain standard weight, such as 10$\frac{1}{2}$ pounds, in rabbits of the New Zealand breed. Since some individual rabbits mature faster than others this standard weight frequently may be attained before the animals reach the age generally considered normal for the first mating.

The accepted practice in breeding rabbits is to take the doe to the buck’s hutch for service. Mating should occur at once, after which the animals should be immediately separated and the doe returned to her own hutch. Only one service per doe is necessary or desirable, as overuse is likely to lower the vitality of the buck. A vigorous, mature buck may be used as many as three times a week for short periods. Normally, one buck should be kept for every ten does.
Figure 4. Satisfactory type of hay feed rack construction.
Figure 5. Satisfactory type of automatic or self-feeder, showing divided hopper suitable for two types of food and illustrating feed trough construction using tin partitions.
Test matings to determine whether the doe has conceived are generally made 5 days after the first mating and, occasionally, also at 18 days. If the doe avoids the buck and refuses to mate, conception has probably occurred and the doe may be expected to bear young approximately 31 days after the date of mating.

Figure 6. Slat bottom hutch with door opened to show open-topped nest box.

The female rabbit, unlike most other domestic animals, has no regular “heat period.” The sex cells are continually being developed in the ovaries but are not released until mating occurs or until the doe has been sexually stimulated in some other manner. False pregnancies sometimes occur, usually as the result of infertile matings. If the doe pulls fur and attempts to make a nest about 2 weeks before the end of her normal 31-day gestation period, this is good evidence of the termination of false pregnancy, and she should be test mated again.

Besides false pregnancies, other failures to reproduce young may result from the doe’s being abnormally fat, in poor physical condition, too young at the time of mating, too old to be fertile, or in the molting period. Generally the highest percentage of conceptions will occur during the spring and the lowest percentage during the period of molt in the fall.
A nest box, as previously described, should be filled with clean straw and placed in the doe's hutch 7 days before the date of kindling or bearing young. The doe will arrange the straw and line the nest box with fur pulled from her sides and under parts. In some cases it may be necessary to pluck additional fur from the under parts of the doe for this purpose. It is generally considered to be good practice to feed the doe small quantities of green feed in addition to the regular ration for a few days before and after kindling. It is essential that the doe not be disturbed during kindling, which usually occurs at night.

The litter should be inspected the day following kindling and all dead or deformed young removed from the nest box. Usually from six to eight young are left with the doe, depending on her capacity for milk production. Whenever possible, it is advisable to breed several does on the same or consecutive days so that they will kindle at about the same time. Litters may then be evened up by transferring some of the young from larger litters to does having a smaller number of young. The females readily accept young from litters of other does if the transfer is made within 2 or 3 days after kindling.

Young rabbits are born without any fur on their bodies and with their eyes closed. At about 12 days their eyes begin to open and at about 18 days of age they start coming out of the nest box and taking solid food. When the young reach 4 weeks of age the nest box may be removed and the hutch thoroughly cleaned.

Young rabbits are usually weaned at about 8 weeks of age. At this time many rabbit breeders separate the young they intend to keep as breeding stock. The young to be used for meat may be left with the doe until needed, thereby making full use of the hutch equipment.

If three or four litters are to be produced per year it is essential that the doe be rebred as soon as the young are weaned. If for some reason her litter is markedly reduced in number she may be mated at an earlier date.

The sex of rabbits may be determined by pressing open the sexual aperture just below the anal opening. In does a longitudinal slit is present; in bucks a round opening is observed and the male organ may be made to protrude.

Rabbits should never be handled or lifted by the ears or legs. An animal to be lifted and carried should be grasped with one hand by a fold of skin over the shoulders while the other hand is used to support the rump. Less struggling will occur if the animal is then held close to the body.
Most rabbits have a habit of chewing wood even when fed a full, well-balanced ration. To prevent damage from wood chewing, self-feeders and other wooden hutch equipment may be stripped with tin.

Frequent inquiries are received concerning does that eat their young. It is thought that this is frequently the result of a dietary deficiency that may sometimes be remedied by a change in the ration fed. Any doe that destroys her young more than once when fed proper food should be butchered for meat.

Rabbit losses frequently occur during periods of extremely high temperature. Shade and maximum ventilation should be afforded rabbits at this time. In addition, it may be advisable to place wet feed sacks on the hutch floor for the rabbits to lie on. Hutches may also be efficiently cooled by means of a sprinkling system, care being taken to see that the water falls on the waterproof roof and does not wet the rabbits in the hutch. This method is especially effective when it is necessary to keep young rabbits, as well as mature rabbits, comfortable under critical heat conditions.

As stated previously, rabbit manure is an excellent garden fertilizer. Extreme care should be taken, however, not to place the manure where vegetables or greens are grown for rabbit food as by this practice rabbit parasites may be introduced and spread.

If a breeder wishes to improve the quality of his stock, hutch record cards are of definite value. These may list, among other items, dates of breeding and kindling, sizes of litters, number of young raised to fryer or marketing age, weight of litter at 3 weeks, and weight at 8 weeks of age. The weight at 3 weeks is generally taken to indicate the “milk production” and the weight at 8 weeks the “meat production.”

Care should be exercised in choosing the young to be retained as breeding stock. Undesirable tendencies noted in the parents such as wasting and soiling feed, high mortality of young, poor milk production, and the like, may appear in the offspring. The same is generally true of desirable traits such as cleanliness and high productivity. Thus, it is evident that careful selection of breeding stock will pay dividends to the rabbit breeder just as it will to breeders of other types of livestock.

**FEEDING**

Rabbits readily consume and find palatable and nutritious a large variety of plant foods. The foods fed in any specific locality, therefore, will depend largely on availability and cost. The whole grains
such as wheat, oats, barley, and rye usually form the basis for most rabbit rations. These grains are approximately equal in nutritive value and may be fed separately or in any combination or mixture. A good quality legume hay such as alfalfa or sweetclover should always be fed in conjunction with any of these grains or grain mixtures. Hay is more efficiently consumed with less waste if cut into 3- or 4-inch lengths before being placed in the hay racks. (A hand saw may be used for this purpose.)

While rabbits generally do well on the basic rations mentioned, more rapid growth and development of young rabbits will be attained by feeding an additional protein supplement such as soy bean, linseed, or peanut oil meal in pea-sized oil cake or pellet form. This protein supplement usually is fed with the whole grains in the proportion of one part by weight to two parts by weight of any of the grains or grain mixtures.

Green feeds and root crops are greatly relished by rabbits and when available may reduce the feed cost as well as help to maintain the health and vitality of the animals. Important among the various green feeds are lawn clippings, palatable weeds, kale, cabbage, and waste from garden vegetables. Carrots, turnips, and beets are a few of the root crops found especially palatable. Rabbits should be carefully conditioned to the feeding of any of the green feeds or root crops, being given only a small amount the first few days with a gradual increase as the rabbits become accustomed to the change in diet. Green feeds and root crops should serve as a supplement to, and not as a substitute for, the basic whole grains and legume hay rations.

The following specific rations for the Northwestern states are suggested in U. S. Department of the Interior, Fish and Wildlife Service, Conservation Bulletin Number 25, Rabbit Raising:

**Ration for dry does, herd bucks, and developing does and bucks**—

Grain and protein:
- Two parts oats or wheat.
- Two parts whole barley.
- One part linseed, soy bean, sesame, or peanut meal.

Roughages:
- Sweetclover or alfalfa hay.
- Green feed or root crops.
- Salt.

**Ration for does and litters**—

Grain and protein:
- Two parts whole oats or wheat.
- Two parts whole barley.
- Two parts linseed, soy bean, sesame, or peanut meal.
the head just behind the ears. The animal should then be suspended by the right hind leg from a nail or hook fastened to the wall (Figure 7) and the head removed immediately to facilitate thorough bleeding. The tail and front feet are cut off, and the free rear leg is removed at the hock joint. The skin is cut around the hock of the suspended leg and a cut made along the inside of the hind legs from hock to hock. The edges of the skin are loosened and the pelt then may be pulled from the carcass in the same manner that a glove might be removed from the hand.

RABBIT PRODUCTION FOR MEAT

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Roughages:
Sweetclover or alfalfa hay.
Green feed or root crops.
Salt.

Table scraps, other than greasy foods or meat, may also be used as a supplement to the food supply.

Many rabbit breeders prefer to feed one or more of the many proprietary pelleted rabbit rations now on the market. It is generally thought that for best results a good legume hay should be fed with most of these rations.

Rabbits consume large quantities of water, and an ample fresh, clean supply should be available to the animals at all times. Salt is not present in sufficient amounts in the average rabbit ration to fill the requirements of the animals. An additional supply of salt, in block or spool form, therefore, should be placed in each hutch.

There is considerable variation in the number of times a day rabbits are fed by different persons. Some feed only once a day, others two or three times. Usually, dry does and herd bucks are fed only once a day, the amount being that which will be readily consumed in 20 to 30 minutes. Individual rabbits vary in the amount of food required. Growing rabbits and does with nursing litters should have available all the food they will consume without waste each 24 hours.

Full feeding by means of one of the many types of automatic or self-feeders has several definite advantages over daily hand-feeding methods. The self-feeder holds several days' or weeks' supply of food, thereby saving the rabbit breeder considerable time and labor. In addition, experiments indicate that heavier, better conditioned fryer rabbits may be produced by this method with less food required. The self-feeder is not so well adapted to the feeding of mature breeding stock as these animals when full-fed occasionally become excessively fat.

SLAUGHTERING AND SKINNING

A rabbit may be humanely and quickly killed by a sharp blow on the head just behind the ears. The animal should then be suspended by the right hind leg from a nail or hook fastened to the wall (Figure 7) and the head removed immediately to facilitate thorough bleeding. The tail and front feet are cut off, and the free rear leg is removed at the hock joint. The skin is cut around the hock of the suspended leg and a cut made along the inside of the hind legs from hock to hock. The edges of the skin are loosened and the pelt then may be pulled from the carcass in the same manner that a glove might be removed from the hand.
A slit is made in the carcass along the belly, cutting through the body wall, but care is taken not to cut the intestines. The entrails are then removed, leaving the liver and heart still in place. The right hind foot is cut off; the carcass is cleaned by rinsing in cold water and prepared for the pan by cutting into pieces as shown in Figure 10.

Figure 7. Steps (right to left) in skinning and cleaning rabbits. Courtesy U. S. Department of the Interior.

RABBIT PELTS

All rabbit pelts have a market value and if properly handled the returns from pelts sold may aid materially toward paying the feed cost.

Shapers for the pelts may be made from No. 9 galvanized wire (Figure 8). Immediately after skinning, the pelt should be slipped over the shaper, flesh side out, care being taken to arrange both front legs on one side and to prevent wrinkling of the skin. All surplus fat should be removed. Clothespins may be used to make fast the edges of the skin to the shaper (Figure 9).
Figures 8 and 9. Shaper for rabbit skins and pelts properly placed on shapers.

RABBIT DISEASES

Diseases of rabbits, as in many of our other domestic animals, must be studied from a point of view of prevention rather than treatment. The very nature of properly constructed hutches makes many of the disease problems easy to control. When a few of the simple rules of sanitation and good husbandry are observed, most parasites and many of the bacterial diseases are eliminated.

Some of the rules that must be observed will be set forth and an explanation of these rules will then be given.

Pelts should be hung out of reach of rats and mice until dry. Artificial heat, sun, and salt are all injurious to drying pelts.

If pelts are to be stored, they should be placed in a tight box and sprinkled liberally with naphthalene or paradichlorobenzine flakes or crystals.
1. Do not use old hutches until after they have been thoroughly cleaned and disinfected.
2. All breeding stock must be free of disease.
3. All new additions of breeding stock must be held in quarantine for at least 2 weeks.
4. Whenever a rabbit dies, its pen should be cleaned and disinfected before any new animals are added to the pen.
5. Whenever a rabbit becomes sick, it should be removed to an isolation pen until it is disposed of or recovers.
6. All dead animals must be properly disposed of.

Some suggestions will be made as to the best methods of carrying out the foregoing rules.

The best way to clean a rabbit hutch is to scrape free from the boards or wire all dirt and fecal material, using a putty knife and a wire brush. The hutch should then be scrubbed with a stiff brush and scalding lye water. The lye water is made by adding 1 pound of commercial lye to 10 gallons of boiling water. It is advisable to wear rubber gloves and glasses in this operation to protect the hands and eyes. After the pen has been washed down, the excess lye water should be rinsed off with clear water. Following this, the wire and metal parts should be gone over with a blow torch. Good cleaning equipment is the most economical investment in the rabbitry.

It is difficult for the layman to select breeding stock that is free from disease. The best assurance one can have is to buy stock from a reliable dealer who is known to be a successful rabbit raiser. Presence of coccidia and other intestinal parasites can be determined by microscopic examination of the fecal material, which must be done by a person trained in this type of work.

By having a quarantine pen that is set aside from the main hutches, it is often possible to prevent the introduction of disease. If the new stock is isolated in this pen for 2 weeks, most of the diseases to which it may have been exposed will have developed by the end of this time.

Rule number four could read "Never take chances." It is just good common sense to clean house before the new tenant arrives, so whenever a rabbit dies, thoroughly clean the hutch and equipment before new stock is added.

The isolation pen for sick rabbits should be one that is warm, well ventilated, easy to clean, and away from the colony hutches. It should be provided with plenty of fresh, clean water and dry, clean bedding. The sick rabbit should be tended after the others and not before. It is often best to have a member of the family who does
not tend the breeding stock look after the isolation pens. This will prevent the possibility of disease being carried from pen to pen. While tending the isolated rabbits, it is well to wear rubber gloves, as they can be easily cleaned and disinfected.

Proper disposition of dead stock is always important and only two methods are satisfactory. The best method is to burn the carcass, and many rabbitries have a burner for this purpose. The next best method is to bury the carcass, but it must be buried deep enough so that it will not be dug up by dogs. It is always best to cover the carcass with lime when it is buried. Burning is by far the easiest and best method of disposing of dead stock.

In the discussion of rabbit diseases, it is not our plan to cover all the diseases and parasites, but to limit our scope to those that are more or less common to Oregon. We are guided in our topics by the diseases that have been reported or diagnosed by the Department of Veterinary Medicine of Oregon State College.

Diseases and parasites will be discussed under the following headings:

- External parasites
- Internal parasites
- Bacterial and virus diseases
- Injuries and accidents

**EXTERNAL PARASITES**

Of the external parasites, the most important are the mange mites. A mite is a very small animal organism that for the most part is just in the range of normal vision. They are free-living and those found on rabbits burrow into the skin.

**Ear mange**

The most common are the ear mange mites that cause the disease known as ear canker. There are two species of mites that can cause this disease, but since the treatment and control are the same they can be considered together. The mite burrows just under the skin and sets up an inflammation that causes a flaky crust to form. This usually starts deep in the ear and extends outward until the crust is clearly visible. On some occasions the inflammation will extend into the middle ear and even to the coverings of the brain itself.

The symptoms of this disease are nervousness, shaking of the head, scratching of the ears, or in some cases the twisting of the neck until the head is held in an oblique position (Wry Neck).
Diagnosis is made by looking into the ear and finding the canker. In early stages the canker is deep in the ear canal and may be difficult to see. Microscopic examination of ear scrapings will reveal the mites.

This is one of the rabbit diseases that can be treated successfully. The ear is first cleansed by moistening the scab with some cottonseed oil and picking it loose with a pair of tweezers. The ear is then cleansed as much as possible with cotton swabs. After the ear is cleansed it is swabbed with one of the following preparations:

- Tetrachlorethylene 2 cc.
- Cottonseed oil 1 oz.

or

An oily solution containing 2 per cent pyrethrum extract.

This operation must be repeated every 6 to 8 days until the ear appears normal. Remove the animal to an isolation pen while treating it and thoroughly clean its pen before returning. While scabs are being treated and removed the rabbit should be placed on a piece of paper; then the paper with all the crust should be burned.

**Skin mange**

Skin mange is rare, but is occasionally seen in domestic rabbits. This disease also is caused by mites, but a species different from the mites causing ear mange. There are two species of skin mites, but they can be considered as one as far as control and treatment are concerned. These mites burrow deeper than the ear mites and because of this are much more difficult to treat.

The symptoms are scratching and rubbing of the affected parts. The condition usually appears first around the nose and sides of the face and spreads from there to the ears and under the chin. In extreme cases the lesions may spread even to the legs and body. The severe itching causes an inflammation that leads to the formation of a serous exudate that dries into a hard scab. There may be secondary bacterial infections that cause open sores about the affected parts.

Unless the rabbit has unusual value as a breeder or show animal, it is far more economical to destroy the animal than to attempt treatment. This form of mange spreads rapidly and will cause heavy loss unless it is brought under control very early. First, the hair around the scab should be clipped, then the scab softened with cottonseed oil. If the scab is heavy it should be worked loose, and a sulphur ointment applied, which is made up as follows:

- Sulphur one part
- Lard three parts
This must be rubbed well into the mangy areas every fourth day. Some have suggested the use of lime sulphur dip, but the disadvantages of this are that it is quite irritating to the eyes and hard to apply without getting some into the eyes. Derris or pyrethrum extracts that are made up for the treatment of mange in dogs have been suggested as being of value.

Another preparation can be made by mixing one part finely-powdered pyrethrum flowers and nine parts of vaseline. Rub well into the affected parts. Treat 1 week following apparent recovery.

Following an outbreak of skin mange, every sanitary precaution mentioned earlier must be followed out to prevent spread and recurrence.

**Lice and fleas**

Lice and fleas have been reported occasionally but are not common. If they are found, the animal should be placed on a paper and sprinkled with a pyrethrum powder for lice or with derris powder for fleas. After the powder has been on the rabbit for about ½ hour, it should be brushed off and the brushings burned. The operation must be repeated in about 10 days. In the case of lice, the eggs are on the body of the rabbit, being attached to the hair, but in the case of the fleas the eggs hatch and develop off the body, usually in corners or cracks of the floor of the hutch; thus unless the hutch is cleaned the rabbit will soon be reinfested.

**INTERNAL PARASITES**

The intestinal parasites are classified as protozoa, roundworms, tapeworms, and flukes. In wild rabbits or in rabbits that are raised under insanitary conditions, any of the foregoing groups of parasites may become a serious problem, but with the advent of the modern hutch and daily cleaning practices these parasites can largely be avoided.

**Coccidiosis**

The most widespread and important disease of domestic rabbits is coccidiosis. This disease is important not only because of the total number of deaths that it causes, but also because of the retarded growth of the rabbits that survive the acute form of the disease.

Coccidiosis is primarily a disease of young rabbits but may also cause considerable loss in adults, particularly those that have not previously had the disease.

This is not a new disease. It was first reported in 1838, when Carswell noticed the lesions of the liver form of coccidiosis. He
made drawings of the lesions and thought they were tubercules. The following year, 1839, Hake found the oocysts in the liver and small intestines. It is even possible that Leeuwenhoek was describing oocysts as bile bodies as early as 1674.

It was not until domestic rabbits became a commercial enterprise that coccidiosis passed from the realm of parasitic curiosities and was recognized as an important disease.

The coccidia are small single-cell animals that cannot be seen without the aid of a microscope. There are many different kinds of coccidia but fortunately the vast majority of them are host-specific. That is, the coccidia of rabbits will not infest chickens or other animals and those of chickens and other animals will not infest rabbits. Coccidia of rabbits have not been proved able to infest any other animal.

The life cycle of the coccidia must be understood if the disease and its control are to be understood. Since the life cycle of both the liver and intestinal coccidia is the same, we shall give only one, the liver coccidia, in detail.

We shall begin with the form called the oocyst as it appears in fresh fecal material. This is a small egg-shaped body that is flattened on one end and contains a large central body closely resembling in size and shape the yolk of an egg. This form is not infective and if fed to a susceptible animal will not produce the disease. If this oocyst is kept moist and warm it will sporulate in 24 to 72 hours, depending largely on the temperature. By sporulation we mean that the central body has divided into four smaller bodies that are called sporocysts. Each of these sporocysts then divides into two smaller bodies. Thus the original oocyst now contains eight bodies called sporozoites. This is the infective stage and when taken into the body with contaminated food or water the shell of the oocyst and sporocyst is digested and the eight infective forms are freed. These then migrate up the common bile duct until they reach the liver, where they enter the epithelial cells of the small bile ducts.

After entering the cell, they reach maturity by undergoing a number of changes during which further multiplication takes place. Finally, the form referred to as the oocyst is again reached and passes to the intestinal tract through the common bile duct. From there, it reaches the exterior with the fecal material.

There are two forms of coccidiosis in rabbits, as already stated, and we shall take them up individually, first calling attention to the fact that both forms may be and often are seen at the same time in a single rabbit.
Liver coccidiosis, or spotted liver disease

Spotted liver disease is caused by a coccidium called *Eimeria stiedae*, the life cycle of which was just given.

This disease is most often seen in young rabbits about 3 or 4 weeks of age, and they frequently die in large number. If the rabbits survive this acute form, as they often do, then we see what we call the chronic form of the disease. These rabbits seldom do well and the owner notices that they do not eat as well as the others nor gain weight. They are listless, have poor hair coats, and usually become pot-bellied. Some of them will survive and reach maturity, and others slowly waste away and die. It is also well to state at this time that on some occasions the infestation will be light and the owner may not notice any of the symptoms described above and will not be aware of the disease until the rabbits are dressed, at which time he notices the white spots on the liver.

The lesions of this disease are characteristic and do not closely resemble any of the other diseases of rabbits. There are white spots on the liver that, when cut, will liberate a white creamy material. These spots are usually irregular in outline and will vary from the size of a pea to that of a lima bean. There may be only a few spots or the liver may be almost entirely destroyed by these areas. Another lesion that is often seen is edema or fluid in the body cavity. This fluid is usually thin and slightly blood-tinged.

Intestinal coccidiosis

Intestinal coccidiosis is caused by a different coccidium, the *Eimeria perforans*. The life cycle of this organism is the same as the *Eimeria stiedae* except that instead of the sporozoites entering the bile duct, they migrate along the intestinal tract and enter the cells of the lining of the small intestine.

The symptoms of this disease are much the same as for the liver form, except that during the acute stages there is more likely to be a severe dysentery. This form of the disease is usually referred to as rabbit dysentery; however, there are many things in addition to coccidiosis that will cause dysentery in rabbits. Following the acute stages, the rabbit may make a slow recovery or may linger for some time before death. It is difficult at times to tell by external examination which form is causing the trouble. This can be determined by microscopic examination of the feces or by post mortem examination of one of the dead animals.

The lesions of the intestinal form of the disease are not so pronounced as those of the liver form. By careful examination of the
small intestine, small white spots may be noticed through the intes-
tinal wall. These spots are much smaller than those seen in the liver.
Upon opening the small intestine it may be noticed that the lining of
the intestine is inflamed and there even may be some blood free in
the intestinal canal.

Many animals recover from both forms of coccidiosis or may
have the disease and show no symptoms, but the cure cannot be re-
garded as complete. These recovered rabbits usually become chronic
carriers and will continue to shed coccidia for the rest of their lives.
This is the reason that so many litters of rabbits develop the disease
even though the doe appears to be in the best of health and may have
kindled in a new hutch.

The most effective way to control coccidiosis is by using the
modern type of self-cleaning hutch. Hutches of this nature have a
tendency to reduce the extent of the initial infestation even though
they do not prevent the disease entirely. It must be kept in mind
that good hutches will require constant attention, as there are always
platforms, corners, and feeding and watering equipment that must be
regularly cleaned. The coccidium is a very resistant organism and
most disinfectants used to destroy it are worthless. Mechanical
cleaning with a good wire brush and putty knife is quite effective.
Following good mechanical cleaning, the pen may be washed with
scalding lye water. The temperature of the water is important. It
should be boiling hot and freely applied. Wire parts can be flamed
with a blow torch. All feeding and watering equipment should be
removable and cleaned at regular intervals. Placing this equipment
in boiling water for several minutes will kill the coccidia. Regular
cleaning is practiced by all successful rabbit raisers and by such
regular practices the incidence of coccidiosis is kept at a minimum.
If there is an outbreak of the disease, then a complete clean-up should
be made every day during warm weather and at least every other day
during cool weather.

The question most often asked is regarding treatment of the
disease. Up to the present time, no treatment has been reported to
be of any value under controlled experiments. Many treatments
have been tried and under controlled conditions have been no more
effective than the sanitary recommendations that are advised with
the treatments. It is a common practice to sell a patent remedy and
with it insist on a good sanitary program to be carried out in con-
junction with the treatment. It has been learned that these treat-
ments are no more effective than the sanitary program that is
followed.
Other internal parasites

As has been stated before, roundworms, tapeworms, and flukes are occasionally found in domestic rabbits, but seldom become a serious problem except where rabbits are raised on the ground or on solid floors. Seldom have any of these parasites or their eggs been seen during examinations in the Oregon State College Veterinary Department laboratory. Heavy infestations of any of these parasites may become serious, especially in young rabbits, but in clean hutches the possibility of attaining such an infestation is remote. The symptoms of such infestations would closely resemble those of coccidiosis. Diagnosis would depend on finding the worms, flukes, or their eggs. Treatment would depend on the class of the parasite found and no general statement for all parasites can be made.

Tapeworm cysts, also called bladderworms, are occasionally seen in rabbits. These are large, watery cysts that are found under the skin or elsewhere in the body. These are an intermediate stage of the tapeworm of some other animal, usually the dog. The tapeworm needs a secondary host to complete its life cycle. Briefly, the rabbit eats the egg of the dog tapeworm and develops a cyst. This cyst must be eaten by the dog before it can develop into a tapeworm. This cycle is often more complicated, for many of the tapeworms and some of the dog tapeworms require a host other than the rabbit for the intermediate stage of development.

BACTERIAL AND VIRUS DISEASES

There is possibly more confusion in bacterial diseases of rabbits than in any of the other domestic animal diseases. Many of the diseases are well known by their symptoms and lesions, yet there is considerable disagreement as to their actual cause. Much progress is being made by the Division of Wildlife Research, U. S. Department of the Interior, and it may be hoped that in the near future much of the confusion regarding the causes of specific diseases will be cleared up. Since there is general agreement as to the prevention and control of these diseases, it will not be our purpose in this circular to review the literature on the causes of the diseases or enter into any controversy with those investigating them. Most of the serious bacterial and virus diseases of rabbits are rare in Oregon and need not become generally established if the fundamental rules of care and sanitation are followed.

Pasteurellosis

Possibly the most important of the bacterial diseases are the several forms of a disease caused by a microorganism of the Pas-
teurella group. This disease, pasteurellosis, is reported to occur in several forms that will be discussed briefly. The forms reported are: (1) acute septicemic pasteurellosis; (2) contagious nasal catarrh, or sniffles; and (3) boils.

The acute septicemic form of pasteurellosis is usually seen in adult breeding females. The onset is sudden and they may be found dead before any symptoms are noticed. The disease is largely one of the respiratory tract and the symptoms are rapid breathing, dullness, lack of appetite, and marked weakness. The lesions are congestion of the lungs and trachea and an enlarged spleen. Small hemorrhages may be seen along the intestinal tract and on some of the other organs. The symptoms and lesions are not diagnostic as other diseases may resemble pasteurellosis. Positive diagnosis can be made only by a laboratory.

Contagious nasal catarrh, or sniffles, is a form of pasteurellosis that may be seen in rabbits of any age, but is usually thought of as a disease of young rabbits. This form is a disease of the upper respiratory tract or nasal passages.

The first symptom of the disease is sneezing. There will be a thick discharge from the nose and usually a watery discharge from the eyes. The hair and skin around the nose will often become matted and crusty. This disease is usually chronic and tends to clear up, only to be followed by a recurrence. The rabbits will grow progressively weaker and thinner and pneumonia will develop that will result in death of the animals.

Boils of rabbits are more or less common and may be caused by any of a number of organisms. There is one form of boils, however, that often becomes a serious problem in a rabbitry. The Pasteurella organism referred to is the common cause of these large outbreaks of boils. The boils may appear anywhere on the body but are most often seen about the lower chin and neck. These often follow one of the other forms of pasteurellosis. The boils, when cut, discharge a thick, creamy pus that is usually without odor.

The Pasteurella organism seems to be universal in its distribution and it is reasonable to believe that it is prevalent in most of the rabbitries. It seems to become a disease factor only by the lowered resistance of healthy rabbits. Factors that lead to the development of the disease are insanitary conditions, improper and irregular feeding, poor hutch construction and equipment, drafts and exposure.

There are a number of remedies and vaccines for the treatment and immunization of rabbits for pasteurellosis, but none of them
can be recommended. If the animals have been vaccinated well in advance of the outbreak of the disease, some protection is probably afforded, but once the disease is established control measures will only check the loss and spread. The control measures are the same as for any of the other diseases.

Other bacterial diseases that may be confused with pasteurellosis

There is another type of nasal catarrh that is usually of shorter duration and less often fatal than pasteurellosis. It is said to be caused by a number of organisms, but most workers agree that it is Alkaligenes bronchisepticus. This form tends to clear up in a week or two and seldom results in a chronic form.

Boils may follow breeding accidents or fights where the skin has been broken. Any of the pus-forming organisms introduced in this manner will cause infection that may result in either open sores or boils. Boils of this nature do not have a tendency to spread from one pen to another. Another cause of boils or abscesses is becoming more common because of the increased use of bacterins for the treatment or prevention of various diseases. Most of these bacterins have no value and when not used under proper supervision will only result in the introduction of infection.

Vent disease

Another disease that may be seen from time to time is vent disease. This is a disease of the genital organs and is seen in the breeding animals. The disease is caused by a microorganism that belongs to a group known as a spirochete.

The disease is seen in both males and females and spreads during mating. It usually requires 2 or 3 weeks to develop and many animals may have been exposed before it is noticed. This disease is usually introduced by new breeding stock.

The early lesions are small denuded areas about the prepuce of the male or the vent of the female. These enlarge and will become covered with scabs the size of which vary with the individual animal. In some cases the parts may be only swollen and reddened. The external genitalia are usually the only site of the infection; however, it may spread to the lips and eyelids.

Any animal that shows any enlargement or ulceration about the genitalia should be isolated at once and withheld from mating until the cause of the trouble is determined. This usually requires con-
 ordinary oil immersion microscope. There is a very contagious, rapidly fatal disease. Any of several other diseases in that the ani
cides considerable laboratory work. The hair about the affected parts should be clipped away and the denuded areas painted with a solution made up of half tincture of iodine and half glycerin. This should be repeated every other day. In the male, if the lesions are on the inside of the sheath, a less irritating treatment is necessary; 1 per cent solution of potassium permanganate should be used. The rabbit will usually recover in 10 days or so, but since the disease may recur the animals must be examined carefully before mating. It is authoritatively stated that the disease can be cured by a single dose of Neosalveransan, using 0.01 gram per 2.2 pounds of body weight. A veterinarian must be consulted on the use of this drug, as it requires intravenous administration.

Urine burns

It is well to mention at this time that there is a condition that is sometimes confused with vent disease. This is urine burns, a condition that is the direct result of dirty hutches or bedding. The lesions may resemble those of vent disease, but usually there will be other marks of soiled hair on the underneath side of the rabbit. Sore hocks also are usually the result of urine burn or insanitary conditions, but may also be caused by improper flooring of the hutches.

Tularemia

The subject of tularemia is often discussed whenever the subject of rabbit diseases becomes a topic. The reason for this is that tularemia is thought of as a rabbit disease and it does frequently occur in wild rabbits. It also occurs in many other wild animals, mainly the rodents. Domestic rabbits are susceptible, but rabbits raised under modern conditions are not exposed to tularemia. No authentic case of tularemia has been reported in domestic rabbits.

Myxomatosis

Myxomatosis, or big head disease of rabbits, has been reported in this state only once. This is a virus disease. The term virus is used to classify a disease organism that is so small it cannot be seen with the ordinary oil immersion microscope. There are many virus diseases, but the only one in rabbits that occurs locally is myxomatosis. This is a very contagious, rapidly fatal disease. The onset may resemble any of several other diseases in that the animal will lose its
appetite, have a purulent discharge from the eyes, and the coat will become rough. Soon there will be edema about the lips, face, ears, and vent. This swelling increases until the animal becomes very distressed and shows painful, rapid, shallow breathing. The rabbit usually dies in a coma.

There are no characteristic post mortem lesions by which myxomatosis may be definitely diagnosed. Animal inoculation by trained technicians is the only method that is positive. There are a few lesions, however, that are very suggestive of myxomatosis. When the swollen parts are cut, the surface is white and glistening, and when pressed will exude a clear, serous fluid. The lungs may be quite congested and the spleen will often be enlarged and pulpy.

USE OF LABORATORY

The proper use of the laboratory of the Department of Veterinary Medicine at Oregon State College can be of invaluable aid to the rabbit raiser and his veterinarian. Whenever there is a disease problem, it is always best to consult a veterinarian at once. Most of the diseases can be diagnosed immediately and valuable time can be saved.

If it is decided to seek further information or confirmation of a diagnosis, it is best to send a specimen to the laboratory. It is always best to send a sick animal that is showing typical symptoms or lesions. If this cannot be done, the next choice is to kill or take a rabbit that has just died, have it frozen solid or packed in dry ice, and expressed to the laboratory. The entire carcass is of considerable value to the laboratory.

It is becoming common practice for rabbit owners to send in fecal material for examination. This is easy and incurs little expense, but is likely also to result in very little information to the owner. The only thing that can be learned from fecal material is whether or not the animal has coccidiosis or intestinal parasites. If the parasite load is low or the coccidiosis chronic, it is possible that the fecal sample collected may have been free of the eggs or oocysts at the time the sample was taken. Also, if an animal has diarrhea, the parasite load may be so diluted that the sample may not contain any at certain times. It is impossible for the laboratory to be able to give information on commercial feeds, because it does not know the contents.
SOURCES OF RABBIT INFORMATION

For the benefit of persons wishing additional information concerning rabbits the following list of available current publications has been compiled.

RABBIT PUBLICATIONS—FISH AND WILDLIFE SERVICE

73 WL. Inheritance of “Woolly” in Rabbits.
202 WL. Angora Rabbit Wool Production.
213 WL. Infectious Myxomatosis of Domestic Rabbits.
(Mosquito disease; big head disease)
216 WL. Rabbit Manure as a Fertilizer.
218 WL. Domestic Rabbits in the Food for Freedom Program.
230 WL. Sanitation in Domestic Rabbitries.
231 WL. Vent Diseases of Domestic Rabbits.
240 WL. Recipes for Cooking Domestic Rabbit Meat.
241 WL. Suggestions for Control of Coccidiosis in Rabbits.
242 WL. Rabbit Pen Construction in Relation to Sore Hocks.
25 CB. Rabbit Raising—(price 10 cents)

Conservation Bulletin 25, indicated above as “CB,” can be obtained by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Wildlife Leaflets, indicated above as “WL,” can be obtained free from the Fish and Wildlife Service, U. S. Department of the Interior, Chicago, Illinois. (Not more than five copies in all may be sent free to any one person.)

RABBIT PUBLICATION, WASHINGTON STATE COLLEGE

This bulletin may be obtained free from the Agricultural Extension Service, State College of Washington, Pullman, Washington.

PERIODICALS ON RABBITS

For the following periodicals the prices quoted are subject to change by the publishers, to whom requests should be addressed; these periodicals are not for sale by Oregon State College or the U. S. Department of the Interior or the Fish and Wildlife Service.

American Rabbit Journal, Warrenton, Mo. ........................................... $1.00 a year
American Small Stock Farmer, New York, New York ....................... 0.25 a year
California Rabbit News, 1427 Carly Ave., Sacramento, Calif. .......... 0.25 a year
California Rabbits, 942 E. Lambert Ave., El Monte, Calif. ............. 1.00 a year
Commercial Rabbit Journal of California, 401 E. Nichols St., Bellflower, Calif. ................................................................. $1.00 a year
Fur and Feather, Idle, Bradford, England ..................................... 19s 6d a year
International Commercial Rabbit Journal, 743 W. 136th St., Hawthorne, Calif. ................................................................. $1.00 a year
Poultry and Rabbit Monthly, Temple City, Calif. ......................... 0.50 a year
Small Stock Magazine, Lamoni, Iowa .......................................... 1.00 a year
RABBIT RECIPES

Fried Rabbit

Roll pieces of rabbit in flour; salt and pepper; fry slowly in a heavy frying pan in deep fat for about 30 minutes. If desired, the rabbit may be served with cream gravy, using a portion of the fat in which the rabbit was fried. Only young tender rabbits should be fried in this manner.

Rabbit Southern Style

Cut rabbit into pieces. Add 1 tablespoonful of salt to 2 pints of cold water, and pour over rabbit. Let stand 3 hours. Drain and wipe pieces of rabbit; sprinkle with salt and pepper and roll in flour. Heat ½ cup bacon fat in heavy frying pan, add rabbit, cover and cook slowly for 1½ hours, turning frequently. Pour ½ cup of milk over rabbit and cook 30 minutes. Remove to serving dish and garnish with parsley.

Rabbit Pie

Cut rabbit into pieces; put in stew pan and cover with boiling water. Simmer until tender. Remove from broth and separate meat from bones. Add 1 tablespoonful of flour to each cup of broth. Return meat to broth and salt and pepper. Line sides of a baking dish with crust, add meat and broth mixture, cover with crust, and bake in hot oven 30 minutes. This is a good method of cooking a rabbit that is too tough for baking or frying.

Baked Rabbit Special

Cut rabbit into pieces, sprinkle with salt and pepper, dip in flour, then in beaten egg batter diluted with 1 tablespoonful water and bread crumbs. Place in well-greased pan and bake 40 minutes, basting frequently with bacon fat. Serve with white sauce.

Figure 10. Method of cutting up fryer rabbit and suitable containers for the meat.

Courtesy, U. S. Department of the Interior