



Rabbit Housing

Hutches, Cages, Wires

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INTRODUCTION

The decision has been made! You are going to get some rabbits. It doesn't matter whether you are getting one or two for pets for your children, a few for show purposes, some for home meat production, or hundreds for a large commercial operation, you must have housing for the animals. This generally must be built before you get them and, in many cases, before you have any experience raising rabbits. Housing may mean a cage in the garage or carport, a hutch in the back yard or a special building with cages for hundreds of animals.

If many rabbits are to be housed, the investment in the housing will probably will be large. After the housing is built, changes are expensive, so errors in design may have to be tolerated for a long time. As a result, it is much better to be sure of the design you want before construction starts. The problem is that it is difficult to decide what sort of facilities you need if you haven't had experience with rabbits.

One way to get some ideas is to take advantage of other producers' experiences. Visit other rabbit units in your area and observe their construction and use. Discuss the housing design with the owners. Do they like their design? What problems have they had? How would they do it differently if they were to rebuild? Be sure that the owner's reasons for keeping rabbits are similar to yours (for example, for pets, for show, or for commercial production). If you plan to keep a couple of pet rabbits, don't look to a 1,000 doe commercial breeder for housing design ideas!. That is a bit extreme, but keep in mind that design is greatly affected by function. What may be acceptable for 10 does may not work for 100. During your visits, make notes of important observations and ideas and take pictures whenever you can. These will be useful when you finally sit down to design your own unit. Don't rely on your memory; it is easy to forget.

What works in one situation may not be suitable in another area or in the hands of another manager. Each manager has to make his own decisions as to what will work for him. The need to find out what will work is the reason for one of the basic rules in rabbit production: "Don't go into the rabbit business, grow into it." Start slowly with a few animals to get your system worked out, then gradually start expanding. This is also true of your housing. If you have a design that you think will work for you, assemble a small unit to test it. If you find you need to make changes, you can then make them on the small unit that you already have and change the design in future additions.

Ventilation, sanitation, and observation are three extremely important concepts in successful rabbit management. Rabbits need good ventilation to reduce ammonia, moisture and the numbers of disease-causing microorganisms in the air of the rabbitry. The rabbitry must be kept clean to reduce disease in the stock, and the individual rabbits must be observed regularly for any abnormalities that might occur. The housing for rabbits should be constructed to promote ventilation, to provide for easy cleaning, and to allow easy, direct observation of each rabbit.

Most publications about rabbits have some information about housing but the material is often so general that it is of little practical use. That information also often omits many of the important "hows" and "whys" that are learned through experience—a difficult and expensive way to learn. This publication brings together information on rabbit housing and includes the reasons why certain designs, materials, or methods are favored by rabbit raisers. This information is especially important when the preferred method is more expensive or more difficult than an alternative method.

Working with rabbits can be a rewarding experience and one that can provide many hours of enjoyment, but the housing and facilities must be designed correctly from the start to provide facilities suitable and comfortable for the rabbits that live there and for the manager who will spend many hours working there.

REQUIREMENTS FOR RABBIT HOUSING

There is no one style of rabbit housing that is suitable for all situations, but there are certain basic requirements to be met regardless of the type of housing used. These requirements include the following.:

- The housing should be comfortable for the rabbits.
- The housing must confine the rabbits and keep them from escaping.
- The housing must protect the rabbits from predators.
- The housing must protect the rabbits from the adverse weather.
- The housing should allow easy, comfortable access for the manager.
- The housing should be “self-cleaning” or easy to clean.
- The housing should be of a reasonable cost, be easy to maintain and be durable.

The housing should be comfortable for the rabbits.

The rabbits are probably going to spend most of their lives in the cages or hutches that you provide. Because of this, you should make every attempt to make the housing as comfortable for them as you possibly can. As a rule of thumb, many rabbit raisers allow 3/4 square foot (0.75 sq. ft.) for each pound of mature body weight. This provides adequate space for free movement. For example, a New Zealand White rabbit with a mature body weight of 10 pounds will require a cage with a floor area of 7.5 square feet (10 lb. x 0.75 sq.ft./lb. = 7.5 sq.ft.). A cage measuring 30 inches x 36 inches (2.5 x 3.0 feet), which is often considered the standard size cage for the medium breeds, would provide the required area. Some commercial producers use a slightly smaller cage (30” x 30”) for their stock, especially if they use an early weaning system. Cages should be at least 15 inches high, although most are 18 inches high.

A second factor in making the housing comfortable is to make sure that the cage or hutch won't injure the rabbit. There should be no sharp projections in the cage nor any roughness on the floor. When the opening is cut for the door, sharp projections should be smoothed or covered. The wire, as will be discussed later, should be of the correct type to protect the rabbit's feet. If there are any rough projections after the units are built, they should be removed before the rabbits are placed inside.

A third factor in providing comfortable housing is to ensure that there is plenty of fresh air and that the venti-

lation is adequate. Ventilation should be included in the design of the house when it is built. It is almost impossible to have too much ventilation as long as the rabbits are protected from the weather and from direct drafts. Rabbits produce a compound in their urine called urea. Urea reacts with water to form ammonia. This gas is irritating to the nose and eyes and can reduce the rabbit's productivity and health. Care should be taken, as will be discussed later, to reduce the amount of ammonia produced in the rabbitry. It is impossible, however, to avoid ammonia production completely, so it is critical to provide good ventilation to get rid of what is produced. Another benefit of ventilation is reducing the number of microorganisms in the air. The fewer microorganisms around the rabbits, the lower the probability of the rabbits becoming infected.

The rabbit unit should get direct sunlight. This is good for the rabbits as long as they always have a place in their cage where they can move into the shade. Sunlight contains ultraviolet light that works as a disinfectant and will help to keep disease under control. Rabbits also need some sunlight to manufacture vitamin D. While this vitamin is necessary for rabbits, it is generally not added to the diet because it is not needed as long as the rabbits are exposed to some indirect or direct sunlight.

The ideal environment for rabbits is a temperature of about 55° F. High temperatures will reduce feed intake and growth rates whereas low temperatures will result in reduced efficiency because extra dietary energy is needed to keep the animals warm. The relative humidity should be about 35% to 50%. This will help keep the floors and manure pack dry. If the humidity is lower, respiratory problems may develop. Higher humidities may increase ammonia levels.

The housing must confine the rabbits and keep them from escaping.

If you have one or two rabbits as pets or for show purposes, they must be kept confined to a certain area so they don't cause damage to gardens, don't run away, don't get eaten by the neighbor's dogs, and don't get hit by cars. If you have a commercial unit, you must confine the rabbits to ensure they are properly managed so you can realize the maximum profitability from your stock. To confine the rabbits, proper materials must be used to build the housing. This includes using wire that is strong enough that the rabbit can't tear it, being sure that wooden parts are covered so the rabbit can't chew its way out and surrounding the cage or hutch completely on the top, bottom and all four sides. Rabbits can jump very well and climb reasonably well, so tops have to be provided for the housing. Kits can also squeeze through amazingly small spaces, so care has to be taken that all avenues of escape are blocked.

The housing must protect the rabbits from predators.

Dogs, cats, opossums, snakes, foxes and many other animals enjoy a rabbit dinner whenever it becomes available. Many of these animals have strong jaws and claws and are capable of destroying quite substantial rabbit housing. Rather than depending on cages and hutches to protect the rabbits, it may be necessary to install a fence if the rabbits are housed outside or to design some method to secure the building if they are inside.

Humans can also be a problem in your rabbitry. A child playing in your unit may leave a cage open so a rabbit escapes. Vandals may tear up your unit and kill your stock or thieves may break into the unit and steal some of your animals. Whatever the reason for loss caused by humans, the only adequate solution is to provide a secure area that is kept locked to keep out unwanted persons. A watchdog accustomed to rabbits may also be useful. If such a dog is kept in the rabbitry, the rabbits will soon become accustomed to its presence. In some cases even these solutions have not proven successful, and rabbit raisers have been forced to go out of business.

The housing should protect the rabbits from the weather.

Rabbits are quite hardy, but they need to be kept dry and protected from cold winds, heat and direct sunlight. Rabbits are capable of withstanding cold and are quite comfortable even when it is freezing as long as they can be sheltered from direct wind and can stay dry. In the summer, the rabbits require shade and plenty of ventilation. If it gets very hot, some provision for cooling may be necessary.

The housing should allow easy, comfortable access for the manager.

Rabbits require daily care. The rabbit manager must be able to see and reach easily into the cage to take the rabbit out for breeding, palpation or grooming, for cage cleaning or repair, and for maintenance of the watering and feeding systems. The cages should be designed so working with the rabbits and making repairs are as comfortable as possible. If it is difficult to see or reach into the cage or hutch, the inclination will be to avoid doing it as much as possible. As a result, the rabbits in the unit may not receive the quality of observation and care that they require.

The housing should be “self cleaning” or easy to clean.

Disease prevention is very important in rabbit production for the following reasons:

- 1) There are few drugs available to treat diseases in rabbits, and it is often difficult or impossible to know which ones to use until it is too late.
- 2) The cost of the drug is often more than the rabbit is worth.
- 3) The onset of many rabbit diseases is so fast there is little time for treatment.

Cleanliness, along with ventilation and good management, will go a long way toward prevention of disease. Cleanliness is also important, as mentioned previously, to reduce the odors that can develop in a rabbitry.

Even cages or hutches advertised as being self-cleaning need some help occasionally. Some manure pellets may be too big to fall through the wire; the pellets may be stuck together by hair the rabbit has swallowed while grooming itself, or the rabbit may have diarrhea which causes the manure to stick to the wire. In all these cases, it is necessary to use a brush to remove the manure from the cage floor. The housing should be designed so it is not necessary for the manager to crawl into the hutch or even to have to put his or her head and shoulders into the unit to clean it. For this reason, cages are generally constructed so they are not more than 30 inches from front to back, and the doors are located so that by reaching in through the door, the manager will be able to reach the corners. Hutches should be built so no braces go directly underneath the rabbits. These will quickly become fouled with droppings and urine and will cause cleaning to be extremely difficult and unpleasant.

Rabbits molt regularly and does that are about to give birth pull fur to make their nests. As a result of this hair loss, the tops and sides of cages and the rest of the interior of the rabbitry become covered with a layer of rabbit hair. This will need to be removed regularly to improve air circulation in the unit and to reduce the incidence of possible skin conditions like ringworm. Hair can be brushed or vacuumed off the cages and walls, and the unit should be designed to allow that. You can't brush down a surface you can't reach. Hair on the tops and sides of cages can be removed by burning with a torch. This is accomplished by moving the torch quickly along the wire to burn the hair. Torches should never be used on walls of the building because of the danger of burning down the rabbitry. The cage wire should not be allowed to get hot because that will destroy the protection provided by the galvanizing.

The housing should be of a reasonable cost, be easy to maintain and be durable.

Whether you are building one hutch for a pet or are starting a commercial unit, there is no need to spend large amounts of money on rabbit housing. It should be possible to purchase or construct adequate housing for about

\$20 per hole although some people may spend \$10 and others \$35 or more. (Hole is a term used by rabbit raisers to refer to each cage or hutch.) The amount you spend will obviously depend on how much of the material you already have or can obtain cheaply, what sort of material you decide to use and how fancy you want to make the housing.

Once the unit is built, maintenance will be required. Wire will rust and need to be replaced, hinges may come loose or break, or you may decide to change the design. Whatever the reason, work will need to be done on the units frequently and it is important that the unit be designed with this in mind. Durability is also important since the more lasting the unit, the less often you will have to do maintenance.

TYPES OF HOUSING

Housing for rabbits can be either outdoors or within a building. Outdoor housing is often less expensive than indoor housing and, because of better ventilation, the rabbits are usually healthier in outdoor units. However, security is more difficult to provide with outdoor units, and the protection from the weather may not be as good as indoors. This protection applies to the manager as well as to the rabbits. In severe weather (cold, snow, rain, etc.) rabbits housed where the manager is exposed to the elements may not get the care they need because their manager is uncomfortable and in a hurry. It is also more difficult to provide controlled lighting if the rabbits are housed outdoors. (Many commercial producers provide 16 hours of artificial light all year around to promote continuous production.) Outdoor lighting helps provide security for rabbitries that are not inside a building.

Indoor housing is more expensive than outdoor housing but provides better weather protection, better security and more efficiency than the outdoor units. The disadvantages of the indoor housing include the cost, problems with temperature and humidity control and difficulty with ventilation. There may be a greater incidence of diseases, especially respiratory problems. Indoor housing generally involves the use of cages made entirely of wire. These are also usually the most expensive and must be used indoors or in a shelter of some sort.

Free-standing outdoor cages (hutches) can be made of a variety of materials. Wire cages with plastic or sheet metal tops, backs and ends will provide good protection from the weather but are expensive and also will reduce ventilation to the rabbits. Whenever sheet metal or plastic is used for roofs, insulation must be placed between the roof and the rabbits. Sunlight beating down on the roof will cause heating and, if no insulation is provided, this heat will be re-radiated onto the rabbits and may kill them. The most common type of outdoor hutch is a combination of wire and wood. The wood is used to make a frame, the wire for the floor and some of the sides or ends, and sheet metal or other material provides a water-proof roof.

Wood included in rabbit housing can cause problems. Rabbits are gnawers and one of the things they like to chew is wood. As a result, wood used in rabbit housing should be protected to keep the rabbits from gnawing on it and should be pressure-treated to retard rotting. Wood also will absorb urine. This will lead to rotting of the wood and cause odors.

CONSTRUCTION OF CAGES AND HUTCHES

Types of Wire and Building Materials

Wire diameter is designated by gauge numbers (ga.) as shown in Table 1. As can be seen, the wire size increases as the gauge number decreases. Generally 12 ga. or 14 ga. wire is used for suspending cages, 14 ga. for cage sides and tops and 14 ga. or 16 ga. for cage floors. Several types of wire mesh that can be used in the rabbitry are readily available.

Table 1. Wire gauge numbers and diameter in inches.

<i>Gauge</i>	<i>Diameter (inches)</i>
7	.1770
9	.1483
10	.1350
12	.1055
14	.0800
16	.0625
18	.0475
20	.0348
22	.0286

Chicken wire, also called poultry or hexagonal netting, is formed by weaving wire, generally 20 ga. or 22 ga., on a loom to form the hexagonal pattern (Figure 1). The edges are finished with a wrapping of wire known as the selvage. (Figure 2)

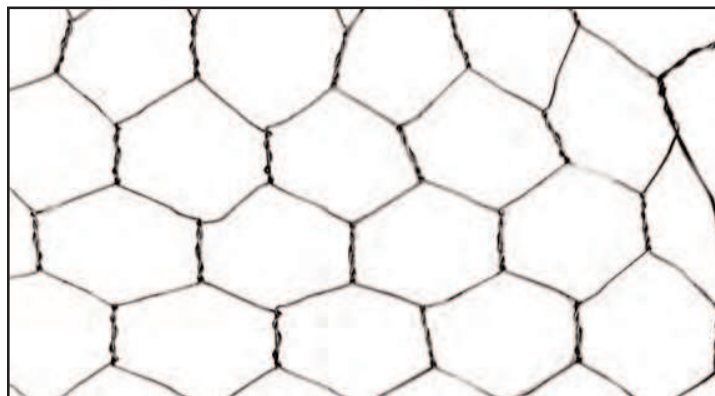


Figure 1. Chicken wire showing the hexagonal pattern.



Figure 2. Enlarged view of chicken wire, showing the weaving of the hexagonal pattern and the selvage along the edge.

This netting is generally too light for use in rabbit cages. If used for floors, it will sag from the weight of the rabbits. It will then be necessary to install braces to hold the wire up. These will hold the manure and urine and make it difficult to keep the cage clean. Another disadvantage of the chicken wire is that it often has sharp ends that can cause injury to the rabbit's feet. Because chicken wire is quite light, it is not suitable for the sides of hutches since a dog or other predator could easily tear the wire to get at the rabbit. Even a rabbit scratching at the wire from inside may break through.

Hardware cloth is a wire mesh that is made by weaving the strands of wire into the grid size desired and then galvanizing it to hold the strands in position (Figure 3). This type of wire carries two size designations: - the gauge which indicates the diameter of the wire being used, and the mesh size. Mesh sizes 2, 3 and 4 refer to meshes that are 1/2", 1/3" and 1/4" square, respectively. Meshes that

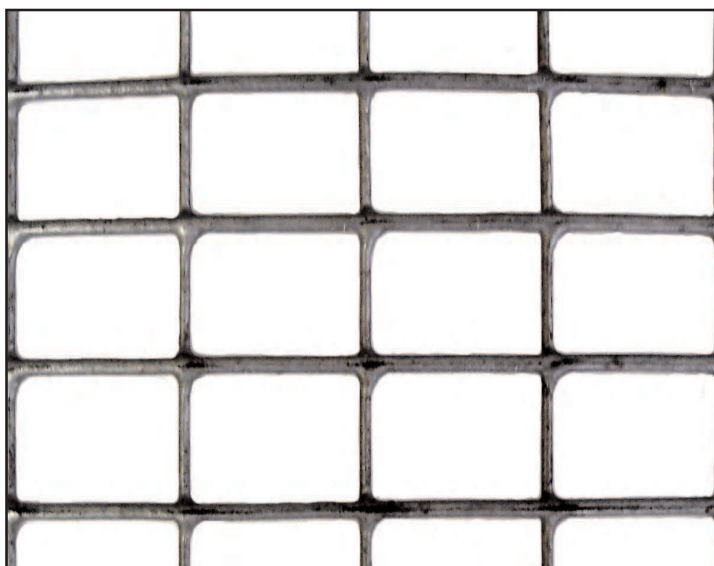


Figure 3. Hardware cloth. Note the accumulations of galvanizing material at the wire junctions.

are 3/4" or 5/8" are so specified since they don't fit into the coding scheme. Hardware cloth is not widely used for floors of rabbit cages. The joints are not strong enough to withstand the flexing caused by the rabbits moving around the cages. As a result, the galvanizing will crack and water will get onto the wire and cause rusting and rapid deterioration. Hardware cloth also often has small points of galvanizing that can cause injury to the rabbit's feet, and it tends to be more expensive than welded mesh.

The most common material used for cages is welded mesh (Figure 4). This is made by laying out the wire so that the strands going the length of the roll (the line wires) are on the bottom and the strands going crosswise (the stay wires) are on the top. Each joint or place where the wires cross is welded. This can be done before or after galvanizing (double galvanized). Wire galvanized after welding is preferable since the welding may cause small cracks in the galvanizing that could lead to deterioration of the wire. Welded mesh is described by three numbers, such as 1/2" x 1", 16 ga. This means there is 1/2" between the stay wires, 1" between the line wires, and the wire is 16 ga. The welded mesh often used for cage floors is 1/2" x 1", 14 ga. or 16 ga. while that for the sides is 1" x 2", 14 ga.

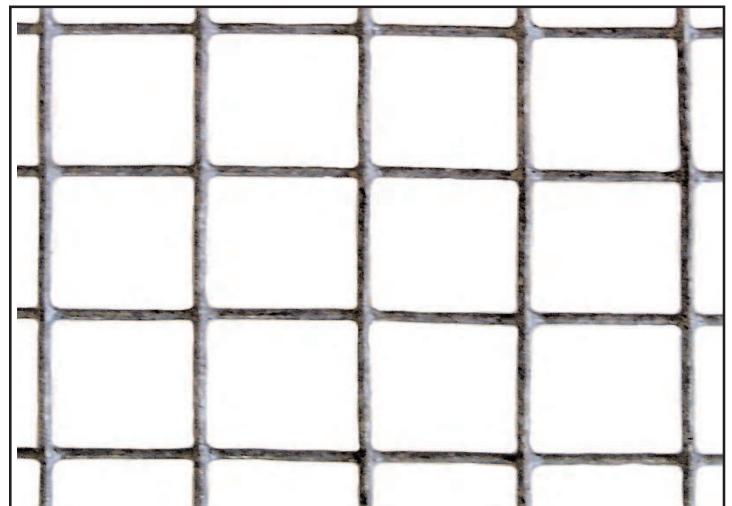


Figure 4. Welded mesh. Note that the vertical wires are all above the horizontal wires. These junctions are joined by welding the wires together.

The lighter wire is used for the floors to allow some "give" as the rabbits move about the cages. Some feel that this "give" may be better for the rabbits' feet and result in fewer problems with sore hocks. The heavier, 14 ga. wire however will last longer than the 16 ga. wire. It is important to use 1/2" x 1" because having the line wires run the length of the cage unit (cages are usually built in 2 or 3 cage units) provides more strength than if 1" x 1/2" is used and the line wires run across the cage. This would be necessary because the floor wire should be installed with the 1/2" spacing on top to provide more support for the rabbits' feet.

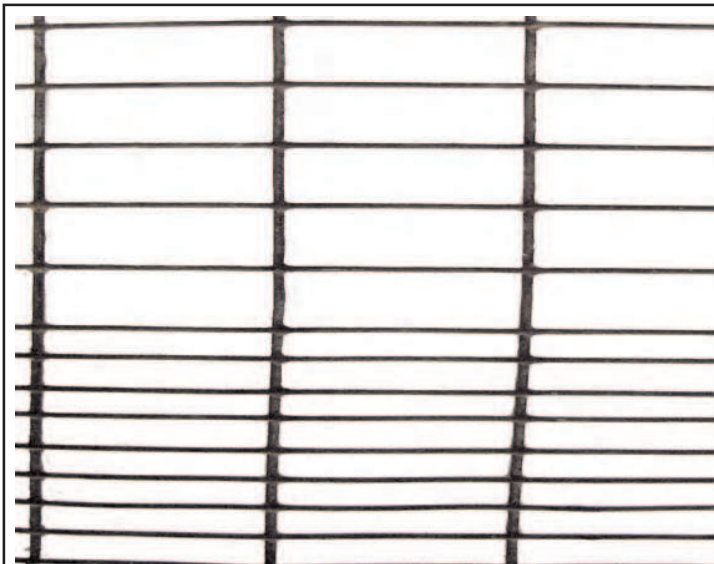


Figure 5. Baby saver wire. The nine line wires at the bottom of this mesh are closer together than the higher line wires.

Other sizes of wire may be available and useful. A 3/4" x 3/4" mesh is good for the floors and in some areas may be used for the entire cage. Meshes smaller than this shouldn't be used because the manure pellets won't drop through. Larger meshes should be avoided because they don't provide adequate support for the rabbits' feet. If required, metal braces can be installed under the floor wire to prevent or overcome sagging. These can be purchased from rabbit supply shops. As mentioned previously, however, these braces may create a serious cleaning problem.

Many producers use what is known as "baby saver" wire for the sides of their cages (Figure 5). This is regular 1" x 2" cage wire except that the bottom four inches have wires every half inch apart rather than every inch. This is useful for doe cages because it will keep young kits from falling out of the cage. Rabbits do not retrieve their young and any that fall out of the nestbox or are born out of the box

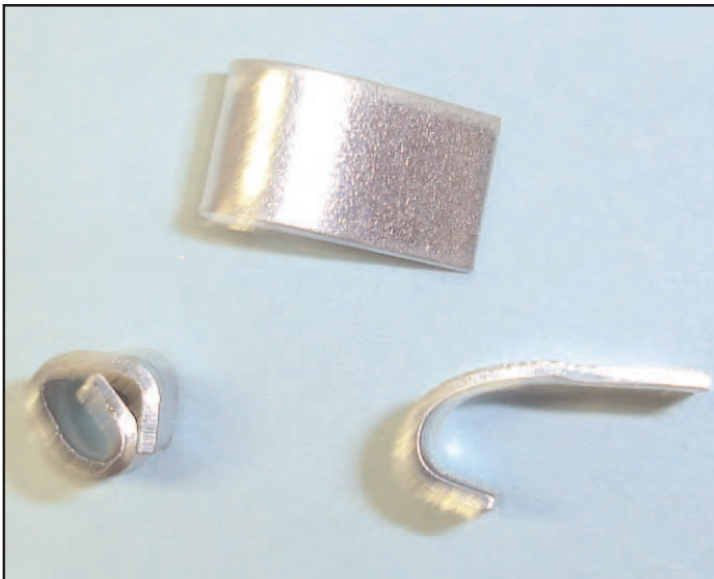


Figure 6. "J" clips opened and closed.

will stay there unless the raiser returns them to the nest. If these small kits are crawling around the floor of the cage and come to the edge, they can easily fall out through the normal 1" x 2" mesh. The half-inch space along the bottom of the baby saver wire helps prevent this. This is more expensive than regular cage wire, but many producers feel that it is worth the cost. Attaching a 4" wide strip of 1/2" x 1" floor mesh or #2 or #3 hardware cloth around the bottom of the cage sides will also provide protection for the kits. This is not as neat as building the baby saver wire into the units but is useful for modifying cages already in use or where only a few cages are needed.

Many firms sell vinyl coated welded mesh wire. This is very good looking wire and is easy to keep clean and looking neat. It is not, however, useful for cage construction because the rabbits will chew the vinyl and the cage floors will very rapidly become rough and cause damage to the rabbits' feet. Coated wire is often used for rabbit carrying cages that are used for taking rabbits to shows, etc. In these cases, the rabbits aren't in contact with the wire for long periods of time so chewing is minimal.

Cages are assembled using "J" clips or hog rings. The "J" clips are bands of galvanized metal 5/16" wide and 1/2" long that are formed into a "J" shape on one end (Figure 6). When this clip is inserted into the special pliers and the pliers closed, the clip is coiled into a circle. If two pieces of wire are adjacent within this circle, they will be joined. Other sizes of "J" clips including 3/8" x 5/8" and 1/2" x 1/2" are also available. The "J" clips provide a neat, tight union between two wires but they are difficult to use if more than two wires are being joined. Many producers prefer not to use "J" clips because it is hard to keep the wires under the clips clean and dry. They feel that these are sources of harmful microorganism growth in their cages and, as a result, prefer to use hog rings.

Hog rings are "U"- shaped pieces of wire that are closed into a circle using special pliers (Figure 7). As with "J"



Figure 7. Hog rings opened and closed.

clips, if the circle is closed around two wires, they will be joined. The hog rings are available in a variety of sizes ranging from 3/8" to 7/8". The smaller rings are generally suitable for cage construction while the large rings can be used to pull corners together. The rings are easier to keep clean than the "J" clips but care must be taken to be sure that they are closed tightly around the wire as they have a tendency to loosen more rapidly than the "J" clips. They also sometimes have a sharp point that should be faced away from the inside of the cage where it may injure the rabbit. These rings are galvanized like the wire used for the cages although some rings are now available in stainless steel.

Cage Types

Wire cages may be either the rectangular or quonset style. The rectangular cages are further divided into the front-opening (doors located on the front) or top-opening (doors located on the top) types.

The front-opening rectangular cage is useful in situations where the cages are to be stacked or, if the doors swing inward, where aisle space is limited (Figures 8 and 9). In that case, the door would be placed on one side of the front of the cage and the feeder on the other. This may make it difficult to reach into the far corner of the cage. When the doors swing inward, they are generally hinged at the top and there is a special clip or door hanger



Figure 9. Rectangular, front opening cage with 3/4" x 3/4" weldmesh sides.

installed in the cage to hold the door up out of the way when it is open. The difficulty with this type of door is that when the operator reaches into the cage, he often hits the clip with his arm or shoulder and the door swings down, making it difficult to take out the rabbit or other item in his hand. If the doors of the front opening cage are hinged at the side, they take up more aisle space because they swing out into the aisle. This type of door



Figure 8. Front-opening, all wire cage unit with two cages.

does, however, provide a convenient place to install the feeder. With the feeder on the door, the door can be located in the center of the cage making it easier to reach into the corners. Front-opening cages in a single deck can be situated higher off the floor than top-opening cages, so it is easier to work under them for cleaning out manure and for making cage repairs.

Top-opening cages may have a door cut into the top or the entire top may be hinged to open and allow access to the cage. These cages need to be suspended at a lower level than the front opening cages so the operator can have access to the cages. If the cages are hung at the proper level, these cages are comfortable to work with but cleaning out the manure under the cages is more difficult.

The quonset cage has the same floor area as the rectangular cage but the top of the cage is curved. This type of cage requires less wire than the rectangular cage and, because the only wire that needs bending is the floor wire, a wire break is not needed for construction. The door of the quonset cage is on the curved portion and opens upward so it is out of the way when it is open and is easy to pull closed even with full hands (Figures 10a and 10b).

Door openings are constructed by cutting a hole about 14" x 18" in the cage top or wall. There is no one "correct" size. Just be sure the opening is big enough to easily move rabbits and nestboxes in and out. When cutting the wire, leave about 1/2" to 3/4" ends on the cage. These can then be bent backward to prevent sharp ends which may scratch arms and tear clothing (Figure 11). This can be done with pliers or a tool can be constructed from strap steel. The cut ends of the wire can be filed smooth, but this is a tedious, laborious process. If the ends are cut

flush, a plastic, snap-on, door guard can be purchased to cover the sharp ends (Figure 12).

The door should be 1" longer and wider than the opening or, if a purchased door is being used, the hole should be cut 1" smaller than the door (Figure 13). It can then be affixed to the opening with "J" clips or hog rings. Cutting an opening and installing a door hinged on "J" clips or hog rings is preferable to cutting a hole on three sides and bending the wire to open the cage. This will crack the galvanizing at the bend point and the wire will rust and soon break off. To keep the opening covered, it is also necessary to leave the long ends of wire sticking out, which can be dangerous to the rabbits and to the manager.

Door latches can be purchased or constructed at home. Some cages are constructed with heavy wire frames (9 ga.) attached around the door. This makes the door more rigid and helps keep it straight.

Producers who intend to feed hay or greens to their stock should consider inclusion of hay racks in the cage design. Material such as hay or greens should not be fed on the floor of the cage because it will quickly be contaminated with droppings and will make routine cage cleaning more difficult. Quonset cages hung back-to-back in double banks have built-in hay racks (Figure 14). Hay racks for rectangular cages can be included between the cages as a "V" space (Figure 17) or a rack may be installed inside the cage to keep the material off the floor.

Building Cages

Who should build your cages? If you only need three or four cages or if you are short of time and/or mechanical

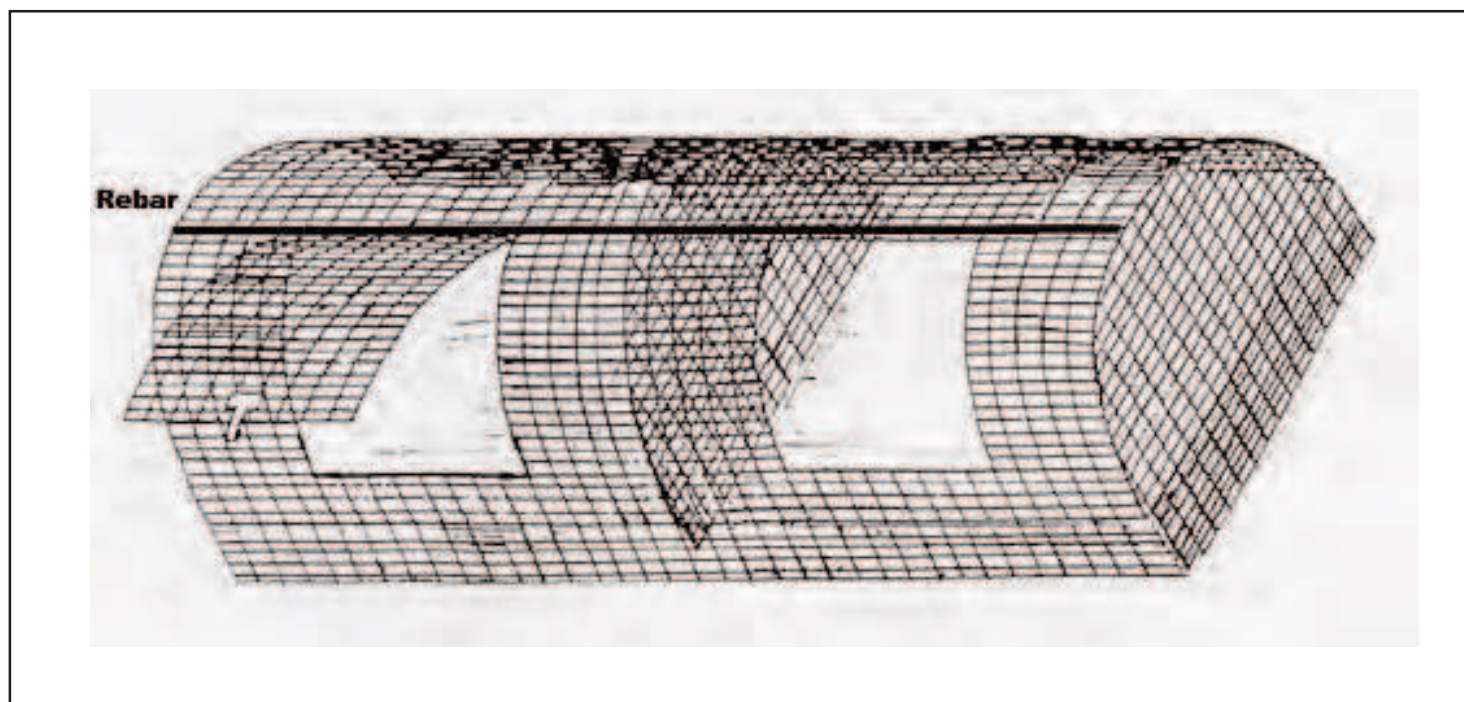


Figure 10a. Quonset cage unit with two cages. Note baby-saver effect of bending up the floor wire along the front edge. Baby-saver wire is used for the ends.

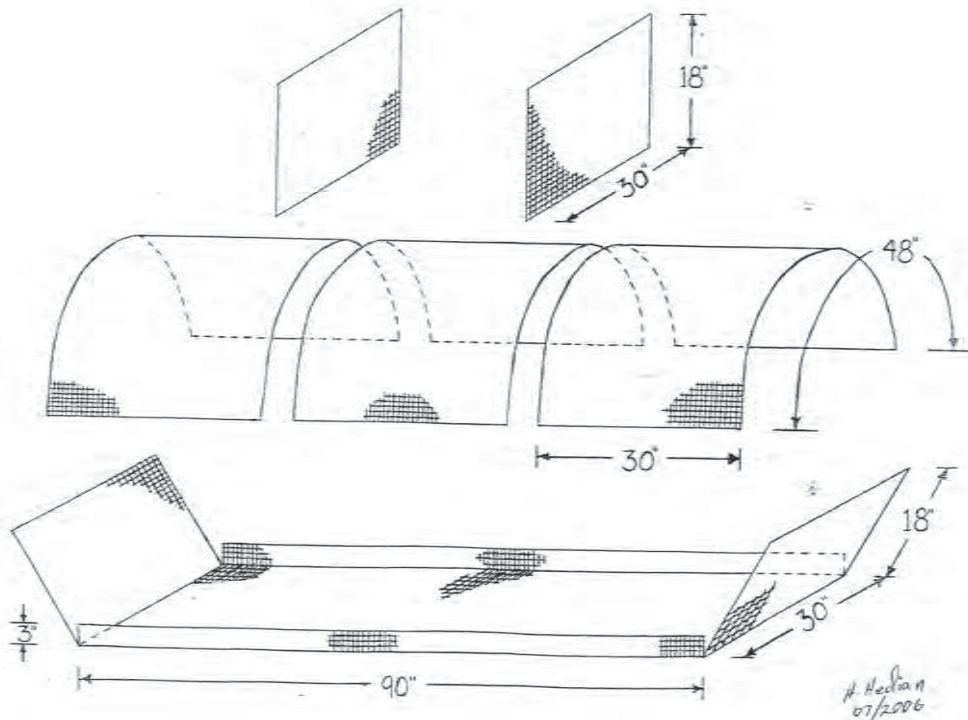


Figure 10b. Construction of a 3-cage quonset unit.

ability, you should pay to have the cages made. Many people look into this and find they will have to pay \$40 or \$50 for a cage and feel that is too expensive. They then decide to build the cages themselves. They often find that they have bitten off more than they can chew. Cage construction is hard, specialized work. They may spend more than the \$40 or \$50 needed to buy ready-made cages. For construction of 20 or 50 cages, the raiser definitely should look into home construction. This will probably also justify purchasing or renting a power wire shear and a power clipper.

Properly built rectangular cages use one piece of wire bent into an inverted channel shape to form the top, front and back of the cage. The ends and floor are then fastened to this. Since this is fairly stiff wire, it is necessary to make the bends using a wire bender or break. Construction of the top and sides from one piece that is bent provides a much stronger cage and uses less wire than cutting the individual pieces and clipping them together. Although discussions and diagrams often refer to only one cage, it is customary to build two or three cages in a single unit. This makes more efficient use of the wire and provides stronger cages. When 1/2" x 1" floor wire is used, care should be taken that this is installed with the wires 1/2" apart (the stay wires) facing upward where the rabbit will walk. This will provide better support for the feet to help prevent development of sore hocks. Many people who raise larger breeds such as the Flemish Giant prefer to have solid floors to reduce the incidence of sore hocks. To provide both the easy cleaning benefit of the wire floor and the foot support of a solid floor, a piece of board (called a "resting board") may be placed in the cage. The rabbit can sit on this but it can also be removed for cleaning and disinfection. Some

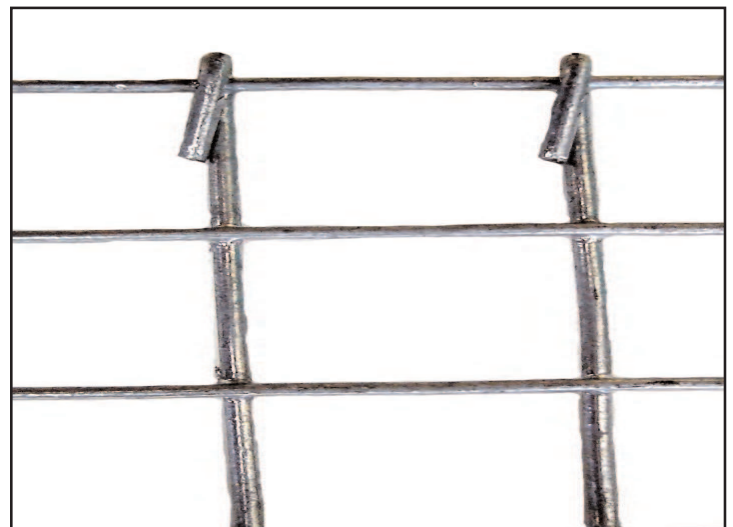


Figure 11. Wire ends bent back on door opening to prevent injury to the rabbits and manager.

cages are constructed with slotted plastic floors. These have stays about 1/2" wide and greatly reduce the incidence of sore hocks. Plastic resting boards with similar configurations can also be purchased.

Cages that are installed in a building are often supported on wires suspended from the rafters or they may be partially supported by wires and partially by framing within the building. Care should be taken that any wooden supports are not exposed to rabbit urine and that it is easy for the manager to move around the rabbitry to clean the walls and the floor. It is preferable not to have cages against outside walls. A walkway along the walls to allow cleaning will make manure removal easier, will reduce urine fouling of the walls and will move the rab-



Figure 12. Cut wire showing ends covered with plastic wire guard.

bits away from what can be, depending on the season, the hottest or coldest area in rabbitry. Hanging the cages from rafters or trusses imposes an additional load. As a general rule, each layer of cages will add 5 lbs. per sq. ft. to the roof loading over and above the minimum required for snow, wind and dead loads. If the existing structure is not strong enough, it may be necessary to use floor mounted cages or to strengthen the trusses or rafters.

The cages should be suspended at a height where the

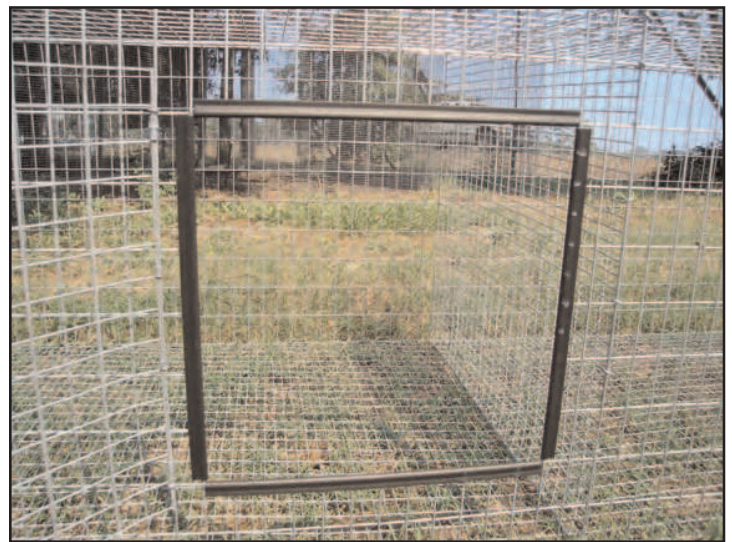


Figure 13. Cage door with door frame and latch.

person who is going to spend the most time working with the rabbits can readily reach into all parts of the cage. Electrical conduit or other light pipe is sometimes inserted along the top edges of cages to be suspended. The suspension wires can then be attached to the conduit rather than to the cage wire. This distributes the weight over the entire cage so no one area is overly stressed and becomes distorted. It also provides good support regardless of where the suspension wires are placed from the rafters.



Figure 14. Use of back-to-back quonset cages as a hay rack.



Figure 15. Stacked cages in a rack with removable pans for cleaning.

Some rabbitries use double- or triple-tiered cages. This allows installing more cages in a given area, but increases the problems with ventilation, respiratory diseases and cleanliness of the rabbitry. It is also difficult to work with the cages on some of the tiers. As a result, the rabbits on the lower or upper tiers may not be as well cared for as the rabbits on the more conveniently accessible tiers. For a small herd, however, a system of stacked cages with dropping pans under each cage may be most conven-

ient (Figure 15).

Some producers have systems in which individual cages (or groups of cages) can be removed from the rack and taken out to be washed. This is a very good system to maintain cleanliness in the unit and one that producers may want to investigate. Cleaning cages when they are fixed in the rabbitry is difficult in that you are never sure that the job is done properly and that all the corners have been cleaned. If the cage can be removed, more care can be taken with the cleaning and disinfecting which will help to provide better disease control. It will also make cage maintenance and floor replacement easier and much more pleasant. If cages are to be removed, it is advisable to build all the cages the same size. If a few extra are available, it is then possible to clean cages on a regular basis, yet not lose the space while the cages are being cleaned.

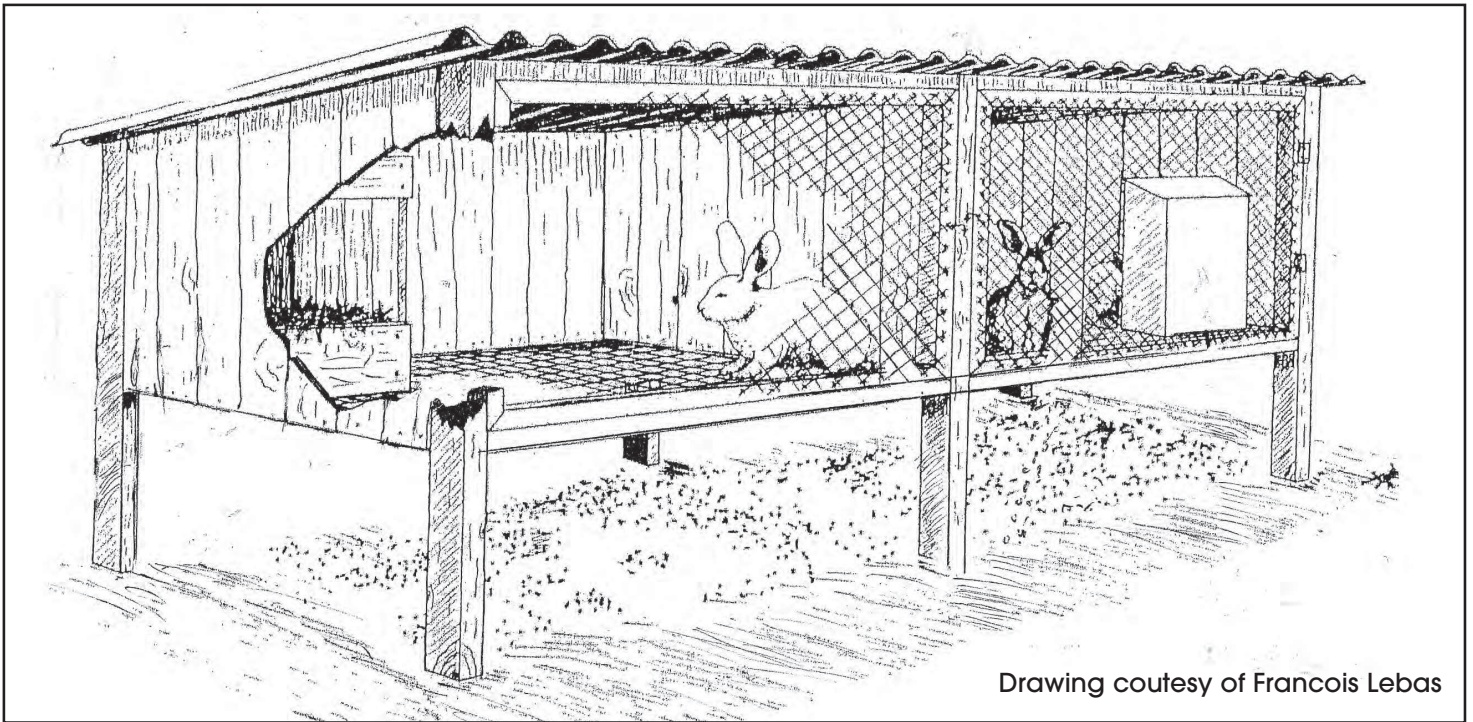
If animals, particularly males, are to be reared for sales for which it is important that they remain clean, (e.g. for laboratories), it may be necessary to install partitions between the adjoining cages. As a normal part of their behavior, male rabbits begin spraying urine when they are quite young. This tends to color the animals in adjoining cages yellow. Partitions will prevent the hutch stains that result. These may be of metal or plastic. Wood can be used but suffers the usual disadvantages that it will absorb urine and be hard to keep clean and that the rabbits will chew on it.

Hutches

A rabbit hutch is a free free-standing unit in which one or several rabbits can be housed. Hutches usually have their own protection from the weather, rodents and other predators. In constructing a hutch, some provision has to be made for legs or supports, for the cage area where the rabbits are to be housed, and for the roof and sides which will provide weather protection for the rabbits.

Most outdoor hutches are supported on wooden legs, either poles or treated 4" x 4" timbers, that keep the rabbits off the ground, provide space for the buildup of a manure pack, elevate the rabbits so they will be convenient to manage and to keep them from being harassed by dogs, cats and other neighborhood pests. The legs should be treated against termites and rotting if they are made of wood. They will be on the ground and will be subjected to wetting from the ground as well as from the moisture (urine and water) from the rabbits. Placing bricks or similar materials under the legs will help to reduce rotting. It goes without saying that the legs should be sturdy and placed to provide solid support for the rabbit unit.

Wrapping cones of sheet metal around the legs about 36" off the ground will prevent rats, mice and snakes from climbing the legs to get to the feed and the rabbits. If you are in an area where the red fire ant is a problem, wrap the legs with cloths about 24" from the ground. These should then be soaked with motor oil or kerosene (watch



Drawing courtesy of Francois Lebas

Figure 16. An outdoor hutch.

for fire) to keep the ants from climbing the legs and consuming litters in the nestbox. An insecticide, such as carbaryl, may be mixed with the oil to help kill the ants that try to climb the legs. These materials may harm worm beds, so it might be necessary to remove the worms from under the hutches if fire ant protection becomes necessary.

Construction of hutches will depend to a large extent on the materials available and the amount of protection needed from the weather and from predators (Figure 16). The most common design is a combination of wood

framing and wire to hold the rabbits. As with all-wire cages, welded mesh should be used to provide the necessary strength to hold the rabbits and keep out predators. If the sides and/or back are to be solid, sheet metal or wood may be used. The use of galvanized nails in the areas exposed to the weather will prolong the life of the unit. Remember, rabbits love to chew and will quickly chew any wood that they can reach.

For this reason, wood should be limited to those areas that the rabbits cannot reach or, if wood has to be placed within the rabbit's reach, constant checks should

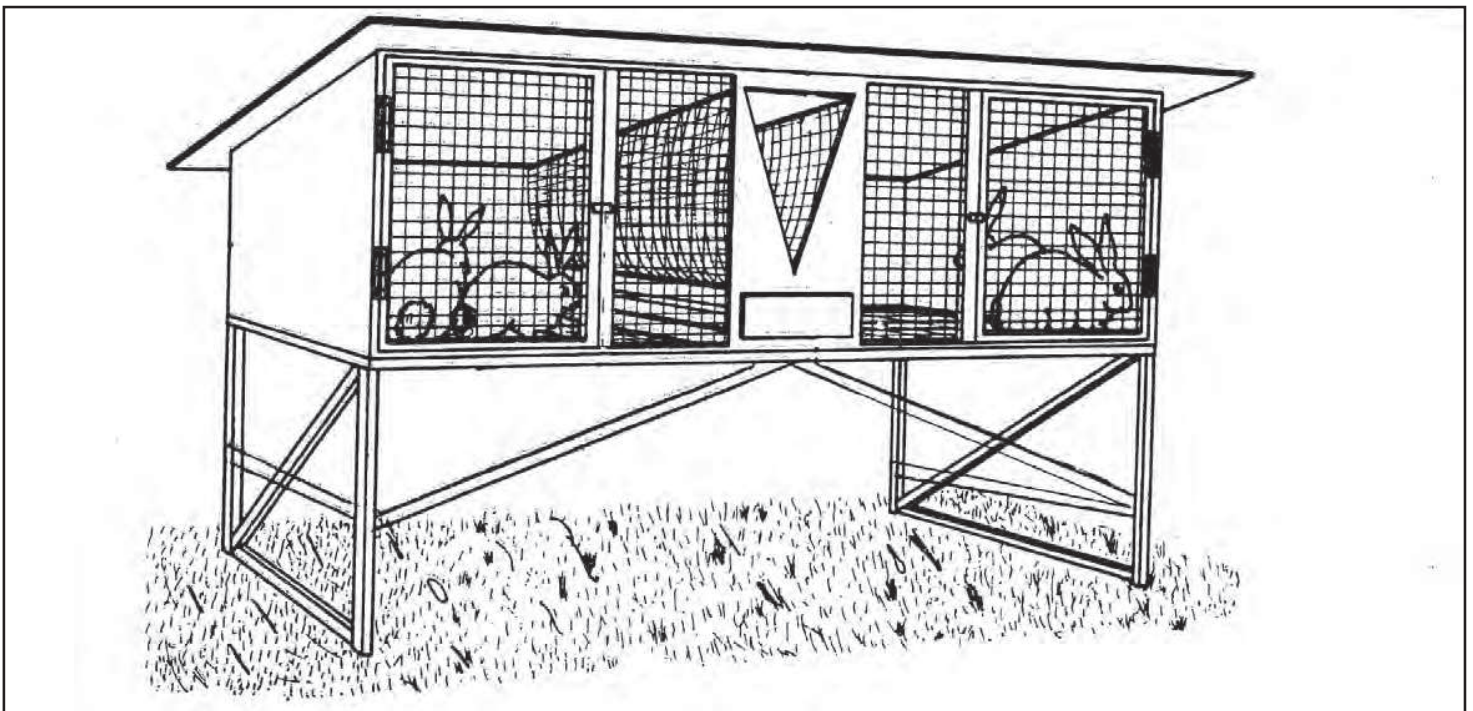


Figure 17. Perspective of a single deck hutch. Note the hayrack between the cages

be made to be sure that the rabbits aren't chewing through so they can escape. Be sure the rabbits cannot chew treated wood because the wood treatments may be toxic.

Hutches, especially those designed by people who are getting rabbits for the first time, are very often too big to be cleaned easily. Cleanliness is important regardless of the type of rabbits, and the housing must be designed to simplify cleaning. If units are too big, the producer may have to crawl into the units to clean them. The space requirements for rabbits are the same regardless of the type of housing. Thus, there is no reason that a hutch should be more than 30" from front to back or that the door opening shouldn't provide access to all areas of the unit.

Another common error of new producers is forgetting that cute little rabbits don't stay that way and, as they mature, they will have to be separated. If they are bred, housing will need to be provided for the litters as well. Proper design of the hutch will take this into account, and, instead of one large unit, a unit will be constructed that is divided into a number of individual cages.

Doors of some sort will be necessary for the hutch. Doors must be attached by stout hinges that are securely fastened to both the door and the unit. There should also be some sort of lock on the doors. A positive lock is best. This prevents opening the lock by accidentally brushing against it or by a dog jumping against it. A hasp and staple with a padlock is a sure way of securing doors so they aren't opened by mistake.

The roof of the hutch is important because it serves to keep the rabbits dry and to protect them from the sun. The roof should overlap the housing area on all sides so that driving rains will not beat in on the rabbits. Some provision should also be made to protect the rabbits from heat that is radiated down from a sun-heated roof (Figure 18). This may involve laying plant material on the top of the roof to reduce heat buildup, insulating the underside of the roof (be sure the rabbits can't chew the insulation), constructing a double roof with an air space between the layers or locating the hutch under a tree or some other source of shade. A shake or shingle roof can provide good insulation. If you depend on trees for shade, be sure they are healthy trees that are not going to have large branches break off and fall on the hutch.

When locating your hutch, you should be sure that there is shade if possible, that there is good drainage, that you have the unit in a location to which your neighbors won't object, and that you can protect the unit from predators.

Ventilation is very important for the rabbits, but care should be taken that the rabbits are not exposed to cold, wet winds. Depending on the type of hutch, it may be necessary to provide some sort of protection in areas where cold, damp winds are common. In areas with severe winters, provision should be made to close up the unit more in the winter than in the summer. This may

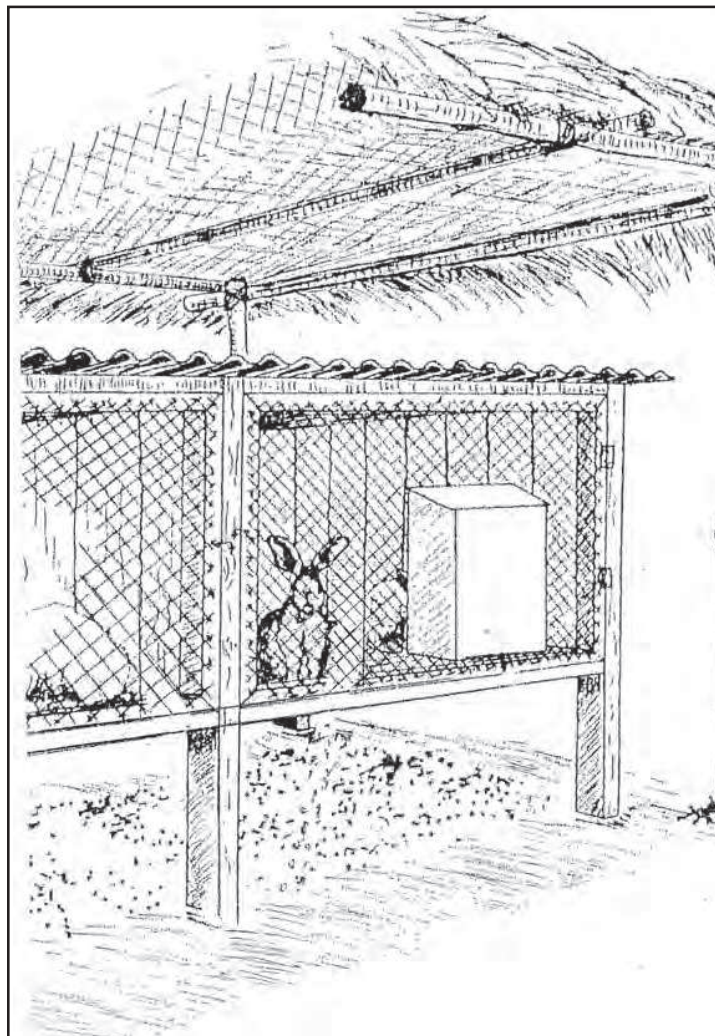


Figure 18. Insulation (thatch roof) over galvanized roofing to keep the roofing from heating and radiating heat down onto the rabbits.

involve flaps of some sort over the screened areas. Never close a rabbit unit completely. Some ventilation is always required to get rid of ammonia that builds up in the unit.

RABBITRY BUILDINGS

Location

In the following discussion, it is assumed a new building is being constructed. Much of the material also applies to buildings that are being modified.

If you decide you want to house your rabbits inside a building, you may be able to convert a structure that already exists or you may have to build a new one. In any case, you should investigate the zoning laws in your area to ensure that you will be able to keep rabbits, that you will be able to construct or modify a building as you wish, and to be sure that you comply with any special requirements that may apply in your area. As an example, you may not be able to house your rabbits in an open sided building or you may have to place a hedge or wooden fence around the unit so it cannot be seen

from the street. It is better to find these things out in advance so you don't have to modify your plans halfway through your construction or, even worse, have to make changes after you are through with the job.

You should also check to be sure that future changes in zoning won't put you out of business. Many cities have extraterritorial jurisdictions outside their city limits and can affect development in a very wide area.

The location of your rabbitry building is very important. Rabbits have fur coats that keep them warm in the winter but they cannot take them off in the summer. Much of the consideration in the siting and construction of the rabbitry is aimed at keeping the unit as cool as possible in the summer. To keep the unit cool, it is advisable to locate it in the shade of large trees and in relation to the prevailing winds to provide maximum natural ventilation. In the winter, the rabbits need only be protected from direct drafts and from getting wet. Open-sided buildings should have an east-west orientation to avoid the direct morning and afternoon sun.

Another important factor is drainage. Rabbits generate a lot of liquid through their urine and there is also wastage from the drinking system. Water in the rabbitry leads to ammonia production so it is important that the site of the rabbitry be well drained so that water produced in the unit can be drained away and water does not flow in from outside. If the site is too low to provide good drainage, use fill to raise the level before starting construction. This should be done well in advance to allow for settling. Minimum fall away from the building should be 6" in the first 10 feet. The water must be conducted well away from the rabbitry and not allowed to form stagnant pools that will create sanitary problems and insect breeding areas. Drainage should meet state pollution control regulations to avoid groundwater contamination.

There will be odors produced from the rabbitry no matter how well it is managed. For this reason, the unit should be located at least 150 feet from your home and as much as 500 feet from other people's homes.

Ventilation

Before you construct or modify a building for housing rabbits, you should spend some time visiting a number of rabbitries to find out what other producers have done to house rabbits in your area. It is important that this be done within the area because differences in climate make blanket recommendations difficult. The discussion below points out a number of factors to consider and about which you will have to make decisions. Your state Cooperative Extension Service may have agricultural engineers who can provide advice on many of these factors.

Ventilation is extremely important in rabbit production. Ventilation provides fresh air; reduces humidity; dilutes or kills airborne, disease-causing organisms; and helps con-

trol temperature. If the building is located in an area with good breezes most of the time and the building is narrow enough that the breezes can ventilate across the entire unit (which generally means 20 feet or less) you may be able to rely on natural ventilation. If the building is more than about 20 feet wide or you live in an area where breezes are not consistent, you probably will have to plan to supply some sort of forced ventilation using fans. Total environmental control with air conditioning is generally not feasible for commercial operations.

Some buildings have adjustable side flaps that can be opened to provide maximum ventilation and closed when necessary to reduce the amount of air circulation. These flaps can be hinged panels or curtains of canvas, burlap or plastic that can be rolled up to allow more ventilation. A ventilation slot or vent in the ridge of the roof will allow the warm air that rises from the animals to escape. When the sun beats down on a metal roof, part of the radiation is reflected and part is absorbed. Painting the roof with a reflective white or aluminum paint will increase the proportion reflected. This is desirable because the absorbed part of the radiation raises the temperature of the roof. This hot roof then produces long wave heat radiation that is directed downward into the rabbitry and onto the rabbits.

To protect your rabbits from this radiant heat from the roof, it may be necessary to provide a ceiling in the rabbitry or to install insulation between the rafters to prevent radiation of heat down from the roofing. In very hot areas, misting nozzles on the outside of the roof will help to keep the roof cooler and reduce the heat load on the rabbits. The nozzles should be adjusted so there is little, if any, waste water dripping from the roof. If there is waste water, adequate drainage should be provided to direct it away from the rabbitry.

Interior Design

Cage Location

The location of the cages within the building will affect the amount of ventilation required and how the fans and other equipment should be installed. As a result, it is important that the installation pattern for the cages be worked out before the building is constructed.

The outside walls of a rabbitry are generally the coldest areas of the building in the winter and the hottest in the summer, so it is not advisable to install cages on or next to those walls. That sort of installation will also lead to problems with cleanliness because of the urine and manure that will collect on the walls. This is almost impossible to remove and will create odors and promote rotting of wood.

Cages should be installed with wide aisles between them. It is tempting to install the cages as closely as possible to get more rabbits into a smaller area. This is a mistake. You, as a rabbit manager, will be spending many hours walking up and down the aisles, reaching into the

cages, checking waterers, carrying rabbits, feeding, etc., and you will very quickly learn to dislike narrow aisles. Without sufficient space between banks of cages, you will find yourself continually bumping into the feeders, hitting your knuckles on the cages when you sweep, and walking in rabbit manure and urine. Rabbits select a particular location in their cage as a midden where they defecate and urinate. For some perverse reason this, more often than not, is toward the aisle. This means wet spots and piles of pellets in the aisle and, with narrow aisles, an occasional wet pants leg and shoe. Leave at least three feet; four is even better. You may lose a bit on carrying capacity but will enjoy your rabbitry much more with the wider spacing. The lower density of rabbits will also make ventilation more efficient and will thus result in healthier, more productive stock.

If the cages are hung so they face each other across the aisles, you will be able to work cages on both sides of the aisles at one time and will thus save steps. If your building is wide enough that you will have more than one aisle, you should try to have two or four rather than three. That way, you will go down one aisle and back up the other and end up where you started. Be sure to leave sufficient space at the ends for turning carts and other equipment. Over a period of time, that will save you many, many steps and a lot of time. In long buildings with more than two rows of cages, crosswalks should be installed about every 50 feet.

The cages should be hung at a height that is comfortable for you, the rabbit manager. The person who is going to have to reach into the cages day after day should be the one who determines the height. The best way to do this is to suspend the cages temporarily and have the manager try reaching in. Can all corners of the cage be conveniently reached? Will the managers be able to work in the cage without having to lean on the wire because the cage is too high or having to stoop over because it is too low? If it is not correct the first time, continue moving the cage up and down until it feels comfortable.

Once you have decided how the cages are to be installed in your building, you can determine how your ventilation system will work, how many fans you will need and where they will have to be placed. Remember, the fans are there to move the air for the rabbits, not for the workers. Fans are often placed above the cages. This gives good air movement above the cages and removes the warmer air (that tends to rise). On the other hand, if the fans are located beneath the cages, the ammonia that forms from the manure will be blown away, and the air within the rabbitry will have less ammonia odor. Whether the fans are to be located above or below the cages is an individual decision and can be changed after the house is constructed. If several banks of fans are to be installed, however, it is necessary to know where they will be placed in the building so electrical outlets can be provided during the construction period.

In a wide building where natural ventilation is a problem or where summers are very hot, an air distribution system can be used for cooling. This is similar to the heating and/or air conditioning system in a house. A fan is located outside the building and blows fresh air into 12" diameter metal ducts. A long duct is placed just above the cages and a single 3/4" hole is drilled in the duct for each cage so a jet of air blows into the cage. This provides fresh air in the cages and, if it is very hot, the rabbits can lay in front of the jet of air for cooling. Flexible plastic ducts such as those used in greenhouses can be used but when the power goes off, the tubing collapses onto the rabbit cages and they will chew holes in it. A thermostat can be used to turn the fan on whenever the temperature in the rabbitry gets above a certain level.

Where enclosed buildings are used, location of the air inlets is more critical than location of the fans. The inlets must be properly sized and spaced along the building to provide a uniform, draft-free flow of air. Assistance should be obtained from an agricultural engineer when designing this type of ventilation system.

Feeders

Some provision will have to be made to provide the rabbits with feed. Small herds with a few rabbits may be fed using crocks or bowls but large herds will, in the interest of efficiency, require some sort of hopper feeder that can be filled from outside the cage. There are several types of feeders available that fasten to the front of the cage. The design used will depend on the individual preferences of the producer. During construction of the cages and design of the building layout, the installation of the feeders on the cages must be considered along with the placement of the waterers as discussed in the next section.

Feeders will affect building layout because they project as much as 4" out from the front of the cages. This effectively narrows the aisle by 8" when there are cages on both sides. This is a substantial loss of space and must be considered because, if the cages are so close together that it is difficult to walk down the aisle without bumping the feeders, the producer will have problems with torn clothing as well as knocking the feeders off the cages. Cage designs should include the location of the feeder. The front of the cage will have space occupied by the feeder, the waterer and, in some cases, by the door. The cage design should take all these factors into consideration. Front-opening cages often have limited space, so the door is placed on one end of the front and the feeder on the other. This makes reaching into the far corner of the cage difficult. If the door is hinged to swing horizontally outward, it is possible to place the feeder on the door. This allows centering the door on the front of the cage to provide easier access to the interior of the cage.

Feeders are available in widths from 3" to 11". The width needed depends on the number of rabbits in the cage. Feeders are also made with solid or screen bottoms. Some producers feel the rabbits will eat the feed dust

(fines) while others prefer the screen so the fines can fall through. In dry areas where several days feed can be provided at one time, a gallon plastic bottle with the top and bottom cut out can be used to extend the height of the feeder. Feeders are another item that should be tested in your small unit before making a commitment for a large number of a design with which you may not be satisfied. Buy a few and try them out before you make a final commitment for a large number.

Watering Systems

Provision of constant access to fresh water is important to maintain the productivity of the rabbits. This may be done by the use of crocks or watering bowls, bottle drinkers that hang on the cages, or automatic watering systems. It is strongly recommended that anyone with more than a few rabbits install an automatic system.

There are several types of automatic watering systems. All rely on a low-pressure water supply and with a drinker with some sort of valve that the rabbit manipulates to obtain water. The low pressure is obtained by use of a pressure regulator installed in the line or a pressure-breaker tank. The latter is a small tank that is filled by water at line pressure. This is controlled by a float valve similar to that found in a toilet tank. The pressure at the waterer in the cage is regulated by adjusting the height of the breaker tank above the waterers. It is important that the pressure be sufficient to prevent leakage from the waterers, but must not be so high that the rabbits are unable to push in the stems on the drinkers to get water.

The type of watering system to be used will, to some extent, affect the placement and hanging of the cages. Many producers install watering systems between their back-to-back cages. This has the advantage that a single pipe can supply both sets of cages but suffers the disadvantage that the waterers are at the back of the cages where they are difficult to reach to check or service. If you are in an area where winter freezes occur, the danger of the pipe between the cages cracking from freezing is always present. Repair of such a pipe presents a difficult problem. The cages will have to be emptied and spread apart to provide access to the pipe. The repair will then need to be done upside down under cages that have been recently occupied by rabbits. Not a pleasant chore! For these reasons, many rabbitries are now being constructed with the watering systems on the fronts of the cages. In cold areas, heat cables can be installed inside the water lines to help prevent freezing.

As with cage and building design, you should investigate watering systems carefully before you invest. When you do decide what you want, make a small investment to see if they perform as the salesperson or catalog suggests and whether you like the placement of the water lines, breaker tanks and drinkers. If you are not happy with the units or the way they are installed, you then have the option of changing them at a relatively low cost on a few units rather than committing your entire rabbitry to something that you will dislike but have to live with.

Nestboxes

The type of nestbox that you decide to use will, to some extent, affect the design of your building and cages. If you decide to use the drop or subterranean type, you will have to use single deck cages and you probably will want to use quonset or front-opening cages that can be suspended at a reasonable height above the floor. Even with conventional boxes, you must be sure that the doors of the cages are large enough to move the boxes in and out easily, that the nestboxes can be placed in the cages without interfering with the feeding and watering systems, and that the boxes can be moved within the cages to avoid the latrine areas established by the does.

Waste Handling

Your rabbits are going to consume the food and water that you provide for them, and from this they will produce urine and feces. A medium sized doe will produce about 350 pounds to 400 pounds of fecal pellets and about 50 gallons of urine each year. The amount will depend on the size of the animals and the type of feed; but disposing of these wastes will be a part of management of the rabbitry and provisions should be made for this in the design of the building.

Provision must be made to remove water from the rabbitry. Rabbits produce copious amounts of urine, and there will also be substantial amounts of waste from the watering system. If you wash the floors, there will be water from that source as well. If the manure pack under the cages is wet, it provides an ideal breeding place for bacteria and other disease-causing organisms and insect pests like flies and mosquitoes. It will also be a source of ammonia. The rabbit produces in its urine a compound called urea. Urea, in the presence of water and the enzyme urease, forms ammonia. This colorless gas can lower the production of your rabbits as well as making the rabbitry an unpleasant place in which to live (the rabbits) and work (the manager).

The best way to reduce ammonia levels is to prevent its formation. One way to do this is to get rid of the moisture. For this reason, solid concrete floors in rabbitries are not recommended. If such floors are installed, the unit will need to be cleaned daily and the floor washed to remove all traces of the urine. This is not usually a satisfactory method because the daily washing of the floor will raise the humidity in the unit. That may lead to respiratory problems and bacterial growth. If the floor is properly constructed with slopes of at least 2% (1/4" per foot) toward an outlet, the floors will dry reasonably quickly if the ventilating system is properly sized, operated and maintained.

In small units, each cage may sit over a galvanized metal dropping pan. This will collect the urine, feces and other wastes from the rabbit cage. The waste can then be carried out of the rabbitry for disposal. This will need to be done often, and, with more than a few rabbits, it will be a large chore. This pan may serve as a useful temporary

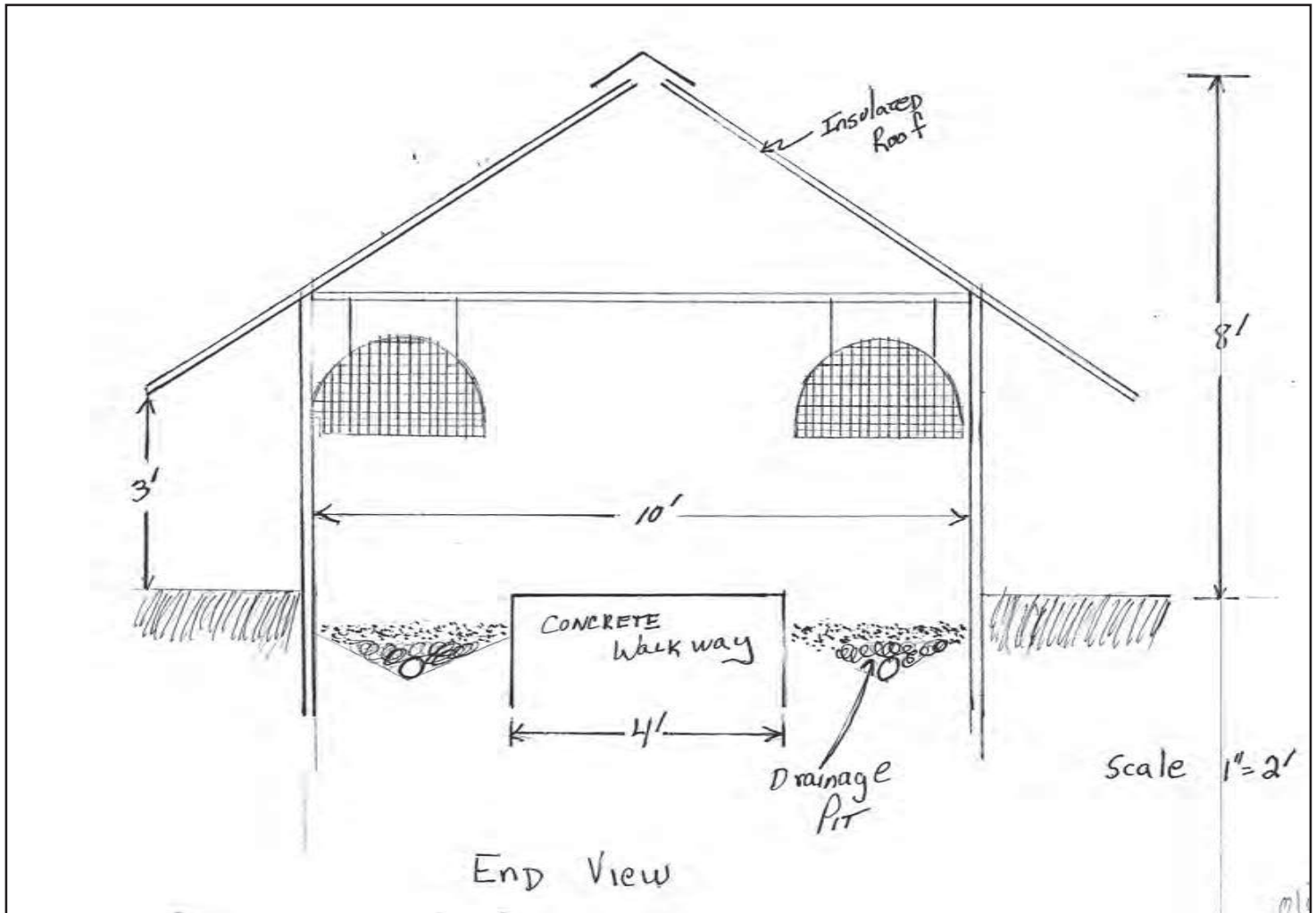


Figure 19. End view of a long (100 ft), narrow (10 ft) rabbit barn showing drainage in the manure pits. Cleaning is done from the outside by pulling manure out with a hoe.

method, however, in the case where a suitable building is not available and the manager is not sure exactly what sort of investment he or she wants to make.

Many large rabbitries provide drainage pits under the cages that allow the manure pellets to remain as the moisture soaks into a drainage system and is removed from the building. Figure 19 shows a method for construction of these pits. The drainage tile in the bottom of the "V" has many holes in it so water and urine soaking down from the rabbits will enter the pipe and can be led out of the building. The layer of gravel above the pipe keeps the holes from being plugged and the pipe from filling with sand. In areas with well-drained soils, the perforated drain pipe may be unnecessary. The sand is installed to provide a firm, level surface on which the manure pellets can be collected.

With this system, the urine and feces fall from the cages onto the sand. The urine and other water soaks downward and are led out of the building through the drain pipe. The manure pellets dry and are very light and easy to handle when the unit is cleaned out. How often this will need to be done will depend on how many rabbits you have in the cages and how far the sand surface is below the surface of the walkway. If the sand surface is about 8"

below the walkway, the pits will need to be cleaned about every six months. This sort of manure pit usually requires cleaning with a shovel and wheelbarrow. Some large rabbitries have special scrapers mounted on small tractors to push the manure to the end of the building. The manure can then be removed from the unit through trap doors or other openings.

A number of mechanical manure removal systems have been devised but few, if any, live up to their promise to provide a low cost, efficient method of manure removal. This is especially true for rabbitries with up to 300 or 400 does. Manure removal is hard work but, with well-constructed pits, needs only be done a few times a year. Thus, careful consideration must be given before making a large investment in a mechanical system that may not work as one would wish.

Some producers use the manure pits under their rabbit cages to produce fish worms. Others feel that the worms require too much moisture in the manure pack to be healthy for the rabbits. These producers build worm beds outside the rabbitry so they can provide the proper moisture for both the worms and the rabbits without one interfering with the other. Worms help break down manure and can cause some drying.

Walkways

The walkways between the cages are for you. They are a part of the rabbit house but you will be the one who must walk up and down them to carry out your rabbit management chores. The walkways will be raised above the manure pits and you must decide whether or not they should be made of concrete. The concrete will provide a smooth, solid surface on which to roll feed carts, etc., and will not get muddy after long periods of rainfall. On the other hand, concrete can be very hard on your feet and legs when you walk for long periods. Another disadvantage is that the rabbits will urinate on the walk. With concrete, this moisture will stay on the walk and will have to be washed off periodically. Also, if you are in an area with winter freezes, these pools of urine may cause ice patches that could make walking treacherous. With hard packed earth or sand walkways, the urine will soak in and not cause ice patches. Another disadvantage of Concrete walkways is that they also provide excellent hiding places for rats. The rats dig burrows under the walkway and are hard to displace.

Wooden planks or pallets may provide a dry walking surface in areas that tend to get muddy. The advantage of these is that they can be removed for cleaning. The area may also be built up with sand to give drainage.

Lights

Unless you only have a few rabbits, you probably will want to install lights in your rabbitry. During the winter months, it may be necessary to have lights in the rabbitry in order to be able to see to carry out the required management chores. In addition, rabbits in the wild do not normally breed during the autumn and winter months and this is still seen to some extent in domesticated rabbits. It has been shown that providing 16 hours of light year around will help overcome this winter reduction in the reproductive rate. Such a lighting system can be arranged quite inexpensively using a timer for a poultry house or even one made for turning on the coffee pot in the morning. If you use one of the latter, be sure that it has sufficient capacity to handle the number of lights in your unit. Once a timer has been installed, it can be set so the lights will come on for a certain period each evening to provide the 16 hours that are needed. The lights should also be controlled in the morning because changes in time of sunrise and switching from standard to daylight savings time and back will also affect productivity. It is much better to have an automatic system because trying to remember to turn the lights on and off will result in too many mistakes. Irregular lighting may be more harmful than no light control at all. No work has shown conclusively that either incandescent or fluorescent lighting is better, so what you install will depend to a large extent on your preference and what is available. A level of light sufficient to allow you to see to walk through the rabbitry seems to be sufficient.

Feed Storage

You should make provision for storage of feed. Even if you only have a few rabbits, you will be buying feed for a week or more in advance. Given the price of feed, you don't want it to get wet and spoil or be eaten by rats. Planning for storage early will help to overcome these problems. Many producers use an old chest type freezer or refrigerator to store their feed. The bags can be placed in the unit and feed taken out when it is needed. The metal case of the unit will protect the feed from rats and mice and the insulation will prevent hot spots and moisture accumulation in the feed. (NOTE: Remove the door latch so children cannot crawl in, become trapped, and suffocate.)

Larger rabbitries that use sacked feed may include a room built of concrete block with a solid ceiling and a tight fitting door to keep vermin out. Some large rabbitries buy their feed in bulk because it is cheaper than sacked feed. This sort of feed is generally stored in specially constructed tanks.

Office Area

Your rabbitry should also include an "office" area where you can keep your record books, have a flat surface upon which to write your records, and a separate table surface covered with carpeting on which you can place a rabbit to inspect it or treat it. The office area may just be a stand-up bench in one end of your unit or you may wish to assign one area where you can sit down at a desk or bench, have shelves and storage cabinets and maybe a telephone.

Summary

Having read this far, you are probably somewhat overwhelmed with the number of factors that must be considered when setting up rabbit housing. The lack of definite recommendations is also very frustrating. It is very difficult to make concrete suggestions for a number of reasons. In the first place, the purpose for which the rabbits are kept will obviously have an effect on the housing required. Rabbit producers are individualists, and many of them have ideas that they want to try for themselves. They thus set up their housing in a manner that is suitable for them.

The climate in which the rabbits are to be reared will obviously have a great deal to do with how the housing is designed. Perhaps one of the most important reasons for having difficulty making concrete suggestions about rabbit housing is that we just don't have the necessary information. The research has not been done, so the answers are not available for the producers.

As explained earlier, it is important, regardless of why or how you keep rabbits, that you keep these basic principles of rabbit housing in mind. The housing should:

- Be comfortable for the rabbits;
- Confine the rabbits and keep them from escaping;
- Protect the rabbits from predators;
- Protect the rabbits from the weather;
- Allow easy, comfortable access for the manager;
- Be "self-cleaning" or easy to clean; and
- Be of a reasonable cost, be easy to maintain and be durable.

Remember to start your rabbitry small so you can try your construction ideas on a small scale and not be tied to errors or inconveniences for years. It is also advisable to start your herd small so you have time to learn the rabbit business from a few rabbits as you grow into full production and can breed your own replacement stock. Remember the adage, "Don't go into the rabbit business, grow into it."

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Glossary

The following glossary includes words used in this bulletin that may not be familiar to all readers or that have special meanings with regard to rabbits. No attempt has been made to provide exhaustive definitions. Rather, the definitions given are those that apply to the manner in which the word has been used in this publication.

Ammonia: a pungent gas found in rabbitries that is formed by reaction of urea with water.

Buck: a male rabbit.

Cage: a housing unit for one or several rabbits mostly or entirely constructed of wire.

Chicken wire: wire woven on a loom to form a hexagonal pattern. Also called poultry or hexagonal netting.

Doe: a female rabbit.

Early weaning: an intensive management system under which kits are weaned at four or five weeks of age.

Fryer: a young rabbit being reared for meat.

Galvanize: to coat with zinc to provide rust resistance.

Gauge: a standard or scale of measurement.

Grooming: cleaning and brushing the hair of the rabbit.

Hardware cloth: wire mesh formed by interweaving strands of wire that are held in place by galvanizing.

Hog ring: a “U” shaped piece of wire that can be closed around two wires to join them.

Hole: a cage or hutch in a rabbit unit.

Hutch stain: yellow stain on the fur from rabbit urine or rust from cages or hutches.

“J” clip: a flat strip of metal formed into a “J” that can be closed around two wires to join them.

Kindle: to give birth.

Kit: a rabbit of either sex from birth to weaning.

Line wires: the wires in welded mesh which run the length of the roll.

Midden: the area of the cage or hutch where the rabbit deposits its urine and feces.

Manure pack: the build up of manure under the cages or hutches.

Molt: the act or process of shedding or changing the fur.

Palpation: feeling the doe’s abdomen to determine whether she is pregnant.

Quonset cage: a cage formed with a curved top.

Resting board: a piece of board placed in the cage on which the rabbit can sit.

Selvage: the edge of woven wire that is wound so it won’t unravel.

Sore hocks: an ulcerated condition of the rabbit’s foot-pads or soles of the feet.

Stay wires: the wires in welded mesh that go across the roll.

Urea: a nitrogen containing compound found in rabbit urine. Reacts with water to form ammonia.

Urease: an enzyme that is necessary for the formation of ammonia from urea and water.

Vermin: rats, mice, snakes, and any other small animals that are destructive, annoying or harmful to the rabbits.

Welded mesh: wire mesh formed by welding the wires together.

Wire break: a tool used to bend welded mesh wire.

About the Author

James McNitt, Ph.D., has been a professor of animal science at Southern University and A&M College since 1984. He holds a bachelor of science in livestock production from Cornell University, a masters of science in animal breeding from Colorado State University and a doctorate in reproductive physiology from the University of Wisconsin. His primary interests are related to practical animal production for small, limited resource farmers; especially the use of alternative species to increase home meat consumption and small farm income. For a number of years he has been involved in research on various aspects of commercial meat rabbit production. He also has recently been studying rearing poultry in various pasture situations. McNitt has held faculty positions at the University of Botswana, Lesotho and Swaziland in Swaziland and at Bunda College of Agriculture in Malawi. He taught a wide variety of courses at those institutions and carried out research on rabbit production systems. He is currently working with active rabbit development projects in Haiti and El Salvador. He is also a participant in the Armenian Food Safety System Project sponsored by the USDA. It is a four-year collaborative technical assistance effort between the LSU Agricultural Center, Southern University Agricultural Research and Extension Center, the International Institute for Food Safety and Quality, and the Center for Agribusiness and Rural Development, Armenia. McNitt has published a number of scientific articles and is also senior author of the definitive book *Rabbit Production*. Many brochures about rabbit and pastured poultry production have been produced and distributed.

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