

# RAISING CHUKAR PARTRIDGES



## **Introduction**

Raising Red-legged partridge, commonly referred to as the "chukar," can be an enjoyable hobby, or if properly managed, a profitable business.

Many bird fanciers consider the chukar one of the easiest game birds to raise in captivity, especially when it is raised on wire to minimize disease problems.

Initially introduced into California in the early 1930s to help supply birds for hunting recreation, the chukar partridge in recent years has gained popularity as a gourmet food. The texture and taste of cooked partridge compares favorably with that of the Bobwhite quail.

With modern techniques it is possible to raise chicks during any season, thus producing a marketable product all year. This has definite monetary advantages for the producer who can more efficiently utilize his growing facilities. It is still recommended, however, that managers establish dependable markets before venturing into business on a large scale.

## **Distribution**

The Red-legged partridge familiar to most game bird fanciers in the United States is thought to be a composite (hybrid) of several subspecies

of the genus *Alectoris* originating from central Asia. There are at least 13 subspecies of Red-legged or rock partridge that look alike yet have unique traits that identify them with their respective habitats.

The *chukar* partridge recently reclassified by some taxonomists as belonging to the species *chukar*, is presently identified as *Alectoris chukar chukar*. This subspecies was first liberated in California in about 1932; 20 years later some 53,000 birds had been released in all but four counties. As a result of these releases, chukars are established in the desert and semi-arid regions of northern and southern California where yearly precipitation rarely exceeds 10 inches. The bird has been successfully established in other western states including Nevada, Washington, Oregon, Utah, Montana, Wyoming, Idaho and Arizona.

Use of the term *chukar* in this leaflet is synonymous with the Red-legged partridge, *Alectoris chukar chukar*.

## **Description**

The chukar can best be identified by the black band running across the forehead through the eyes, down the neck, and meeting as a gorget, between the white throat feathers and upper breast. The lower breast and back are generally ash-gray. Feathers on the flanks are gray at the base and have two black bands at the tip, giving the appearance of numerous bands of black bars flanking the side. The bill, legs and feet of both sexes are orange-red.

## **Sex Determination**

There is no obvious feather color dimorphism in chukars. Consequently, sexing adult birds for the untrained eye is most difficult. However, it is possible to distinguish adult males from female by body size, shape of the head (blocky appearance in males) (figure 1) and presence of the metatarsal spur (which can be present on some females).

A more reliable technique for determining sexes in partridges was developed by University of California workers who found that examining the genital protuberance for evidence of a rudimentary sex organ is about 95 percent accurate for determining differences in sex. In adult males the cone-shaped protuberance is usually centrally located on the cloacal fold

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Figure 1. Side profile of the male (top) and female (bottom). Compare the shape and size of the head.

(figure 2a). In females it is absent or two small nodules appear off-center of the mid-region of the fold (figure 2b). The rudimentary protuberance, averaging about 2.78 mm in diameter, is easier to see on older birds.

### *Characteristics of the Chukar Egg*

Partridge eggs are uniformly yellowish-white in color, with numerous speckles of brown, of varying sizes and shapes, appearing over most

of the shell. Eggs weigh from 16 to 25 g (average about 21 g), are oblong in shape, and are an average 42 mm long and 31 mm wide. Egg shell thickness is about 0.228 mm and shell membranes about 0.047 mm. The wet proportion of shell, yolk and albumen to total egg weight are 15.2 percent, 35.0 percent and 49.8 percent, respectively.

### *Egg Care*

The critical period for most hatching eggs is the time from lay to actual setting in the incubator. Eggs should be gathered at least four times a day and more frequently during extreme heat or cold. Eggs must not be exposed for long periods of time to ambient temperatures below 40° F (4.4° C) and in excess of 80° F (26.7° C). Ideally a uniform temperature of 55° F to 60° F should be provided.

Proper use of nest boxes for floor-managed breeders will greatly reduce the number of heavily soiled eggs harvested. Slightly soiled eggs can be cleaned with a fine-grained abrasive pad. However, for managers who prefer to wash all hatching eggs, a correct procedure must be followed. Eggs must never be washed in water colder than the temperature of the egg. A wash water temperature of 110° to 120° F (43.3° to 48.9° C) is recommended for most eggs and a detergent-sanitizer (any of the chlorine-based disinfectants)<sup>1</sup> added to reduce egg shell contamination. Not more than 200 eggs should be washed in one gallon of wash water. Immersion time should not exceed 3 minutes,

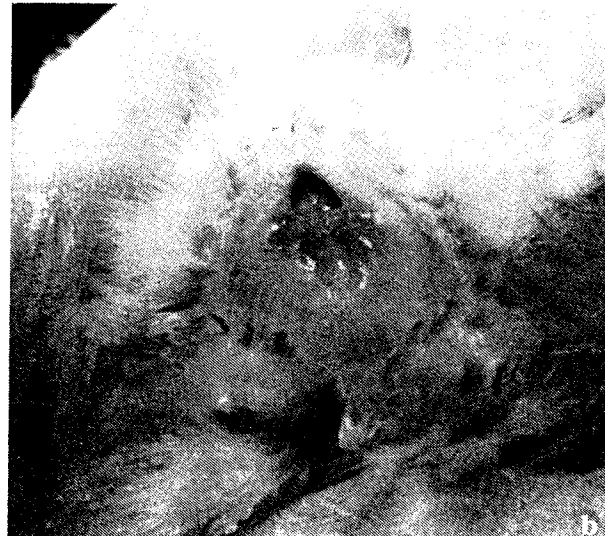


Figure 2. Eversion of the cloaca to show rudimentary genital protuberance of the male (2a) and its absence in the female (2b).

<sup>1</sup> Refer to U.C. Extension Leaflet 2629, *Hatchery and Hatching Egg Sanitation*, for further information on egg washing procedure.

and eggs should be thoroughly dry before being stored.

### Egg Storage

Clean eggs should be stored, large end up, on trays or flats in a cool, well ventilated room kept at about 55° F (12.8° C) at a relative humidity of 70 percent. A unique feature of partridge eggs is their ability to withstand storage up to 28 days without appreciably affecting hatchability (table 1). However, most breeders prefer to set eggs every 7 days. Further studies at the University of California show that eggs need not be turned daily if the storage period does not exceed 14 days (table 2).

**TABLE 1. Influence of Length of Storage Time on Hatchability of Game Bird Eggs.**

Holding period (days)	Hatchability(%)		
	Chukar	Pheasant	Coturnix
1-7	78.4	58.1	57.4
8-14	77.1	41.7	60.0
15-21	79.4	17.6	25.7
22-28	66.0	7.1	14.4
29-35	37.7	0.0	4.2
36-42	22.3	0.0	0.0

**TABLE 2. Effect of Turning Eggs During Storage on Hatchability in Game Bird Eggs.**

Holding period (days)	Hatchability (%)			
	Chukar		Coturnix	
	Turned*	Control	Turned*	Control
1-7	63.0	75.5	61.4	53.4
8-14	60.8	62.0	60.0	60.0
15-21	61.9	48.0	29.2	22.6
22-28	62.2	52.2	11.5	17.2
Average	61.9	59.4	40.5	38.3

\*Eggs were turned through 90° twice a day during the hold period.

### Hatching

For the beginner, it is advisable to purchase eggs from a well-established reputable game bird producer who can provide a product (reasonably) free of disease. A number of large

breeders in the United States provide good saleable stock or eggs. Contact your local farm advisor or Department of Fish and Game for more information on sources of stock.

The hatchery room should be well ventilated and temperature maintained at about 75° F (23.9° C). For sanitary reasons, the hatcher should be kept in a separate room from the incubators. Walls should be constructed of, or treated with, a water-impervious material. Concrete floors should slope to central drains for ease of cleaning.

### Incubation

One of the most important investments you must make is the purchase of an incubator large enough to maintain accurate control of temperature ( $\pm .25^\circ$  F or  $0.15^\circ$  C) and humidity ( $\pm 1.0^\circ$  F or  $0.56^\circ$  C). Other essential features include automatic turning of eggs and forced air movement.

Commercial incubators for poultry can be modified to accommodate game bird eggs. Contact a representative from any commercial incubator manufacturer for information about different models and select the one most suitable for your needs.

The incubator should be thoroughly cleaned and fumigated before eggs are placed in the machine. One popular fumigant used is formaldehyde gas, the product generated by mixing 60 grams (2¼ ounces) of potassium permanganate with 120 cubic centimeters (½ cup) of a commercial 37 percent formaldehyde solution for each 100 cubic feet (2.83 cubic meters) of space to be fumigated. Pour the formaldehyde over the potassium permanganate in an earthenware or enamelware container. Circulate the gas for 20 minutes with a fan, and then expel the gas from the fumigation room or cabinet.<sup>2</sup>

When eggs are to be fumigated, be sure to place them on trays large end up in the incubator that will allow adequate gas circulation for all of them (figure 3).

The incubation period for chukar eggs is about 24 days (the range is 23 to 25 days), depending upon age and line of stock used. The dry-bulb and wet-bulb temperature used successfully at Davis for both incubation and hatching is a dry-bulb of 99.5° F (37.5° C), and a wet-bulb of 86 to 87° F (30.0° to 30.5° C), respectively. Eggs are transferred to the hatcher on the 19th or 20th day of incubation.

2. Formaldehyde solution (formalin) is highly irritating. Follow precautions on the container label. Wear goggles, respirator, long-sleeved shirt and liquid-proof gloves when handling the fumigant. If the fumigant chamber is within another room, be sure the outside room is well ventilated. If the chemical solution spills on you, wash it off immediately.

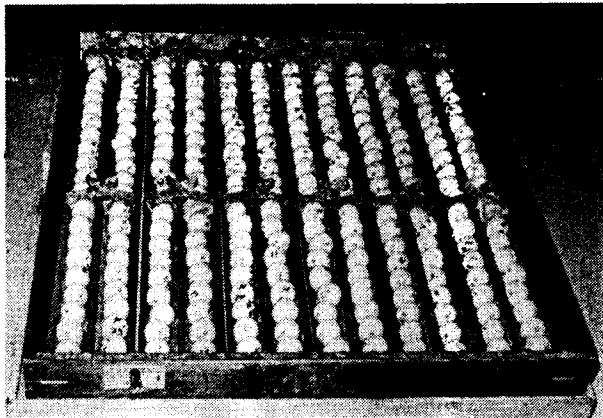


Figure 3. Chukar eggs set large end up on a tray adapted for Jamesway incubators.

### Embryo Mortality

A sampling of hatching eggs from each setting should be candled on the seventh or eighth day to check flock fertility and for other problems that can be detected when "clear"-appearing eggs are opened and examined for failure to develop.

There are two peaks of embryo mortality for chukar eggs (figure 4). The first peak occurs between 3 to 5 days of incubation and most mortality is due to a failure to form embryonic structures or to a defect in embryonic and extra-embryonic organs and tissues.

The second and largest peak in mortality is generally associated with several critical functions occurring from the 20th to 24th day. These functions include: change in position of the embryo before pipping; utilization of the remaining albumen; absorption of the yolk sac, and change from allantoic to pulmonary respiration.

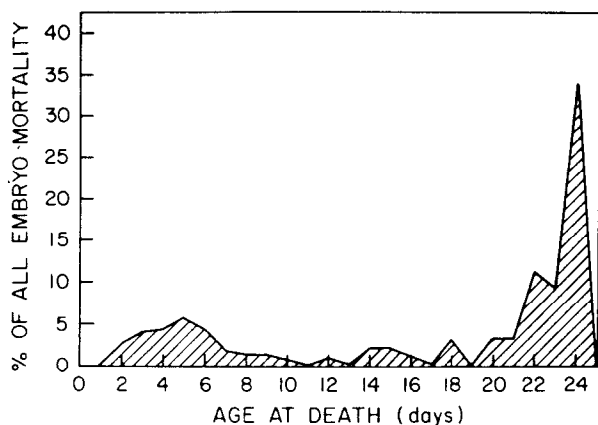


Figure 4. Embryo mortality curve for the chukar.

### Brooding

The average brooding chukar chick weighs about 13 to 14 grams at hatch. Although amply covered with down feathers at hatch, it is basically an incomplete homoiotherm. It requires supplemental heat for several weeks until its own temperature regulatory mechanism is fully established.

Chicks can be brooded successfully in multi-deck batteries (figure 5) or on the floor (figure 6). Most commercial chicken batteries, with some modification to the floors, feeders and waterers, can accommodate the smaller partridge chicks. To reduce hock injury the floor area immediately beneath the heating element should be covered with a commercial polyethylene matting (poly-mesh) having  $\frac{1}{4}$ -inch spacing.<sup>3</sup> The matting is durable and can be washed and reused for several years. The birds should be moved into more permanent growing cages or pens at 6 weeks.

Floor brooding is generally considered the most economical way to start chicks. The size and style of brooding facility will vary among regions of the United States. The procedure, however, is much the same, involving a separate enclosed room, preferably with insulated walls

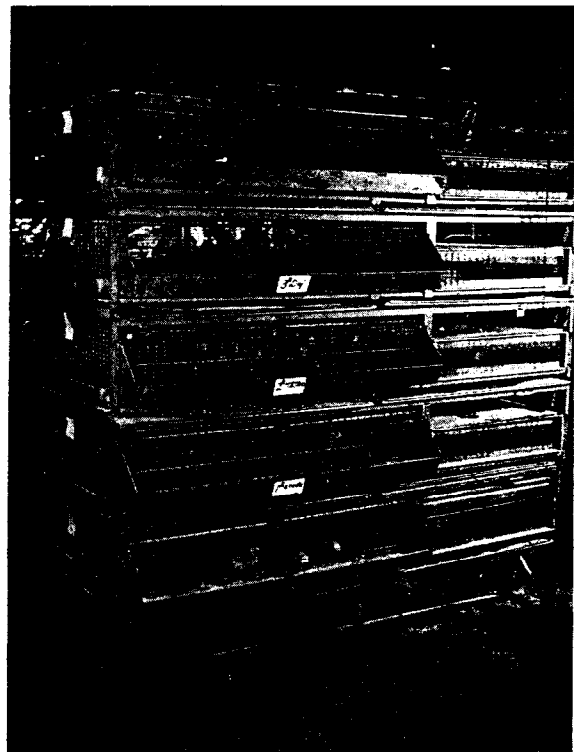


Figure 5. Commercial five-deck game bird battery. Waterers and feeders are located inside unit for the first week, then are moved to outside.

3. The polyethylene matting is normally used in laboratories but can be cut and adapted for use as matting for brooders. For further information contact Cole-Parmer Instrument Company, 7425 North Oak Park Avenue, Chicago, Illinois 60648.

and ceiling, and heat is provided by gas or electric hovers. Some managers use a raised wire-floor system, allowing fecal material to fall through the wire floor where it accumulates below and is later removed mechanically. One Pennsylvania grower uses a vinyl-coated wire ( $\frac{1}{4} \times \frac{1}{2}$  inch) that covers the entire floor area of the brooding compartment. This floor type greatly minimizes the incidence of foot trouble. The vinyl mesh is also easy to clean (figure 7).

Floor brooding requires the use of a suitable surface, preferably cement, with adequate floor drains for cleanup. Use a litter that can absorb moisture, serve as an insulation barrier between bird and floor, and be economical in price. The use of a draft shield, a cardboard circle placed around the hover, is optional, especially when attraction lights are used on the hover.

The capacity of the hover will determine how many birds can be kept in each unit. A rule of thumb is to allow 1 square foot per 5 chicks for the first 2 weeks, then reduce it to 3 birds per square foot to 6 weeks of age.

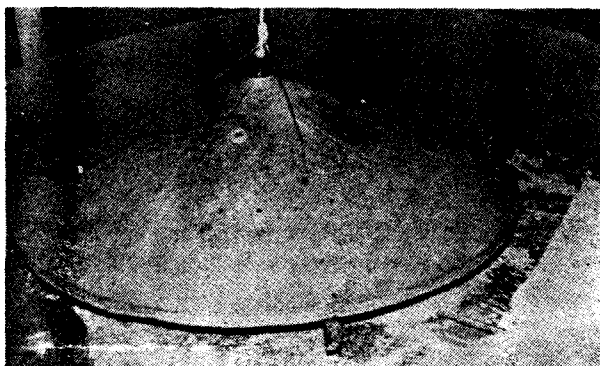


Figure 6. Floor brooding chukars, using a pancake hover and draft shield.

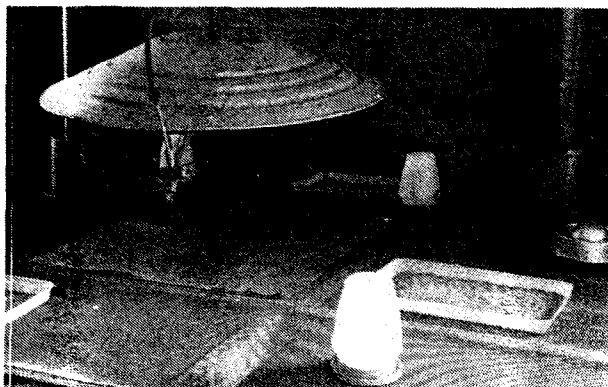


Figure 7. Wire-floor brooding, using a  $\frac{1}{4} \times \frac{1}{2}$  inch vinyl-coated wire floor. Approximately 600 chicks are started in each 12 x 12 foot room. Four 1-gallon water jars and 4 feederlids are used to start the chicks. The pit below the floor is enclosed to conserve heat. —Photo courtesy of Mabantongo Game Farm, Pillow, Penn.

For the first week of brooding use a one-gallon fount (jar) for each 200 chicks. Thereafter, the chicks can be given access to automatic waterers. However, make the transition from fount to automatic waterer a gradual one.

Chicks should be allowed from  $\frac{3}{4}$  to 1 inch of feeder space per bird. To stimulate eating, place paper plates containing chick starter near hover; this do in addition to supplying feed in regular chick feeders.

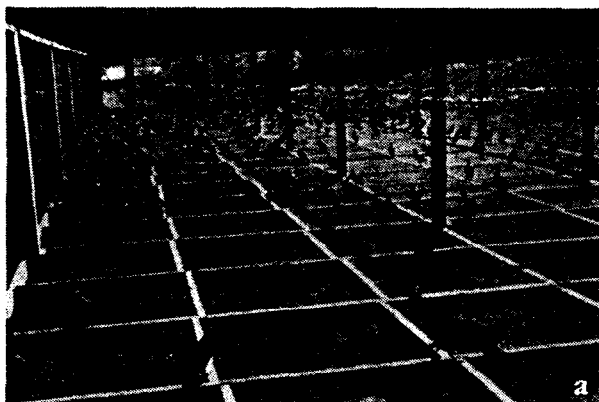
Some recommended procedures for completing a successful brooding season include:

1. Brooder area or chick battery to be thoroughly cleaned and disinfected before arrival of chicks.
2. Start up hovers or battery heating units at least 4 hours before arrival of chicks. Check hover or battery thermometers for accuracy and use a starting temperature of 95° F (35° C) and decrease the temperature 5° F (2.8° C) each week until the fourth week at which time further supplemental heat is not needed.
3. Be certain that the brooding area is ventilated enough to avoid ammonia buildup. If odor of ammonia can be detected, then additional air movement in the room is needed.
4. Drinking founts should be cleaned and refilled daily until birds are switched to an automatic watering system. Keep litter dry around drinking founts.
5. Start the birds on a chick diet containing about 28 percent protein. Commercially prepared turkey starter diets can be fed to most game birds with satisfactory results. Conserve feed by not over-filling feed hoppers.
6. Check chicks daily for cannibalism or sickness. Remove dead birds immediately and dispose of them in a sanitary manner (preferably an incinerator or deep pit).

### *Growing Chukars*

Past experience has shown that birds do best when kept off the ground in wire-floor flight pens. Chukars are very susceptible to blackhead (a condition caused by a protozoan parasite that attacks the liver and ceca) coccidiosis, and worms, including crop, cecal and intestinal varieties, that can cause severe mortality in ground managed birds.

The growing pens can be separate from the brooder house or attached to it in such a manner as to allow the upper end of the flight pen to be



Figures 8a and 8b. Wire-floor flight pens for growing birds. Each section measures 12 feet  $\times$  100 feet. Feeders and waterers are located at each end of the pen under cover.—Photo courtesy of Mabantongo Game Farm, Pillow, Penn.

a sunporch and used by the chicks from the second week of age on.

Flight pens can vary in size, but should be long enough to make flight possible. A pen size frequently used is one that is about 12 feet wide by 100 feet long (figures 8a and 8b). The wire-floor and partitions are covered with 1-inch mesh. The top-wire should be a 2-inch mesh especially in areas where snow is a common winter product. A product frequently used as top-netting, in place of poultry netting, is a synthetic product called "Toprite" made of olefin fibers. The product is manufactured in 2 sizes, 1- and 2-inch netting, and pieces are laced together with dacron twine or hog rings.<sup>4</sup>

Overcrowding is one major management problem to avoid. As a rule of thumb allow each bird approximately 2 square feet of space in the flight pens.

A system used satisfactorily at the University of California for growing birds is double-deck colony cages that are kept in temperature- and light-controlled rooms. Each colony cage measures 5 feet wide  $\times$  2.5 feet deep  $\times$  2 feet high (figure 9). Approximately 25 birds are kept in each unit to 16 weeks of age. The sloping floor of each unit is constructed of  $\frac{1}{2}$  inch  $\times$  1 inch welded wire, the side partitions and top made of 1 inch  $\times$  2 inch welded wire. One automatic water fountain, mounted outside the cage, supplies the fresh water for the growing birds. Removable trays permit ease of cleaning.

### Growth and Marketing

In partridge, growth is rapid during the first 12 weeks, then slows during the next 4, and at

16 weeks the bird has attained approximately 92 percent of its adult weight (figure 10). Using the cumulative feed conversion scale on the right ordinate in Figure 8, a male chukar should reach 1 pound weight at about 9 weeks and will consume approximately 3.75 pounds of feed. The females will attain 1 pound weight at 12 weeks, consuming about 4.5 pounds of feed. Birds raised for shooting club activity should be marketed at 16 to 20 weeks. For monetary reasons birds should not be kept beyond 20 weeks, unless held for special shooting club activity, in which case an additional holding charge must be included to cover feed and labor costs.

Special gourmet markets desire a processed bird weighing about 1 pound (454 grams). Thus, the average flock live weight should be about 1.32 pounds (600 grams), a weight reached at about 20 weeks.

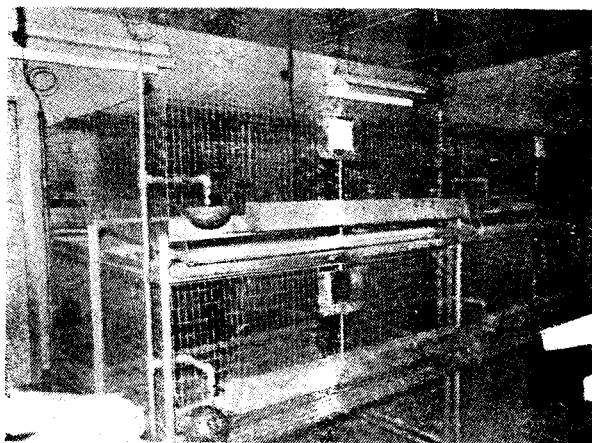


Figure 9. Double-deck colony growing pens. Waterers and feeders are positioned at front of cage.

6 <sup>4</sup>. Toprite II is a commercial product manufactured by J. A. Cissel Company, Inc. Squankum-Yellowbrook Road, Farmingdale, New Jersey 07727.

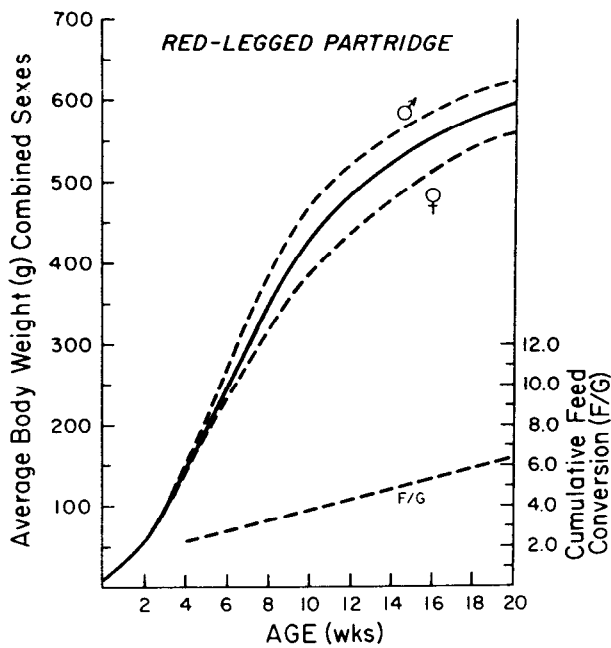


Figure 10. Growth curve and approximate feed conversion (F/C) for chukars from hatch to 20 weeks.

### Lighting for Growing Birds

After the first week of brooding, light is used sparingly at low intensities (less than .05-foot candle) to minimize cannibalism and reduce activity in birds raised for shooting club activity. When raised in outside flight pens the birds should receive natural daylight only.

Birds raised for meat should be grown to the desired marketable weight as quickly as possible. For this purpose, cycles of intermittent lighting (1L:2D) repeated eight times per 24 hours or a constant period of light in excess of 20 hours per day are used to produce the best growth in partridges. For most light regimens use a low intensity light of about 0.5 foot candles (5 lux).

### Nutrition

The source of all tissue proteins, including the major muscle mass of the body, is dietary proteins and amino acids. The closer the supply of dietary amino acids comes to actual levels required for optimum growth, the greater the proportion of lean tissue in the body. The body of the bird, like humans, has a remarkable capacity for storing surplus dietary energy in the form of fat. A certain amount of fat on the carcass of the chukar may be desirable for its meat has a tendency to be "dry." Diets formulated at the University of California, Davis, for chukars are

TABLE 3. Suggested Diets for Chukars.

Ingredient	Diet Composition (%)		
	Starter	Grower	Breeder
Corn, yellow (grd.)	46.22	54.04	61.25
Soybean Meal(dehul.)	47.47	26.84	18.59
Wheatbran	—	14.19	10.46
Methionine	0.10	0.17	0.23
Limestone	1.65	1.76	7.38
Fat	1.56	—	—
Salt	0.50	0.50	0.50
CA Phosphate	2.00	2.00	1.09
Premix*	0.50	0.50	0.50
Estimated			
Crude Protein (%)	25.00	20.00	16.00
ME (KCAL/gm)	2.80	2.70	2.70
Fat (%)	3.70	2.70	2.80
Fiber (%)	4.50	3.80	3.20
CA (%)	1.20	1.20	3.00
P (%)	0.80	0.70	0.50

\*Supplied the following per Kg diet: Vitamin A, 5000 IU; Vitamin D<sub>3</sub>, 1500 IU; Vitamin E, 20 IU; (in mg) menadione bisulfide, 2.0; Riboflavin, 6.0; niacin, 40.0; calcium pantothenate, 20.0; folacin, 0.5; Vitamin B<sub>12</sub>, 5.0; MnSO<sub>4</sub>·H<sub>2</sub>O, 140.0; ZnO, 120.0; gallomycin, 10.0; BHT, 40.0; Choline chloride to balance.

given in table 3. The suggested protein level of the starter diet is 25 percent; this level was found to be more than adequate for satisfactory growth in the chukar. For those who desire a higher protein starter diet, we recommended the following feeding regimen: 28 percent protein diet for 7 weeks followed by a 24 percent diet for 4 weeks, thereafter switch to a 20 percent diet in which, by weight, half is supplemented with milo.

A breeder diet containing 16 percent protein is adequate for most laying flocks of chukars. A commercial chicken breeder diet can be easily obtained in bulk and generally costs less than most game bird breeder diets.

### Management of Breeders

For optimum performance partridge breeders should be kept in a laying house in either cages, wire-floor colony pens, or on the floor where temperature and light can be controlled. When pedigree matings are desired, the individual cage system is used where individual bird performances can easily be monitored.

The most economical method for keeping chukar breeders is on the floor in mass-mated

flocks, maintaining a mating ratio of one male to four females. This ratio may be revised upward or downward depending upon the strain and environmental conditions under which the birds are kept.

Keeping breeders in outside range pens is practiced with limited success in some areas of the United States. Some disadvantages associated with this system of management is exposure of the birds to adverse weather conditions and high disease risk with blackhead and coccidiosis, two diseases that can cause high mortality.

**Individual cage management.** Breeder cages large enough to keep a mating pair or two females and one male per cage are used exclusively at the University of California research farm. The all-wire cages with sloping floors measure 12 inches wide  $\times$  24 inches deep  $\times$  15 inches high (figure 11). The  $\frac{1}{2}$  inch  $\times$  1 inch mesh welded wire floor slopes about 2 inches from back to front. The galvanized 2 inch deep "V" trough waterers are attached to the back of the cage, providing water to back-to-back cage sections if such a system is desired.

**Colony cage management.** Another system used at Davis consists of an all-wire colony pen that measures 60 inches wide  $\times$  28 inches deep  $\times$  20 inches high. The sloping floor is constructed of  $\frac{1}{2}$  inch  $\times$  1 inch welded wire mesh that allows the egg to roll to the front of the cage for ease in harvesting. Each cage is equipped with a 6-inch diameter water fount that is adjustable for proper water level. The pen will accommodate 12 breeder birds, 3 males and 9 females (figure 9).

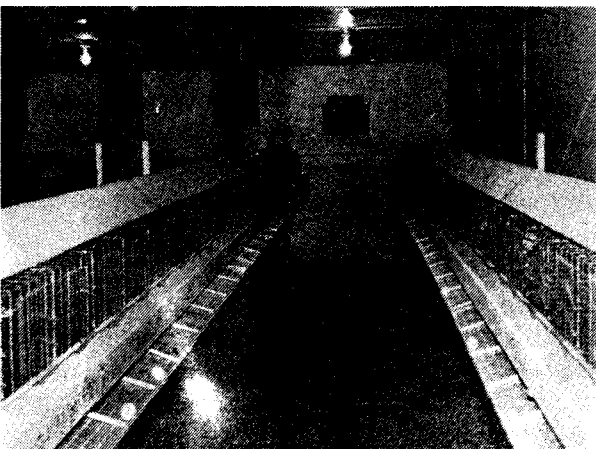


Figure 11. Single row individual laying cages. Cages measure 12 inches wide  $\times$  24 inches deep  $\times$  15 inches high. An open "V" trough is located at the back of the cage.

**Floor management.** Perhaps the most economical method of managing breeders is to keep them in floor pens. The floor should be concrete and equipped with a drain for washing. The walls should be painted with an impermeable material for ease of washing. Either bulk feeders or automated feeding troughs are used to reduce labor involved with feeding. Locate automatic watering founts on a stand or roost and equip them with rollers to discourage birds from roosting on them. The location of nest boxes along the walls of the floor pen will greatly reduce the number of dirty eggs and egg breakage. The colony type nest is most commonly used in floor managements, allowing 1 square foot of nest box for every 6 hens.

### **Mating Ratio**

Chukars normally pair-mate in the wild. In captivity, however, 1 male can be mated to 3 or 4 females under colony cage or floor management systems. It is important to candle a sampling of the first setting of eggs to determine level of fertility.

### **Fertility**

Low fertility can result from many management problems:

1. Age of the bird when given stimulatory light. It has been demonstrated that breeders should be at least 30 weeks of age before stimulated to lay (table 4).
2. Breeder diets low in protein, vitamins or essential amino acids. These can cause fertility problems.
3. Management. Poor or inadequate lighting, overexposure to climatic stress, outbreaks of cannibalism are but a few of the management problems causing a decline in fertility.
4. Disease. Most acute outbreaks of disease will cause a drop in fertility and subsequent termination of lay. A few diseases known to acutely affect fertility are bronchitis, newcastle and salmonellosis.

Fertility is generally higher in chukar flocks mass mated on the floor as compared to those pair-mated and kept in cages. Females mass mated on the floor are usually serviced by more than one male, thus assuring successful fertilization of the egg.

A typical fertility curve for pair-mated chukar breeders kept in individual cages can be seen in



**TABLE 4. Effect of Age When Given Stimulatory Light on Sexual Maturity and Egg Production in the Chukar Partridge.**

Age when given stimulatory light (16L:8D)	No. of birds	% of total birds reaching sexual maturing	Av. days to 1st egg after given stimulatory light	Av. eggs laid per hen in 10-week period	% of laying hens producing 4 eggs or less during 13 weeks of lay
16	8	12.5	49.0	4.0	100.0
18	21	33.3	57.4	6.3	71.4
20	13	30.8	48.5	4.5	50.0
22	22	45.5	51.9	7.0	70.0
24	18	55.6	48.2	15.0	30.0
26	13	84.6	41.5	18.0	9.1
28	20	90.0	38.8	17.4	16.7
30	10	100.0	40.6	21.5	20.0

figure 12. The lower level of fertility that occurs during the first 2 weeks of lay can be attributed to the lag in male potency, especially if artificial light programs are used to induce out-of-season lay.

Duration of fertility in the chukar is comparable to that for the duck and slightly longer than for coturnix (figure 13). These results indicate that fertility remains reasonably high for approximately 6 days following the removal of the male, thus for stud-breeding the male should be mated with the females at least once per week.

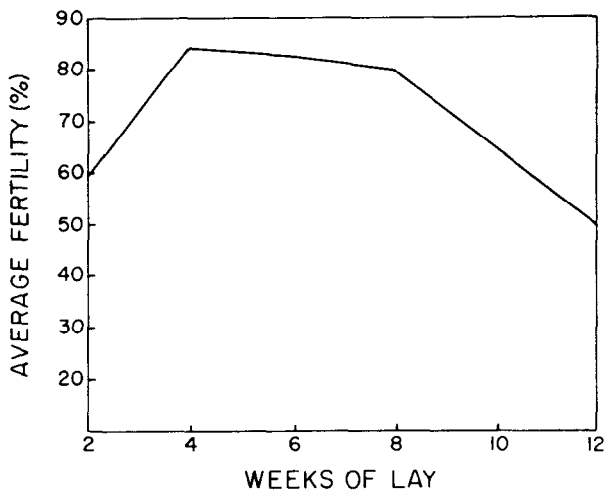


Figure 12. Average fertility for 8 generations of chukars kept in individual mating cages.

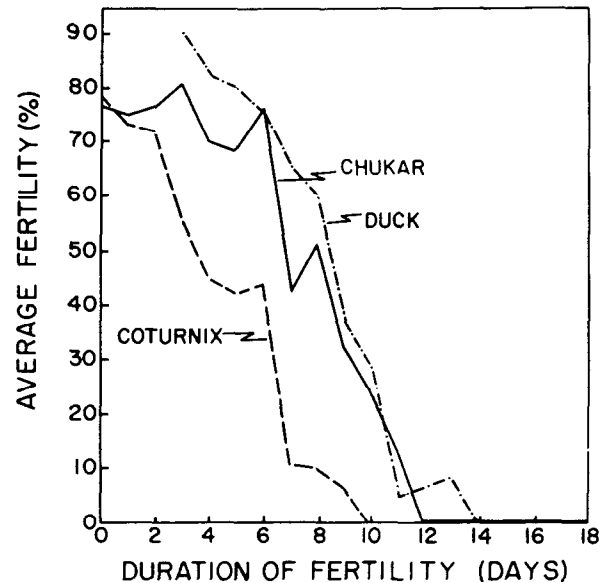


Figure 13. Comparison of duration of fertility following removal of male in 3 different gallinaceous birds.

### Egg Production

Reproduction in the chukar is much the same as in other seasonal layers in that eggs are produced in the spring, when favorable light conditions prevail. It is possible, however, to induce lay in chukars at any time of the year with proper preconditioning with light. In preparation for lay, chukars must receive a period of nonstimulatory light, and by alternating 2 flocks through either stimulatory or nonstimulatory light, it is

possible to have one or the other flock in egg production at all times, irrespective of the season. A lighting scheme used to demonstrate this is shown in figure 14. Experience gained at Davis has shown that egg production from young chukars (35 to 40 weeks old) for the first lay period is always less than for their second cycle of lay (figure 15). The use of artificial light to induce lay has one disadvantage in that it takes the males approximately two weeks longer than females to reach sexual maturity. To avoid this problem, males should be separated from the hens and given stimulatory light two weeks in advance of them.

For egg production, a light intensity of about 5- to 10-foot candle (50 to 100 lux) is adequate. During the "rest" period, under nonstimulatory light (8L:16D), the level of intensity should be about 0.5 foot candle (5 lux). For maximum conditioning during the rest period, the long dark period of the day should never be disrupted by light, even for a brief second.

It was found at the University of California that for birds given light from 4 a.m. to 10 p.m., the peak of production occurs about 8 hours after the onset of light (figure 16). Approximately 50 percent of all eggs are laid between the hours of 9 a.m. and noon, the remainder from 1 to 7 p.m. A late-hour harvest of eggs each day will catch most of the late layers.

There is sufficient evidence to indicate that breeders can be held over for a second year of satisfactory egg production even though cycled through 2 previous lay periods. After 2 years of age, however, other reproductive traits (fertility and hatchability) show a decline. Some producers prefer to hold half of the first-year males as breeders for the next year.

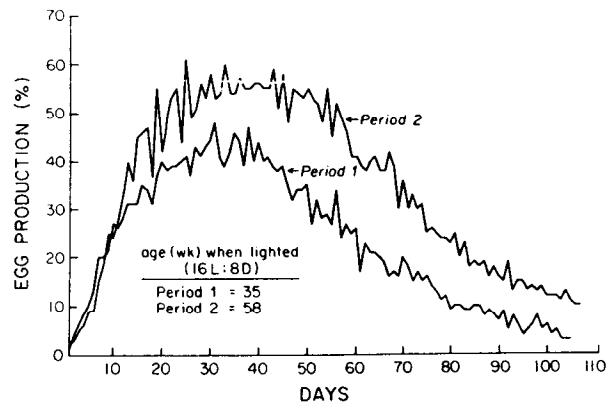


Figure 15. Daily egg production for chukars cycled to lay in 2 periods separated by an 8-week rest period. Data represent the performance of 6 generations of chukars.

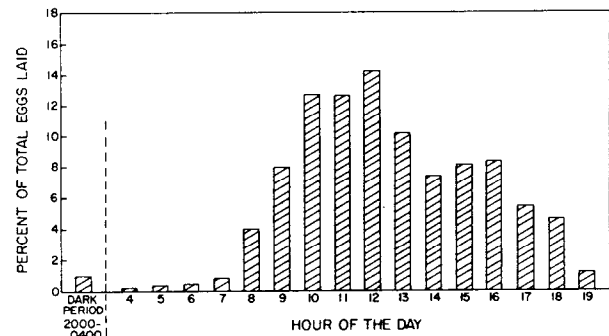


Figure 16. Time of lay for chukars kept in individual cages and maintained under hours light per day. (Light period was from 4 a.m. to 8 p.m.)

### Sanitation

A good disease preventative program is worth the effort to keep equipment and buildings clean and birds isolated from unauthorized traffic. A few sanitation practices to help minimize the occurrence and spread of disease include:

- a. Select healthy vigorous chicks for foundation stock.

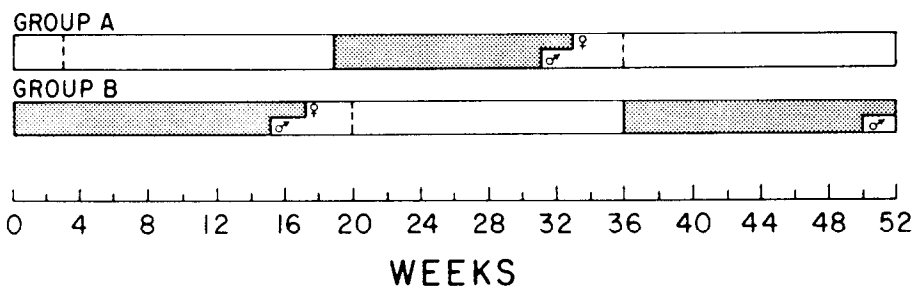


Figure 14. Light schedule for producing eggs continuously, using 2 separate flocks of chukars.

- b. Keep young growing chicks separate from adult birds.
- c. Keep the equipment, buildings and pen environment clean.
- d. Place chicks or adult birds from outside sources in quarantine for at least 30 days before combining them with your own birds.
- e. Never crowd growing chicks or breeder stock. Crowding increases cannibalism, egg breakage, vent picking, and other stress-related problems.
- f. Dispose of dead birds in an incinerator or a deep pit designed for that purpose.
- g. Provide an adequate all-purpose diet for all age groups.
- h. When disease occurs, isolate the pen from others by servicing it last, and take a sampling of sick birds to the nearest diagnostic laboratory.

### Diseases

Some important diseases and pathological agents that have been found in chukars are listed in table 5. In event of an outbreak, early diagnosis and quick treatment of the disease will greatly reduce the spread of the agent and subsequent loss due to mortality.

Information that will greatly benefit the veterinarian in making a correct diagnosis include: age of the birds; number of birds seemingly affected in each pen; description of symptoms seen by the owner; diet of birds; any change in management, and when the symptoms were first noted.

Treatment used should be determined by antibiotic sensitivity testing in a diagnostic laboratory whenever possible. This information can be most rapidly obtained by submitting several birds characteristic of the problem.

Preventive treatment is sometimes advisable; however, unneeded drugs do add substantially to growing expenses and may cause injury themselves.

**TABLE 5. Diseases and Parasites in Chukars**

<i>DISEASES</i>	<i>SYMPTOMS</i>	<i>TREATMENT</i>
<b>Viral</b>		
Newcastle (Avian pneumoencephalitis)	Paralysis, tremors, neck contortions, coughing, near cessation of lay, profuse diarrhea.	No effective treatment. Vaccines available.
Encephalitis	Nervous disorders, depression, paralysis and abnormal postures.	No treatment. Control vectors (wild birds).
Mycoplasma sp. (PPLO)	Respiratory disorders, coughing Sinusitis (swelling of sinuses), moderate drop in egg production.	No effective cure. Tylosin sometimes reduces mortality.
<b>Bacterial</b>		
Salmonellosis ( <i>Salmonella derby</i> )	Acute outbreaks common in young birds. Listlessness, diarrhea, and high mortality during first week of age is characteristic.	Good sanitation; nitrofurazone, and some antibiotics are helpful.
Ulcerative Enteritis	Chronically infected birds are listless; eyes may be partly closed and motionless. Feed consumption is decreased and emaciation rapidly occurs. Generally high mortality in young birds.	Some drugs used include Streptomycin, neomycin and bacitracin.
Chlamydiosis (ornithosis)	Acute infections cause inactivity, respiratory distress, and sometimes a purulent exudate of eye or nose. Mortality high in young stock.	Some antibiotics, including chlorotetracycline, oxytetracycline and tetracycline have been used successfully.

(continued)

**TABLE 5. Diseases and Parasites in Chukars**

<i>DISEASES</i>	<i>SYMPTOMS</i>	<i>TREATMENT</i>
<b>Bacterial</b> ( <i>continued</i> )		
Listeriosis (Circling disease)	Few visual symptoms, may display torticollis, spasms, and other nervous symptoms. Mortality variable.	Antibiotics
<b>Endoparasites</b>		
Crop worm ( <i>Capillaria</i> sp.)	Emaciation, diarrhea, listlessness, anorexia, reduced water consumption.	5 percent Meldane-2 administered in feed.
Gape worm ( <i>Syngamus trachea</i> )	Young birds highly susceptible. Gape worms obstruct the lumen of trachea and cause birds to suffocate.	Barium antimonyl tartrate used as an inhalent. Thiabendazole is effective when administered in feed.
Cecal worm ( <i>Heterakis gallinae</i> )	Gastric disturbances including anorexia, diarrhea, emaciation.	Phenothiazine given in single or repeated doses.
<b>Protozoans</b>		
Coccidiosis ( <i>Eimeria</i> sp.)	Acute outbreaks normally occur during the second to third week of age and can result in high mortality in young stock. Chicks become droopy, have ruffled feathers. Loss of appetite resulting in slow growth.	Many coccidiostats are available. Sulfaquinoxaline is the drug most widely used for control, and amprol to a lesser extent.
Blackhead ( <i>Histomoniasis</i> sp.)	Decreased appetite, watery sulfur-colored droppings and general weakness.	Any of the histomonastats administered in the drinking water or feed.
<b>Ectoparasites</b> —On occasion, some game birds host fleas, lice, and mites. Many commercial pesticides are available for control of ectoparasites.		

\*Consult a veterinarian for correct dosage, route (feed and/or water), and duration.

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