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REPRODUCTIVE EFFICIENCY IN Angora Goats

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SUMMARY

Poor reproductive performance, long a problem of Angora goats under Texas range conditions, was studied to determine the nature of the problem and possible remedies. The basic reproductive phenomena of the Angora goat were re-analyzed. Since Angora goats are sexually active only during the fall seasons, they reach puberty either as kids at 7 to 9 months or 1 year later as yearlings. Only well grown out kids will exhibit sexual activity their first year, and these should not be used for breeding. The estrus cycle is approximately 20 days with an estrus period lasting approximately 1 day. The mean gestation length is 149 days. In most flocks a single kid is born per year, but twin ovulation or twin births may predominate in well-developed does in good condition. Ovulation and birth rate are closely related to weight of the doe at breeding. Birth weights are generally in the range of 5 to 7 pounds, but values above and below this are common. Major causes of loss in reproductive efficiency are failure of the doe to show estrus and ovulate and death loss of the kids produced. Other sources of loss are failure of conception and abortion. A failure to show estrus is explained almost totally by lack of development, which may be corrected by management factors associated with improving the animal's environment. Death losses of kids tend to be associated with low birth weights of kids born of weak, undernourished does, cold stress at kidding or predators. A high percentage of multiple births contributes to increased death loss of the kids, but the overall net reproductive efficiency is generally improved by multiple births. Failure of conception and abortion apparently have complex physiological explanations. Angora males normally act to terminate anestrus in the female. This phenomenon can be used to improve reproductive efficiency by synchronizing mating and kidding in Angora does and also by permitting timing of mating in relation to initiation of estrual cycling.

REPRODUCTIVE EFFICIENCY IN Angora Goats

MAURICE SHELTON AND JACK L. GROFF*

Angora goat production has been an important industry in Texas since the goats were introduced in 1849. Texas normally produces 96 percent of the U.S. mohair supply which represents 60 percent of world production. Numbers of goats have fluctuated widely over the years because of the highly variable mohair prices and the influence of this variability on the demand for replacement animals. The present population (1972) of approximately 1.5 million is the lowest number since 1920. However, favorable mohair prices have rekindled an interest in this industry. At present most of the Angora goats in Texas are in the Edwards Plateau where the industry began. Before losses to predatory animals became so severe and before the mohair market break in 1964, large numbers were also found in other areas such as the Grand Prairie and Cross Timbers (Central and North Central Texas) where they were used to an advantage in land clearing or brush control.

Poor reproductive efficiency has always been a problem. No reliable statistics on the kid crop are available, but values range from a low of 0 to a high of over 100 percent. Although kid crops as high as 100 percent are very rare, those as low as zero are not uncommon in the areas where predation is a problem. The average kid crop weaned is probably in the range of 50 to 60 percent, but the potential is more than 100 percent under favorable conditions.

A high reproductive rate is important because (1) of the sale value of the kids produced, (2) it permits the industry to respond more rapidly to changes in demand for mohair, (3) it facilitates improvement through providing a greater selection differential and (4) it permits improved mohair production (both quantity and quality) through lowering the average age of the flock. As goats become older, both the quantity and quality (fiber diameter) of mohair deteriorates; thus, if the total goat population of the State remains stable, the average age is a direct function of reproductive rate.

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BASIC REPRODUCTIVE PHENOMENA

An understanding of the basic reproductive phenomena of Angora goats is necessary to improvement of reproductive efficiency.

Age of Puberty

Age of puberty is the initial or minimal age at which the animal becomes reproductively active—does start ovulating and are capable of becoming pregnant; males are capable of siring offspring. Angora goats are highly seasonal, and they reach puberty either during their first season at 6 to 8 months or 1 year later at approximately 18 months. Individual well-developed kids will reach sexual maturity their first season. It is not recommended that they be bred or used for breeding their first season. However, to prevent the occasional breeding of doe kids, they should be separated from mature animals during the breeding season. Since kids require or deserve special treatment, they should be managed separately throughout much of the year. Many animals will not breed satisfactorily as yearlings to kid at 2 years, but this failure is more a result of lack of condition and development than of age.

The Breeding Season

Angora goats are seasonally polyestrus; that is, they are seasonal breeders, and the females have re-occurring estrual periods during the season if they are not bred. Angora goats have not been widely studied in this respect, but many other species, including sheep, have been; it seems safe to interpolate across species in this respect. The phenomenon of seasonal breeding is known as photoperiodism, or response to the length of the daylight period, and is found in many plants and animals. In sheep and goats, the number of hours of darkness appears to be the controlling factor. The Angora goat is somewhat unique for domestic animals in that both the males and females are seasonal. The mating season of the male is easily detected by the characteristic odor and rutting activities. The Angora is also unique in that the females do not normally start cycling until they are stimulated by the presence of the male. Later in the season other stimuli can serve this same purpose. Another unique feature is that the female does not first exhibit a silent estrus (ovulation without showing estrus) as do most other ruminants.

Satisfactory results usually can be obtained from matings from the first of September through December. Many individual does will breed as much as 30 days earlier or later than this.

Length of Estrus Cycle

The length of the estrual cycle is reasonably well documented. Typical estrual cycles of individual does are 19, 20 or 21 days. Shelton (1961) found the average cycle length to be 19.5 days, while van Rensburg (1970) suggested a value of 20.6 days. The data on which the 19.5 estimate was obtained are shown in Figure 1. The values 14 to 17 may reflect abnormal cycles; if these are removed, the two estimates are almost identical.

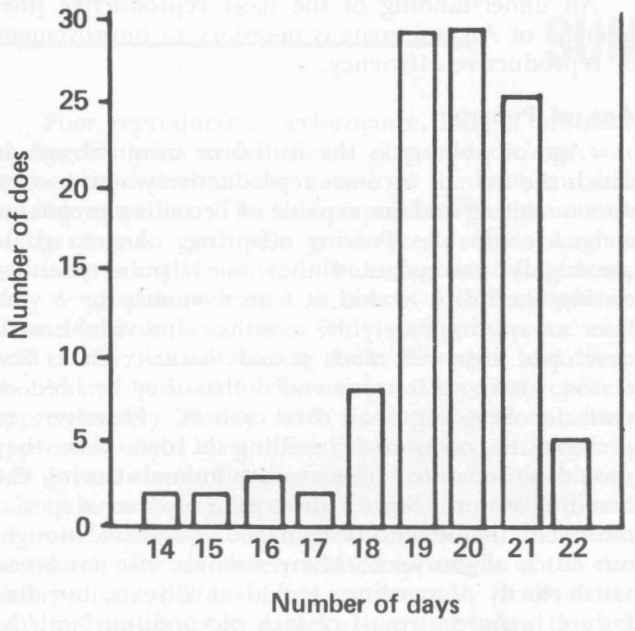

Figure 1. Length of estrus cycle in Angora does.

Length of the Estrus Period

The length of the estrual period has not been extensively studied in Angora does. However, van Rensburg (1970) arrived at an average length of 22.3 hours, which is shorter than in other species such as sheep. Data of this type have not been tabulated in the United States, but observations indicate that many or most of the does will be in estrus for 2 consecutive days. This would be expected in the case of some of the does exhibiting a 22-hour estrus period. The duration and intensity of estrus probably would be somewhat longer at estrual periods subsequent to the first. If van Rensburg's data were based on does bred at the first estrus, this might contribute to an estimate of somewhat shorter period than expected.

Gestation Length

The gestation length of Angora does is well documented with Shelton (1961) reporting an average of 149.2 days (Figure 2) and van Rensburg (1970) reporting 149.4 days. South African researchers reported a range of 143 to 153 days; however, gestation lengths of less than 140 days were deleted and such parturitions were recorded as abortions. Twin kids are normally dropped approximately 1 day earlier than singles.

Ovulation or Kidding Rate

The important contrast in Angora goats is between the nannies that raise one kid and those that raise none, but the potential for twinning is rather

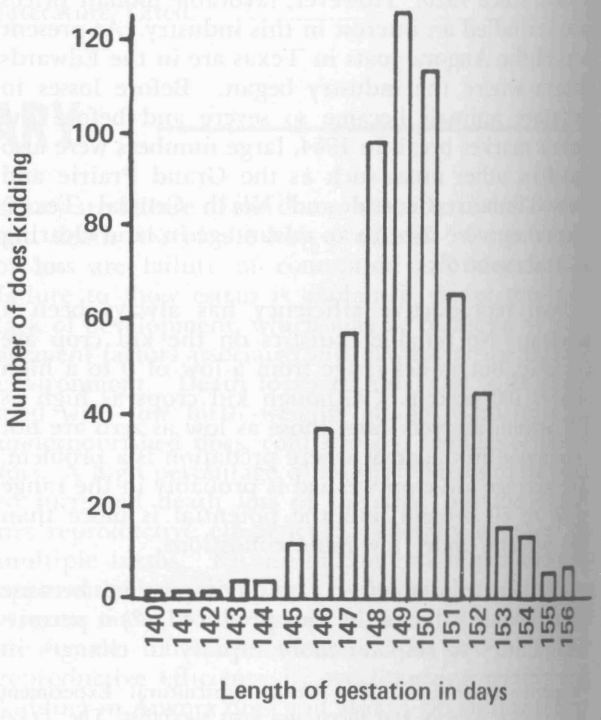

Figure 2. Length of gestation of Angora does based on 600 records.

high. The ovulation rate refers to the number of eggs or ova liberated from the ovary at a given estrus period. Except for the possibility of identical twinning, the ovulation of two eggs or ova is necessary for twin births; but the ovulation of two ova does not insure twin birth as one of the pair may not be fertilized or the resulting zygote may not survive to term. Identical twinning has not been demonstrated or documented with Angora goats; if it occurs, it is of very low frequency. With other species, such as the sheep, ovulation rate is largely determined by breeding (differences between breeds or selection within breeds), season of the year and size or condition. Season of the year is not an important consideration since Angoras normally are not bred outside the fall season. Although the ovulation rate for the various months from September through December has not been studied, observations suggest that this is not an important source of variation.

Size and development of the doe seem to be the major source of variation in ovulation or kidding rate. In a study by Shelton and Stewart (1973), 244 does were slaughtered and the ovulation rate recorded. Of this number, 25 (10.2 percent) had not ovulated, 170 (69.7 percent) had single ovulations and 49 (20.1 percent) had ovulated two eggs. However, the ovulation rate varied greatly between groups of does. The relation of ovulation rate to size is shown in Figure 3. The ovulation rate indicates the potential kidding rate, but in practice the kidding rate always will be somewhat below this potential.

Fetal Development and Birth Weight

In a study of progesterone content of the ovaries (unpublished data, The Texas Agricultural Experiment Station), Angora does were sacrificed at various stages of gestation (30–141 days). Fetal weight and crown-rump length were recorded on 80 embryos. The crown-rump length measurements (body length from the crown of the head to tail setting) are essentially linear (Figure 4). From this relationship, fetal age can be determined—either approximately from the graph (Figure 4) or more accurately by calculation.

Fetal weight is highly correlated with age, but this relationship is curvilinear instead of relatively linear as with fetal length (Figure 4). Actually the increase in fetal weight is geometric in nature, being very similar to the theoretical curve assuming a constant and unlimited rate of cell division. If these values are plotted on log paper, the result is almost a straight line up to approximately 130 days. This shows the relatively small amount of nutrients required for fetal development before about 90 days and during the period of rapid growth from 90 to approximately 130 days. After approximately 130 days, the rate of fetal growth begins to slow or deviate from the theoretical

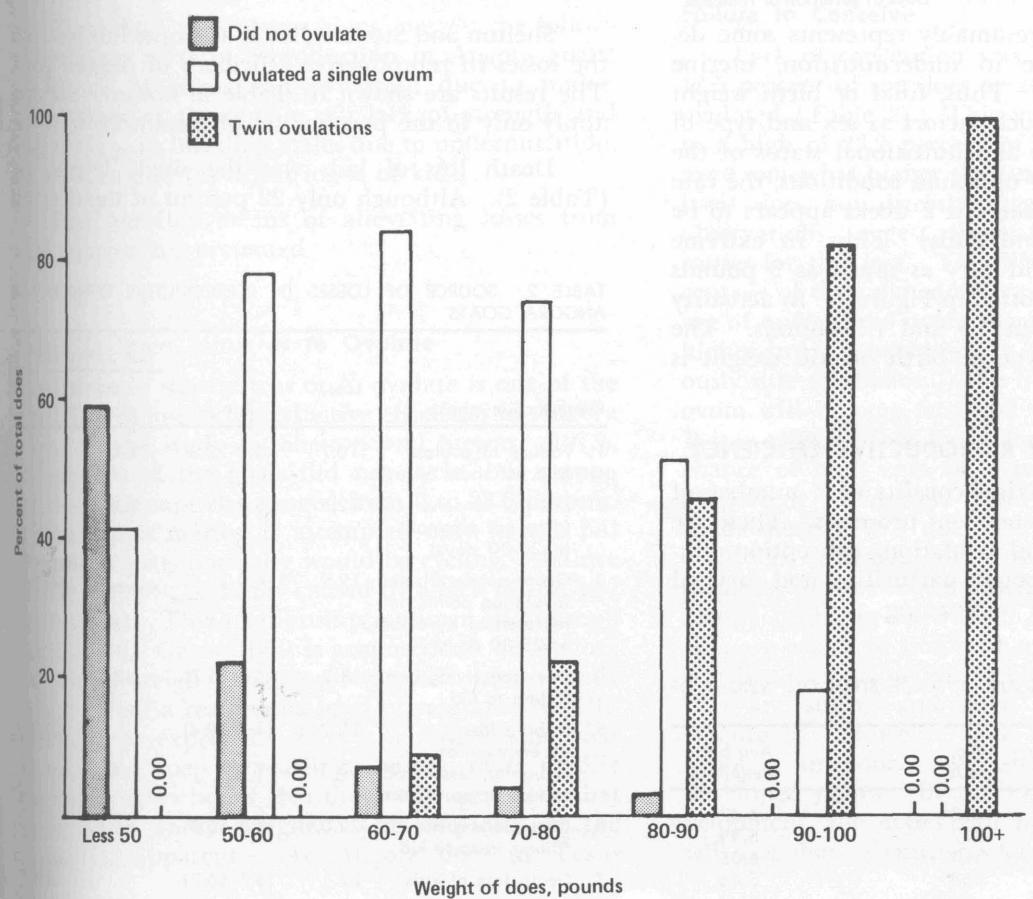

Figure 3. Breeding weight of does in pounds.

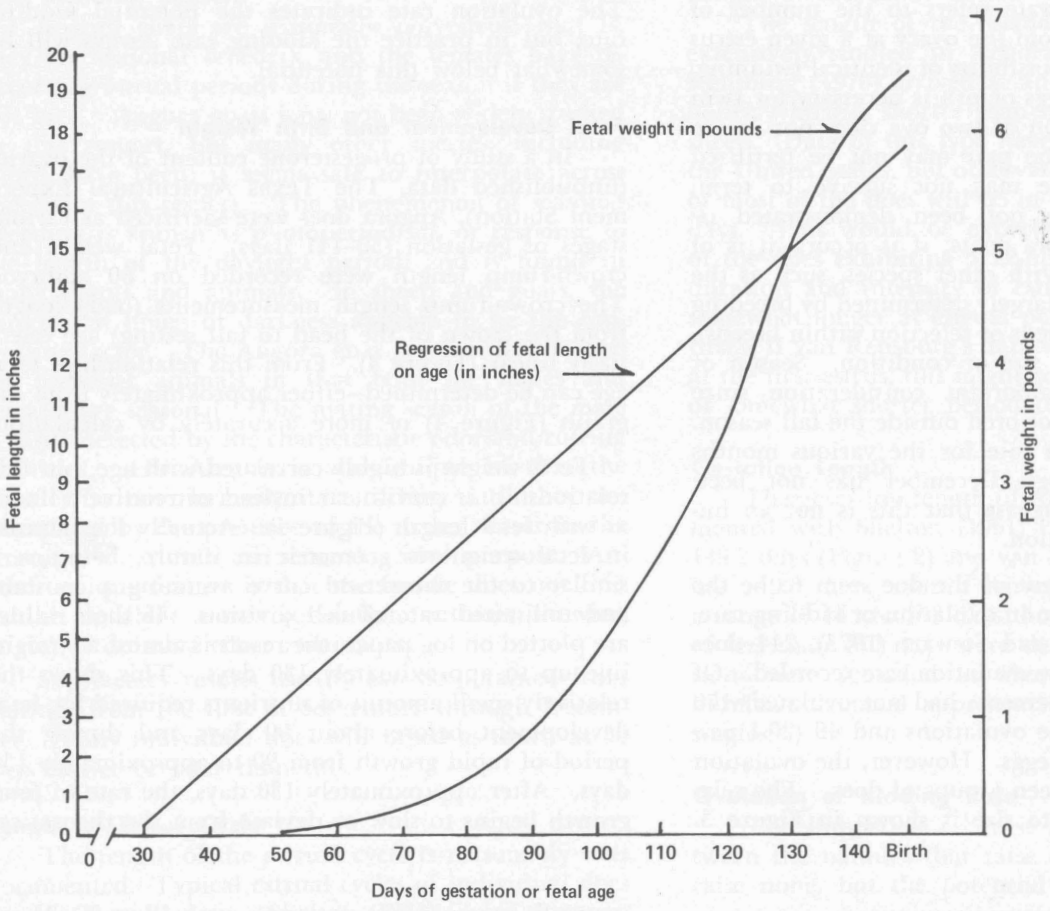

Figure 4. Rate of fetal development. (The age of the fetus or embryo can be calculated with reasonable accuracy by dividing the fetal length (crown-rump length) in inches by .149 and adding 30 to give the age in days.)

growth curve. This presumably represents some degree of limitation due to undernutrition, uterine crowding and so forth. Thus, final or birth weight will be dependent on such factors as sex and type of birth as well as on size and nutritional status of the dam. Under normal or optimum conditions, the rate of fetal growth during the last 2 weeks appears to be approximately 0.1 pound daily. Thus, in extreme cases birth weights could vary as much as 3 pounds below the 6.5 pounds plotted in Figure 4. In actuality most kids weigh between 4.5 and 7.5 pounds. The influence of sex and type of birth on kid weight is shown in Table 1.

SOURCES OF LOSS IN REPRODUCTIVE EFFICIENCY

Successful reproduction consists of a number of discrete and largely independent processes. These are occurrence of estrus and ovulation, conception, embryo survival to and through parturition and survival of kid from parturition to weaning.

TABLE 1. INFLUENCE OF SEX AND TYPE OF BIRTH ON WEIGHT OF KIDS

Sex and type of birth	No. kids	Avg birth weight, lb.
Single male	413	6.47
Single female	347	5.99
Twin male	350	6.05
Twin female	368	5.46

Shelton and Stewart (1973) attempted to partition the losses in reproductive efficiency of Angora goats. The results are shown in Table 2; however the data apply only to the peculiar set of conditions involved.

Death loss of kids was the single largest loss (Table 2). Although only 22 percent of the does lost

TABLE 2. SOURCE OF LOSSES IN REPRODUCTIVE EFFICIENCY IN ANGORA GOATS

Reproductive phase	Loss, %	Range	Cumulative loss, % Per doe	Cumulative loss, % Per ovulation site
1. Failure to ovulate (did not show estrus)	10.7	0.0-28.6	10.7	
2. Did not conceive (does not pregnant at 25-30 days)	12.5	5.9-23.2	23.2	
3. Ovum not fertilized (ovulation points not represented by embryo at 25-30 days)	19.9	(14.0-25.0)		19.9
4. Does conceiving but failing to kid	8.9	(0.20-16.7)	32.1	
5. Embryo loss (% embryos at slaughter, less number of kids at parturition)	12.2	(4.5-29.4)		32.1
6. Does kidding but failing to raise kid	22.0	(4.3-50.0)	54.1	
7. Death loss of kids	32.1	(3.7-66.7)		64.2

their kids, 32.1 percent of the kids were lost. This indicates a heavier death loss among twins than singles. The major causes of losses in Angora kids were predators, damaged udders of does and general weakness in twin born kids. However, two of the major causes of losses (predation and the large number of twin kids) may be unique to the particular conditions of this study. Most of these data were collected on does kidded in confinement, but no effort was made to assist or artificially rear kids. Kidding in confinement does not automatically reduce death losses except in those cases where shelter from inclement weather is provided.

Although the combined data indicate death losses of kids to be the major problem, this was not true of every group of nannies. Thus, in individual flocks other phases in the reproductive process may be the major points of loss.

Abortion, as indicated by losses from 30 days to kidding, was the least important sources of loss (8.9 percent of the does). However, major losses from abortion tend to occur as abortion storms or outbreaks which are sporadic in nature; such were not encountered in any of the experimental groups in this study. Thus, abortion should not be ruled out as a source of loss in reproductive efficiency. It is possible that the abortion syndrome is represented in part of the losses noted as failure of fertilization or conception. Some nannies that abort habitually show reoccurring but irregular heat periods.

These data, plus observations, suggest the following problem areas in reproduction in Angora goats: (1) Failure of estrus and ovulation due to underdevelopment of the female, (2) lack of strength and mating vigor in breeding males due to undernutrition, (3) abortion and (4) death losses of kids.

Some possible means of alleviating losses from these sources are presented.

Failure to Show Estrus or to Ovulate

Failure to show estrus or to ovulate is one of the four causes of loss in reproductive efficiency in Angora goats. In the study by Shelton and Stewart (1973), 10.7 percent of the goats did not cycle, but among the various groups this ranged from 0 to 28.6 percent. Assuming that mating is attempted only in the fall when these goats normally would be cycling, a failure to cycle is almost certainly caused by a lack of size and development. This relationship is shown in Figure 3 and Table 3. Generally it is assumed that an Angora doe should weigh at least 65 pounds (shorn body weight) before a reasonable level of reproductive efficiency can be expected. This is modified somewhat by age of the doe. A yearling doe will more readily breed at weights below this than will aged does that are seriously under weight. The enormity of the problem is apparent—more Angora does in Texas weigh below 65 pounds than above. The solution is difficult. The high level of mohair production of the Angora goat ensures that this animal is almost always in nutritional stress under typical range conditions (the nutritive requirements of Angora goats have been reviewed by Huston, Shelton and Ellis, 1971). Management practices which contribute to better development are proper stocking rate and other range management practices, parasite control and supplemental feeding. If optimizing these practices fails to result in an adequate level of reproduction, it may be necessary to relax somewhat the selection for extreme mohair cover or fleece weight. Perhaps the best way to accomplish this is to select for the animal which performs well under the conditions in which the animals are to be maintained.

TABLE 3. INFLUENCE OF BREEDING WEIGHT ON NUMBER OF KIDS BORN AND RAISED IN TWO RESEARCH FLOCKS

Weight range (shorn body wt at breeding)	Sonora data		McGregor data	
	% kids dropped	% kids raised	% kids dropped	% kids raised
Below 60 lb.	52.2	47.4	76.5	58.8
60 - 70	83.8	78.7	101.9	62.1
70 - 80	91.6	85.2	117.3	81.2
80 - 90	88.9	81.0	143.2	114.8
90 - 100	96.2	88.7	147.4	116.8
Over 100			115.4	113.8
Summary	74.7	69.1	128.1	94.6

Failure to Conceive

Lack of conception was implicated in failure of 12.5 percent of the does or 19.9 percent of the ovum ovulated (Table 2). This varied from a low of 5.9 to a high of 23.2 percent of the does. These values were somewhat higher than expected, and the research itself does not directly suggest the reason. Other observations suggest three factors as the primary causes for this loss. The difference between the percentage of does that do not conceive and the percentage of unfertilized ovum suggests that the loss is much higher in twin ovulations. A portion of this is obviously due to chance. The likelihood that any given ovum will become fertilized is less than 100 percent. If it is assumed that the chance is 80 percent, then the chance of both eggs of a twin ovulation would be 64 percent. However, if only one egg becomes fertilized, the doe will not return to estrus in the next cycle. In twin ovulations, there may be considerable disparity in the time at which ovulations occur. Other factors probably contributing to a failure of conception are a lack of libido or mating vigor of the male. Sterility is not a major problem among Angora males that are strong and have sufficient mating vigor (Figure 5). However, lack of strength is a distinct problem in poorly nourished, unthrifty or underdeveloped males. In the extreme cases of poor development, the males will not be sexually active or will not show a rutting season. Some apparent cases

Figure 5. Strong, well-developed males at breeding time are a necessity. Ideally these should be the type of goat that can maintain itself in strong condition under actual production conditions without excessive supplemental feeding.

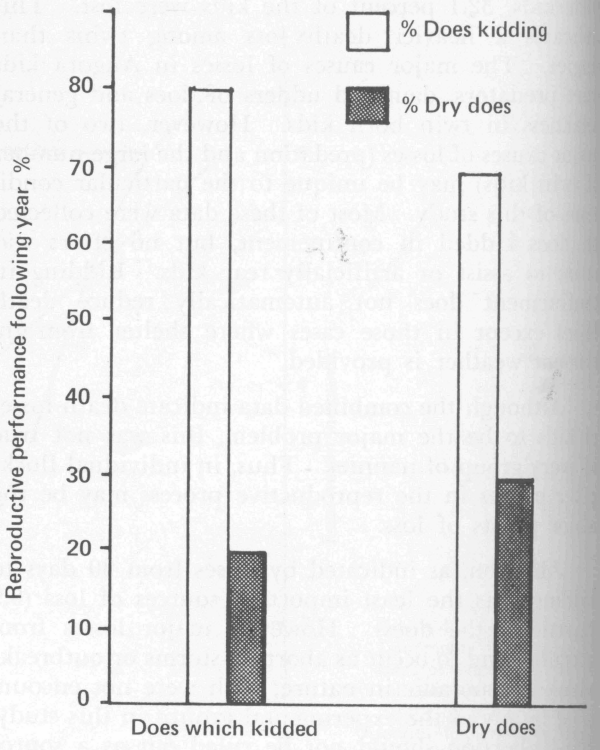

Figure 6. The relation of one dry season to breeding performance the following year.

of failure of conception may be attributed to an early expression of the abortion syndrome.

Where numbers permit, culling of dry does is indicated (Figure 6). Culling of dry does will usually improve kid production in subsequent seasons. However, in times of favorable mohair prices, it may be desirable to keep these does because the value of the hair produced may more than make up for the generally small difference in kid production. The choice of culling or keeping dry does provides one means of adjusting numbers in response to mohair prices.

Abortion

Although not true in the reported data, abortion is an important source of loss in reproductive efficiency in Angora goats. Losses which may be related to the abortion phenomenon may occur in three forms. The most important of these occurs as abortion storms in which a large number or a high percentage of the does abort within a few weeks. The majority of these losses occur in close proximity to 3½ months of gestation. Abortion in range Angora goats occurs infrequently, but the presence of aborters in the flock can be ascertained from observing blood-stained hair on the tail or around the vagina. Its presence is almost a sure sign that abortion has occurred. However, it is important that blood stains be distinguished from urine or fecal stains. Most producers will experience some losses from abortion, but in most flocks this loss is small except in so-called abortion storms.

In the experimental flocks owned by The Texas Agricultural Experiment Station, known abortion losses normally run 0 to 3 percent, but in one season abortion losses amounted to approximately 16 percent. In one problem flock annual losses of 16 percent were incurred over a period of years, and losses much higher than this have occurred in problem flocks in some years. South African mohair producers have apparently suffered even more serious losses. Van Heerdon (1964) reports losses as high as 60 percent. A second form of loss is a low incidence of repeat aborters in which the same doe aborts year after year. Although normally of low incidence, the number could build up to become an important source of loss if these does are not identified and removed. The third expression of this problem is a number of dry does that seemingly have adequate size and development to have bred. These does either fail to conceive or lose the embryo very early after conception. Any large mature or aged doe which does not kid should be considered a suspect. Except as explained by small size or stress, the level of abortion is likely to increase with increasing age of doe.

Cause of Abortion

Attempts to explain abortion in Angora goats have had only limited success. Infectious agents are not thought to be a primary cause of abortion, but future research may prove this to be in error. The most definitive study of abortion is that reported by van Rensburg (1970), but his work was largely concerned with repeat or habitual aborters, whereas the

major loss in the United States is from the sporadic losses. The causes of these appear to differ somewhat according to the actual time in which abortion occurs, but the basic defect of the goat is probably the same for both.

The only consistent difference noted between the normal and aborting goat is the size of the adrenal glands or adrenal steroid production. Since the adrenal gland plays a significant part in initiating a normal parturition, an altered adrenal status as a cause appears to provide a workable hypothesis for abortion in goats. A high cortisol level inhibits hair growth, and van Rensburg postulates that in breeding for the extremely high level of hair production, man has selected for a relatively low level of adrenal function. South African goats which as a group have a high abortion history have smaller adrenals than Texas Angoras (van Rensburg, 1970).

A normal functional adrenal is necessary to maintain pregnancy, and abortion in goats is preceded by a precipitous decline in cortisol levels in the blood, which can be considered to be adrenal fatigue. Actual parturition is normally kept in check by the secretion of cortisol by the maternal organism. Thus, in the absence of a high level of maternal adrenal function, the fetal adrenal increases its output of cortisol, and premature parturition occurs. In Texas most abortion problems center around precipitous outbreaks at around 3½ months of gestation. This initial abortion is largely limited to does of small size, to stress situations or to a combination of these (unpublished data).

Protein deprivation also can bring about an increase in abortion. Although no detailed observations of adrenal function have been made in the United States, general observations are not inconsistent with a theory of abnormal adrenal status. Any type of stress situation would be expected to compound adrenal insufficiency. Protein deficiency results in a decrease in adrenal size or decreased adrenocortical activity. The time in which most abortions occur coincides with the stage of rapid fetal development. High mohair producing goats are almost always deficient in protein; this is particularly true in late gestation (Figure 7). Thus, many very small goats will abort at this time even in the absence of specific stress (Figure 8), but abortion among others likely will occur only if they are subjected to stress at this critical stage. One of the most common forms of stress is feed deprivation brought on by factors such as movement of the flock or snow or ice cover. Abortion outbreaks will occur a few days following these stress periods and not at the actual time of stress.

Several attempts have been made to study flushing of Angora goats. These studies have generally shown that it is possible through feeding at breeding to get several small does to breed that would not otherwise do so, but unless this superior care is continued throughout gestation, many of these does will fail to raise a kid either through abortion or loss of the kid at or subsequent to parturition.

In a broad sense, abortion in Angora goats is inherited since this animal aborts, whereas other types of goats do not have this tendency to any significant degree. However, there is no evidence that any specific gene or genes, independent of other important traits, contribute to this problem. Evidence suggests that genetic selection for a high level of mohair production has altered the metabolic priorities to the extent that

Figure 7. Supplemental feeding at critical times may mean the difference between a good kid crop and a failure. For good reproductive performance, the most critical period is from approximately 100 days of gestation through kidding.

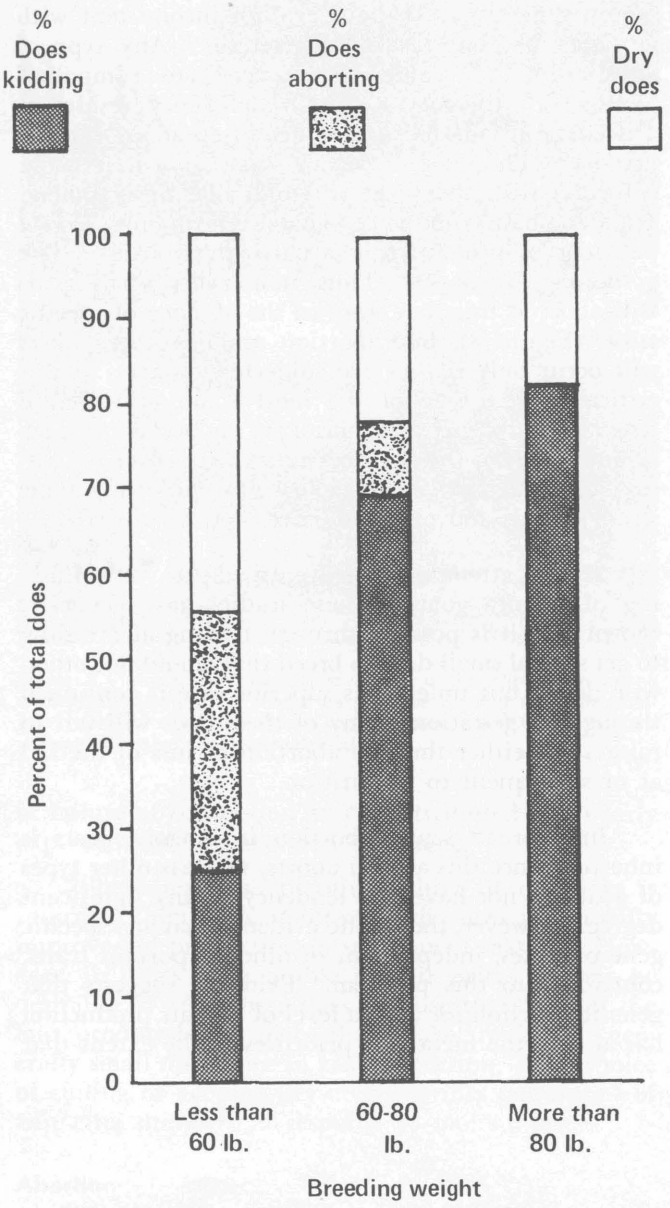

Figure 8. Reproductive performance of 218 does in the experimental flock for the 1969 kidding season. Fifty-six percent of the does that mated in the below-60-pound weight class aborted as compared to 11.5 percent for those weighing 60 to 80 pounds and 0.0 percent for those weighing above 80 pounds.

fiber production takes precedence over other body functions, including reproduction. Abortion is only one expression of this phenomenon, and altered adrenal status, if such is the explanation, is merely the physiological means by which this is accomplished.

As support for the theory of altered metabolic priorities, only relatively high-producing or well-covered goats show a marked tendency to abort, and those that subsequently do abort generally will be found to have been heavier producers early in life. This situation presents a paradox for the breeder in that it suggests selection for reduced hair production as the solution, but it would be difficult to justify this approach. A preferable situation is that in which metabolic priorities are such that the animals produce mohair to their maximum capability when nutrients are available but do not sacrifice reproduction or their own survival for this purpose. Indications are that individual animals do meet these specifications. Thus, selection for desirable mohair traits still appears to be indicated, but breeding males should be kept from only those does that have good reproductive history. This approach would require some kind of record system which many producers will be unwilling to maintain. The next alternative is to select strong, vigorous males that have been raised under actual production conditions. This should go a long way toward eliminating abortion as a serious problem.

Recommendations to Reduce or Prevent Abortion Losses

1. Select as breeding stock, especially males, only those animals that remain strong and vigorous under the actual conditions in which the flock is to be maintained.

2. Do not breed young and underdeveloped females unless feed conditions are likely to support good growth and development to kidding. The alternative to this may be to initiate an abortion history which will be continued throughout the life of the doe.

3. Prevent any undue stress, particularly nutritional stress, after about the third month of pregnancy.

4. Identify and sell or remove to a separate flock any does that abort. In no case should a breeding male be kept from a doe with an abortion history. Ideally does which abort should be culled as there is a tendency for abortion to become repetitive. In times of favorable mohair prices, these does might be kept for mohair production, but preferably they should be maintained in a separate pasture from which all offspring are sold (Figure 9).

5. Large, well-developed does that fail to kid should be considered as potential early aborters and removed from the flock.

DEATH LOSS OF KIDS

Data indicate that death loss of kids is the single most important source of loss (Table 2). In this study 22 percent of the does lost their kid or kids. Although these data were collected under a specific set of conditions not likely to be duplicated in practice, these losses probably represent a major source of loss under all except the very best of conditions.

Two of the major sources of loss are predatory animals and cold stress. Closely following these are weak kids, poor mothering and bad udders on the does (Figure 10).

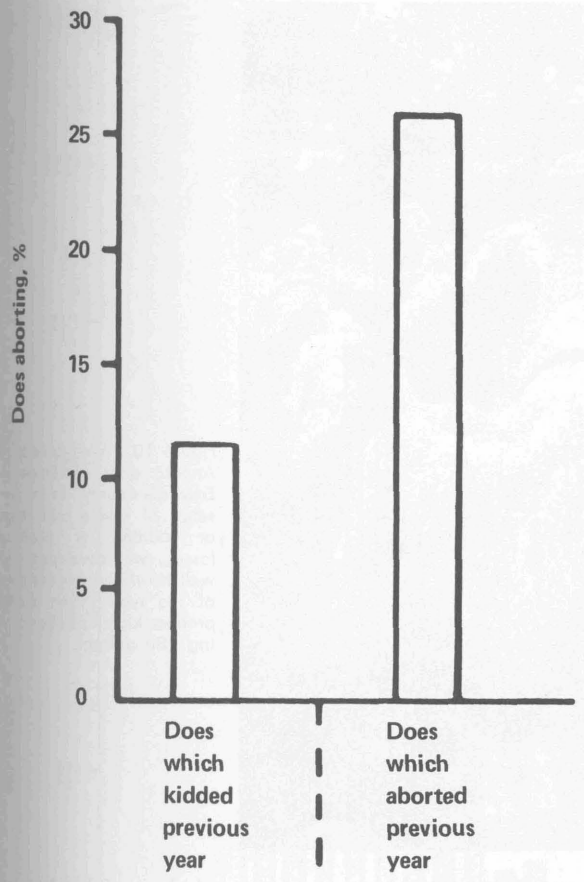

Figure 9. Influence of previous history on abortion rate in Angora does. (These data were taken from a flock which had an abortion history. In 1 year the aborting and kidding does were identified. The following year the overall abortion rate was 16.1 percent. The does that kidded the previous year had an abortion rate of 12.3 percent, whereas those which aborted the previous year suffered an abortion rate of 26.5 percent. Van Heerdon [1964] reported that culling against aborters in 10 flocks for a period of 5 years reduced the abortion rate by as much as 80 percent.)

Predators

Angora kids are among the most susceptible to predation, as they may be killed by both small and large carnivores, as well as by certain flesh-eating birds. There seem to be only two avenues of preventing this predation—either removal of the predator or protection of the kids. If the kids are afforded protection for the first few days, they usually can resist attacks by the small predators such as raccoons, foxes or vultures. However, the larger predators such as the bobcat or coyote will continue to kill, with the latter readily taking adult animals. For this reason removal of the offending predator appears to be the only alternative.

Cold Stress

Chill or cold stress is doubtless a major source of loss among does kidding on the range. Choice of kidding date or provision of some protection are suggested approaches to eliminating this problem. Protection may consist of shelter or a pasture with substantial natural protection for kidding. As the season advances, the likelihood of kids being lost due to cold stress decreases, but the likelihood of getting wind or moisture or combinations of these increases as the season advances through April. However, a combination of all three variables within any given 24-hour period seldom occurs after March 1.

Birth Weight

Underlying all causes of death losses of kids is the problem of birth weight and vigor of the kids (Figure 11). Factors affecting birth weight are primarily size of the doe and nutrition during late gestation. In cases of critical need, such as a pregnant doe subsisting on dry or cured forage, the addition of supplemental protein usually will provide a good response in birth weight and kid survival. When green forage is available to the doe, protein need should not be limiting.

OPPORTUNITIES TO EXTEND KID CROP

Producers who can devote time and effort to their flock probably can increase the kid crop well above the level most would consider acceptable. Some human effort would be required, and whether this would be profitable would be dependent on the available labor supply and the value of the kids produced. At times when surplus kids are selling at or near their meat value, few people would find it profitable to devote additional effort to saving the kid crop; however, when mohair is selling well and surplus goats are in demand, this may well be a good investment of producer's time.

Death loss of kids is probably the single largest source of loss in reproductive efficiency, and cold stress, predators, weak kids and poor mothering are the primary reasons for this loss. All can be overcome to some degree by supervised or confinement kidding. The phenomenon of male goats acting to terminate anestrus in the female at the start of the breeding season can be used to synchronize kidding in which as much as 75 percent of the does will kid within a 5-day period (Figure 12). Thus, the intense labor requirements for supervised kidding may require only a very short time. Generally this may be made to coincide with the period immediately after shearing when protection of the does from cold stress is needed. Consequently, a few days of close supervision may help to solve two of the goat producer's most serious problems. The primary requirements are a limited amount of barn and shed space and provision of the labor required (Figure 13).

Management Routine

Does should be sheared approximately 2 weeks before the start of kidding. Until kidding starts, the

Figure 10. Well-developed Angora does on range in Edwards County. In the absence of severe cold stress at kidding or predator losses, well-developed and well-nourished Angora does of the type shown should produce kid crops approaching 100 percent.

does should be run in a small trap and brought into the barn as needed to provide feed and protection and to get the nannies acquainted with the management routine. Shearing a short time before kidding allows the does to grow some mohair cover and eliminates handling closer to expected date of kidding as this will usually trigger a number of parturitions. A heavy lactating doe grows very little mohair for a time after kidding.

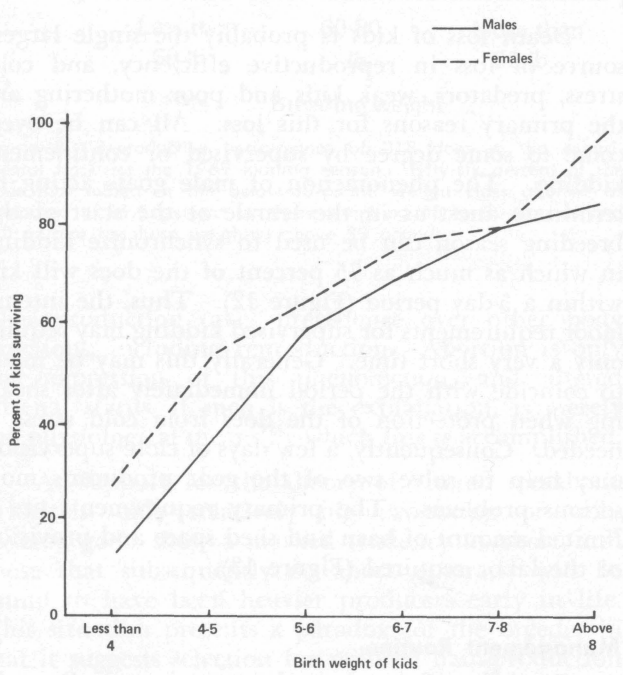

Figure 11. Relation of birth weight and sex to survival of Angora kids.

During the approximately 5-day period when most of the kids are dropped, the does should be observed almost constantly. About 200 does in one group are the maximum that can be managed in this manner, since in synchronized kidding a larger number of kids will be dropped within a short period of time. This will contribute to mismothering through errors in pairing by both the handlers and the does themselves. As kidding occurs, the does and their kids should be moved to confinement quarters until it can be determined that all is well; following this they may go with a larger group. After the intense period of kidding is over, the does and their kids may be turned to pasture, subject to the problems of freeze losses. Generally it is advisable to turn all does to pasture after the period of synchronized kidding is over because the remainder of the kids will be dropped over a long period of time.

For male synchronization to occur, several conditions must be met. The first is that it must be during the breeding season; that is, September or later. The degree of synchronization will be greater if it is early in the breeding season as many of the females will eventually start cycling in the absence of males. The second condition is that the does must have been maintained completely separate from the males, at

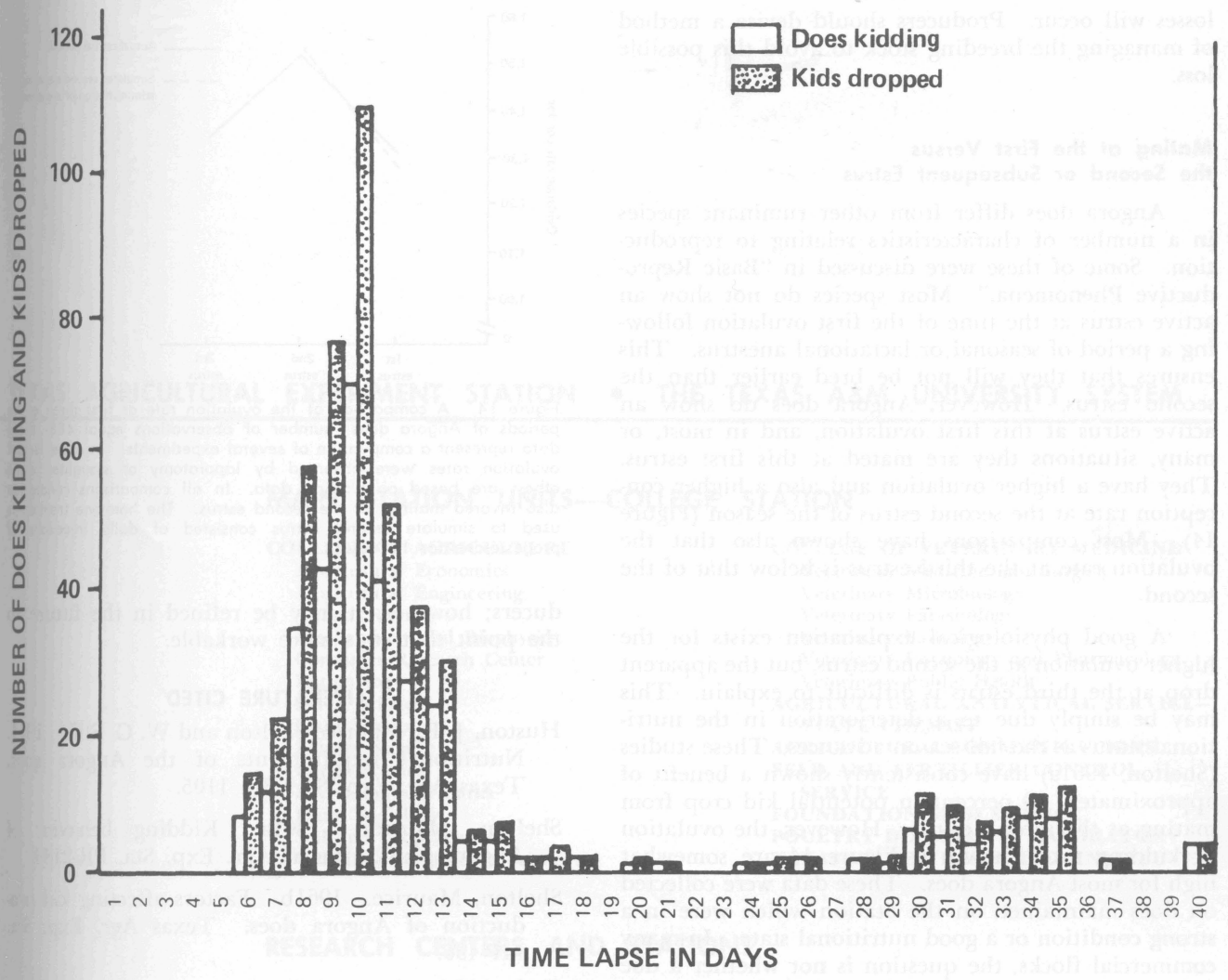

Figure 12. Distribution of birth for 497 kids (1956-58 kid crops combined) from The Texas Agricultural Experiment Station, McGregor.

least since the rutting season started. This includes separation by some distance since males on the other side of the fense will result in initiation of cycling in most does. The third condition for occurrence of a high degree of synchronization is that the does be in healthy vigorous condition.

After an adequate number of active males are placed with the does, the majority will show estrus on approximately the eighth day. Thus, a peak of kidding should occur at approximately 158 days after the males were introduced. The occurrence of estrus will occur largely within a 3-day period, but kidding will be more dispersed because of variation in the length of gestation. The concentrated period of kidding will usually last at least 5 days. Producers should be aware of this phenomenon of synchronization even though they do not intend to utilize it in a supervised kidding program. Synchronization often will occur even when no effort is made to bring it about. This may be undesirable because if unfavorable weather occurs at the critical time, heavy kid

Figure 13. Kidding in the lot with kidding boxes. The doe's identification number is paint-branded on the side. This method of providing the young kid with some protection was practiced in early years but is not widely practiced at present because of the labor requirement. However, the potential for synchronization of kidding suggests that producers might reconsider the possibility of providing supervision and protection at kidding.

losses will occur. Producers should devise a method of managing the breeding stock to avoid this possible loss.

Mating at the First Versus the Second or Subsequent Estrus

Angora does differ from other ruminant species in a number of characteristics relating to reproduction. Some of these were discussed in "Basic Reproductive Phenomena." Most species do not show an active estrus at the time of the first ovulation following a period of seasonal or lactational anestrus. This ensures that they will not be bred earlier than the second estrus. However, Angora does do show an active estrus at this first ovulation, and in most, or many, situations they are mated at this first estrus. They have a higher ovulation and also a higher conception rate at the second estrus of the season (Figure 14). Most comparisons have shown also that the ovulation rate at the third estrus is below that of the second.

A good physiological explanation exists for the higher ovulation at the second estrus, but the apparent drop at the third estrus is difficult to explain. This may be simply due to a deterioration in the nutritional status as the fall season advances. These studies (Shelton, 1961a) have consistently shown a benefit of approximately 20 percent in potential kid crop from mating at the second estrus. However, the ovulation or kidding rates shown in Figure 14 are somewhat high for most Angora does. These data were collected on does maintained on the Station which were in a strong condition or a good nutritional state. In many commercial flocks, the question is not whether a doe will raise one or two kids, but none as compared to one. Field trials under these conditions generally have not shown a benefit from attempting to breed at the second estrus, but this practice should be considered for flocks in strong condition. The mating of does at the second estrus may be brought about by exposing them for at least 10 days to a sterile male (vasectomized, epididymectomized or ridgling males may be used) followed by fertile males. The same phenomenon may be simulated by exposing the does to progesterone before the introduction of males. The expense and difficulty of this practice suggest that it will not be widely used by commercial producers; however, it may be refined in the future to the point that it is more workable.

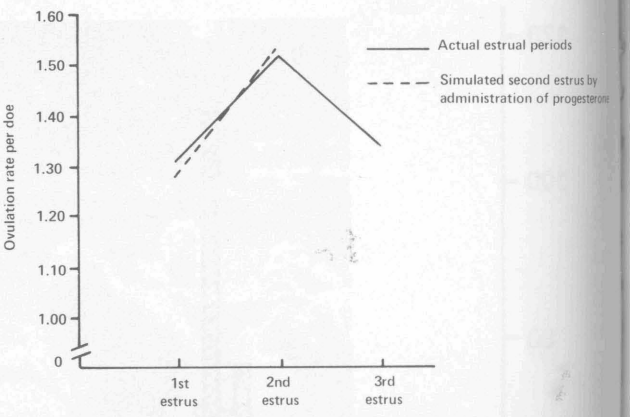

Figure 14. A comparison of the ovulation rate at first three estrus periods of Angora does (number of observations equal 488; these data represent a compilation of several experiments. In some, actual ovulation rates were observed by laporatomy or slaughter while others are based on kidding data. In all comparisons conception also favored matings at the second estrus. The hormone treatments used to simulate second estrus consisted of daily injections of progesterone for 10 days).

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