B-1485
November 1984

Improving Reproductive Efficiency In Angora Goats

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Improving Reproductive Efficiency In Angora Goats

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Cover photo: Well-developed Angora does and kids. In the absence of severe cold stress at kidding, or predator losses, well-developed and well-nourished Angora does of the type shown have the potential to produce kid crops approaching 100 percent. Note guard dogs in foreground.

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SUMMARY

Angora goat production has been an important industry in Texas, dating soon after this type of goat was introduced in 1849. Currently, Texas supplies more than 90% of U.S. mohair, representing approximately one-fourth of the total world production. The Angora goat population in Texas has fluctuated widely over the years because of highly variable mohair prices and the demand for replacement animals. Favorable mohair prices in recent years have rekindled an interest in this industry, but low reproductive efficiency has limited the ability of the industry to respond with increased numbers. Low reproductive efficiency frequently is a problem with the Angora. The Angora has a high genetic potential and thus metabolic potential for fiber production. Thus, under most conditions, especially those of limited nutrition, mohair production occurs at the expense of body development and reproductive efficiency.

This report summarizes research results and observations with Angora goats with the goal of helping producers implement an effective flock management program to improve kid crops. Basic reproductive phenomena are reviewed as background to understand the stages in which reproductive inefficiencies and kid losses can occur. Data reported or discussed include breeding season, duration of estrus, length of estrous cycle, gestation length, and factors affecting ovulation, conception, and kidding rates. Management practices are suggested to minimize abortion and death losses of kids.

KEYWORDS: Goats/Angora/reproduction/mohair/management

INTRODUCTION

Angora goat production has been an important industry in Texas dating soon after this type of goat was introduced in 1849. Currently, Texas supplies more than 90% of U.S. mohair, representing approximately one-fourth of the total world production. Other major producing countries are South Africa and Turkey, with Lesotho, the U.S.S.R., Australia, and Argentina contributing significant amounts of mohair. The Angora goat population in Texas has fluctuated widely over the years because of highly variable mohair prices that influence the demand for replacement animals. The present population (1981) of approximately 1.25 million is the lowest number since 1920 (see Fig. 1). Favorable mohair prices in recent years have rekindled an interest in this industry, but low reproductive efficiency has limited the ability of the industry to respond with increased numbers. At present, most of the Angora goats in Texas are in the Edwards Plateau. In earlier times, significant numbers were found in the Grand Prairie and Cross Timbers areas of Central and North Texas.

Poor reproductive efficiency has long been a problem with the Angora. This problem has intensified in recent decades due, in part, to a reduced labor supply to care for breeding flocks. In addition, the Angora's genetic potential for increasing fiber output tends to improve mohair production at the expense of body development and reproductive efficiency (assuming a constant feed supply or forage quality). Thus, in order to maintain a high level of reproduction, producers must use management practices which circumvent or correct for this inequity. Techniques to improve kid crops are available, but involve some increase in cost through reduced stocking rate, increased labor input, increased supplemental feed, or improved predator control. The producer's challenge is to weigh implementation of these practices against the anticipated economic response. Mohair prices most certainly will influence demand for replacement kids.

The average kid crop weaned in Texas is estimated at 50 to 60% (authors' estimate). Although kid crops as high as 100% are rare, the potential to equal or exceed this value is real under favorable conditions. Values as low as 0% are also rare except under conditions of high predation losses, but kid crops may approach this minimum when the doe flock is in poor condition and when abortion or death loss of kids are excessive.

A high reproductive rate (1) increases the sale value of kids produced, (2) permits the industry to respond more to changes in demand for mohair, (3) facilitates genetic improvement by providing a greater selection differential, and (4) 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 the reproductive rate.

BASIC REPRODUCTIVE PHENOMENA

An understanding of the basic reproductive phenomena of Angora goats is necessary to carry on an efficient management program.

Age of Puberty

Age of puberty is the initial or minimum age at which the animal becomes reproductively active, i.e., does ovulate and are capable of becoming pregnant; males are capable of siring offspring. Angora goats are highly seasonal, with matings occurring only in the fall and winter. As a result, 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. If a producer wishes to push the kids, it may be possible to get kids out of them their first year, but this practice is not recommended under commercial conditions. To prevent the occasional breeding of doe kids, the two sexes should be separated during the breeding season. Since kids require 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.

Breeding Season

Angora females are seasonally polyestrous; that is, they have recurring 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, and it

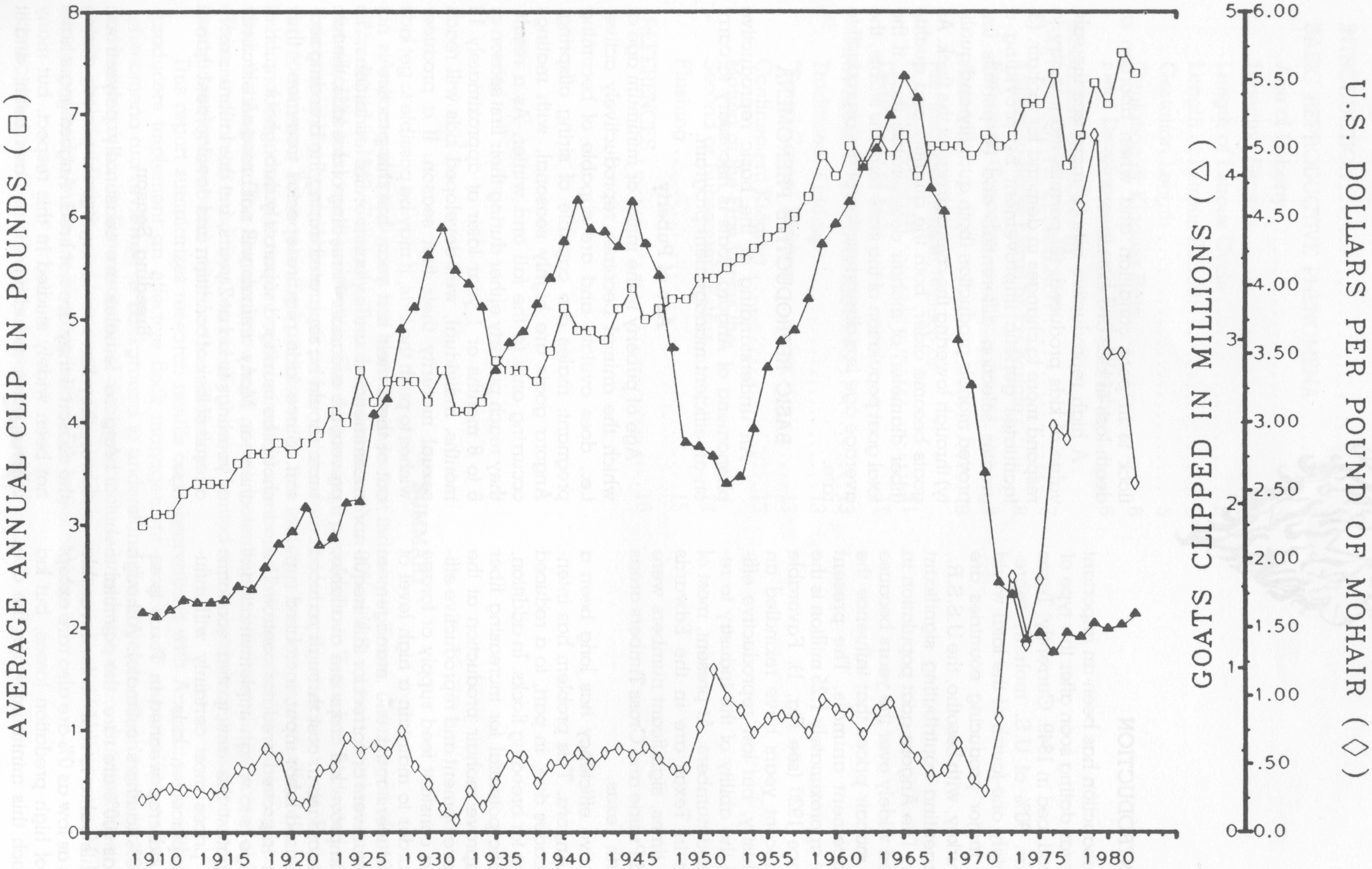

Figure 1. Trends in numbers, average clip, and prices received for mohair in Texas for the years 1909 - 1982. *Source: Mohair Council of America.*

seems safe to interpolate across species. 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. The Angora goat is unique among domestic animals in that both males and females are seasonal. The mating season of males is easily detected by their characteristic odor and rutting behavior. The Angora is also somewhat unique in that females do not normally start cycling untl they are stimulated by the presence of the male. Later in the season other stimuli can serve this purpose.

Kids can be obtained from matings carried out as early as late August or the first of September if the males and females are in good condition. However, it is generally advantageous under commercial conditions to delay matings until October. The actual choice of mating dates should depend not only on the natural breeding season, but on the desirable time for having kids dropped. If not bred earlier, does will continue to cycle into January or February. The only time kids normally are observed from matings after the first of the year is when does abort early in the gestation period and rebreed before going into anestrus. This is the normal explanation for occasional kids born in June or July.

Length of Estrous Cycle

The length of the estrous 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 from which the 19.5 estimate was obtained are shown in Figure 2. The values 14 to 17 may reflect abnormal cycles; if these are removed, the two estimates are almost identical.

Length of Estrous Period

The length of the estrous period has not been studied extensively 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 based on the authors' observations, many or most of the does will be in estrus for two consecutive days. This would be expected in the case of some of the does exhibiting a 22-hour estrous period. The duration and intensity of estrus probably would be longer at estrual periods subsequent to the first and for older does as contrasted to yearlings. If van Rensburg's data were based on does bred at the first estrus, this might contribute to an estimate of a somewhat shorter period than expected.

Gestation Length

Shelton (1961) reported an average of 149.2 days (Fig. 3) and van Rensburg (1970) reported 149.4 days for gestation length of Angora does. 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 normally are dropped approximately one day earlier than singles.

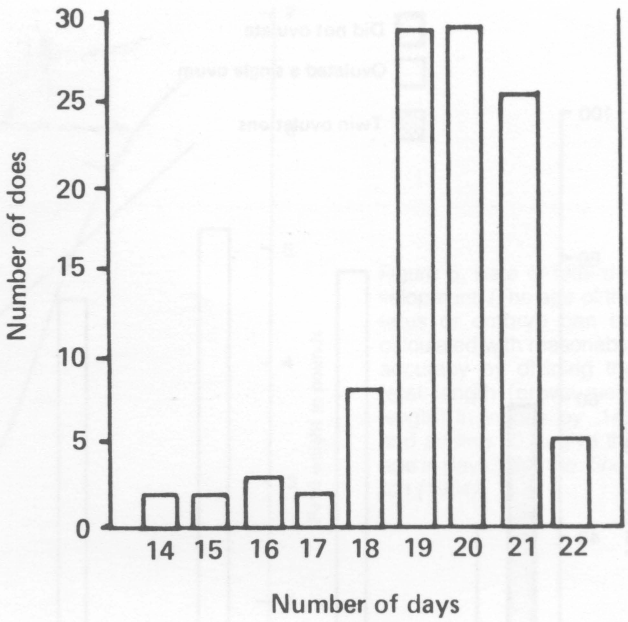

Figure 2. Range in length of estrous cycle for one experimental group of Angora does. *Source: Shelton (1961).*

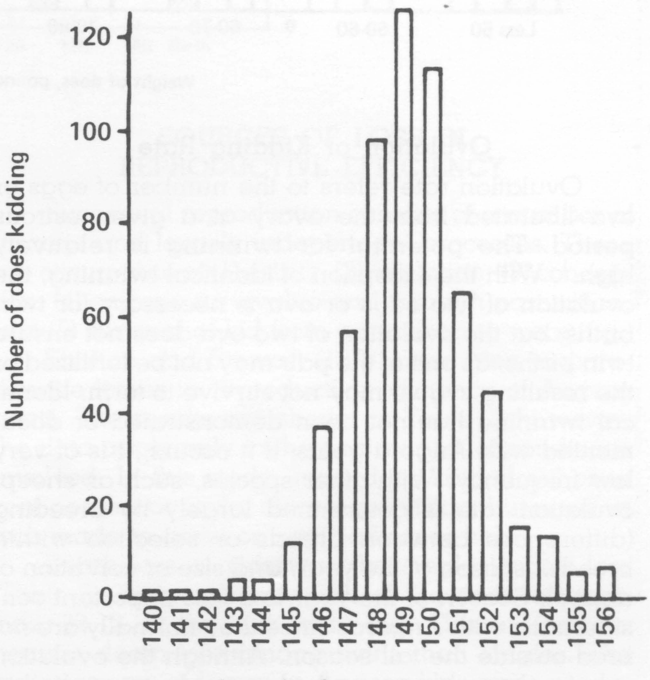

Figure 3. Length of gestation of Angora does based on 600 records. *Source: Shelton (1961).*

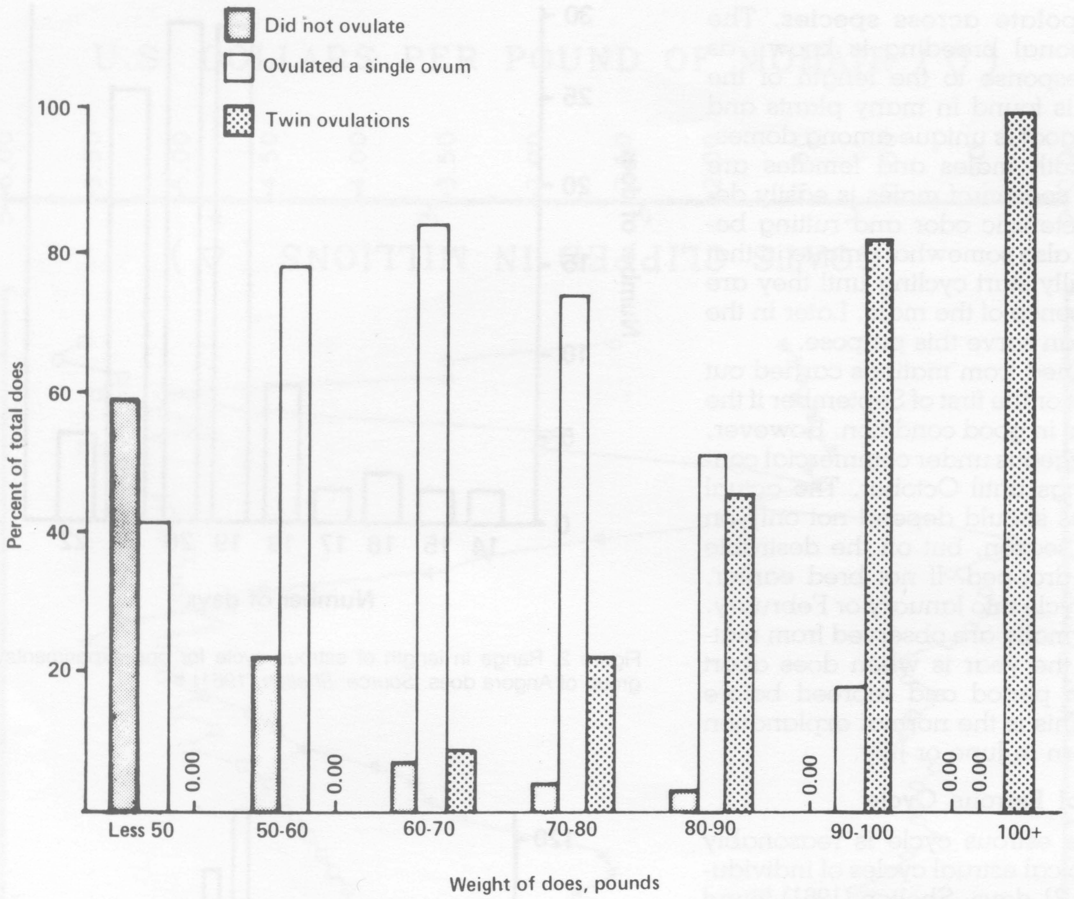

Figure 4. Breeding weight, in pounds, of a 244-number sample of does. *Source: Shelton and Stewart (1973).*

Ovulation or Kidding Rate

Ovulation rate refers to the number of eggs or ova liberated from the ovary at a given estrous period. The potential for twinning is relatively high.[1]. With the exception of identical twinning, the ovulation of two eggs or ova is necessary for twin births; but the ovulation of two ova does not ensure twin births, 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 sheep, ovulation rate is determined largely by breeding (differences between breeds or selection within breeds), season of the year, and size or condition of animal. Season of the year is a less important consideration with Angoras since they normally are not bred outside the fall season. Althugh the ovulation rate for the various months has not been studied in this country, the authors' observations suggest that this is not an important source of variation except that, preferably, does should not be bred on the first estrus.

Size and development of the doe seem to be the major sources 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%) had not ovulated, 170 (69.7%) had single ovulations, and 49 (20.1%) had ovulated two eggs. However, the ovulation rate varied greatly between groups of does. The relation of ovulation rate to size is shown in Fig. 4. The ovulation rate indicates the potential kidding rate, but in practice the kidding rate will always be somewhat below this potential.

Fetal Development and Birth Weight

In one study (Shelton 1964) 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 (Fig. 5). From this relationship, fetal age can be determined—either approximately from the graph (Fig. 5) or more accurately by calculation.

Fetal weight is highly correlated with age, but this relationship is curvilinear instead of linear as with fetal length (Fig. 5). Actually, the increase in fetal weight is geometric in nature, 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, demonstrating that a relatively small amount of nutrients is required for

[1]Texas Angora goats appear to be somewhat different than those in Turkey, as workers in that country report a very low level of twinning (Yalcin 1982).

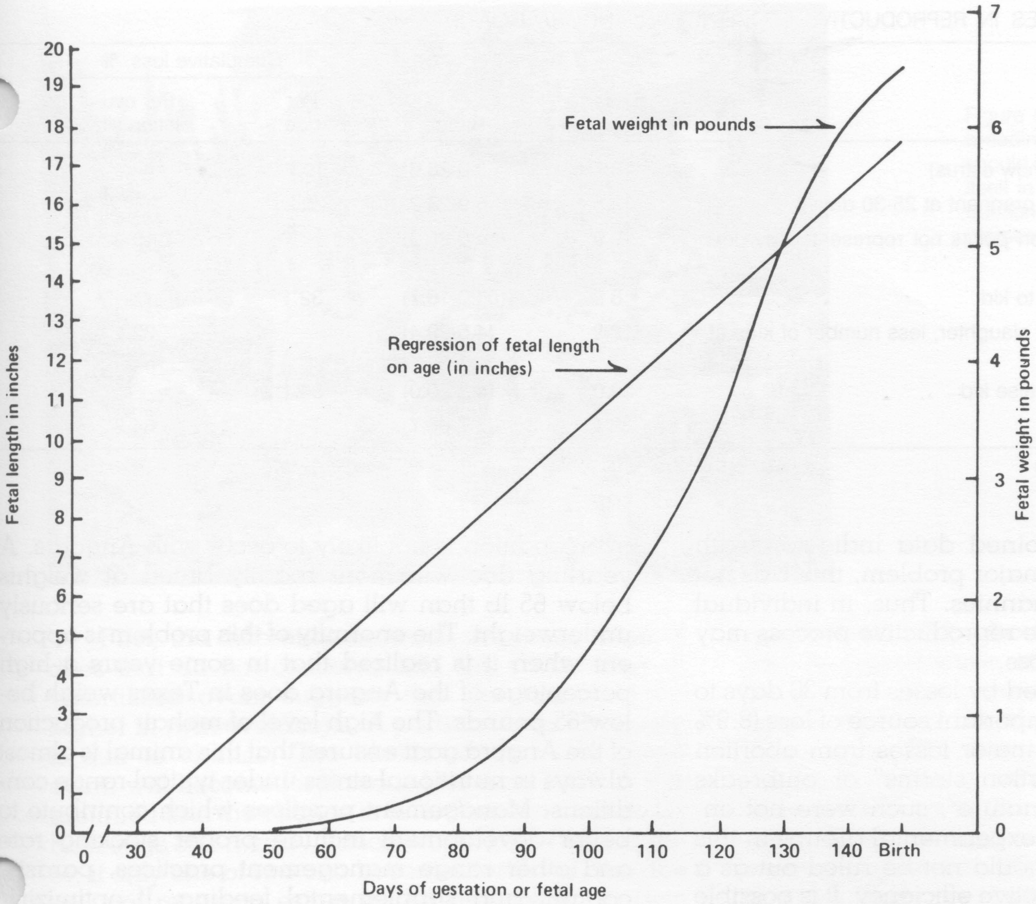

Figure 5. Rate of fetal development. (The age of the fetus or embryo can be calculated with reasonable accuracy by dividing the fetal length [crown-rump length] in inches by .149 and adding 30 to give the age in days.) *Source: Shelton (1964).*

fetal development until the latter stages of gestation. After approximately 130 days, the rate of fetal growth begins to slow or deviate from the theoretical 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 optimal conditions, the rate of fetal growth during the last 2 weeks appears to be approximately 0.1 pound (lb) daily. In extreme cases birth weights could vary as much as 3 lb below the 6.5 lb plotted in Fig. 5. In actuality, most kids weigh between 4.5 and 7.5 lb with the larger kids having better chances of survival. Dystocia (difficult birth) in goats is relatively rare. The influence of sex and type of birth on kid weight is shown in Table 1.

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

Source: Shelton and Groff (1974)

SOURCES OF LOSS IN REPRODUCTIVE EFFICIENCY

Successful reproduction consists of a number of discrete and largely independent processes. These are occurrence of (1) estrus, (2) ovulation, (3) conception, (4) embryo survival to and through parturition, and (5) survival of kid from parturition to weaning.

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. In this study, most does kidded either in confinement or under close supervision, but no effort was made to assist or artificially rear kids.

Death loss of kids was the single largest loss (Table 2). Although only 22% of the does lost their kids, 32.1% 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 listed above. Kidding in confinement, but in the absence of intense supervision and care, may reduce death losses in those cases where the alternative is kidding on the range in periods of inclement weather.

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

Reproductive phase	Loss, %	Range	Cumulative loss, % Per doe	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

Source: Shelton and Stewart (1973)

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 source of loss (8.9% of the does). However, major losses from abortion tend to occur as "abortion storms" or outbreaks which are sporadic in nature[2]; 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 to fertilize or conceive. Some nannies that abort habitually show recurring 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, parasitism, etc.; (3) abortion; and (4) death losses of kids. A discussion of each problem area follows.

Failure to Show Estrus or to Ovulate

In the study by Shelton and Stewart (1973), 10.7% of the goats did not cycle, but among the various groups this ranged from 0 to 28.6%. Assuming that mating is attempted only in the fall when goats normally would be cycling, a failure to cycle is almost certainly caused by incomplete size and development. This relationship is shown in Fig. 4 and Table 3. Generally it can be shown that a mature Angora doe should weigh at least 65 lb (shorn body weight) before a reasonable level of reproductive efficiency can be expected. The level of kid production will also improve with increased body weights above this level. Reduced kid production due to overcondition is not likely to occur with Angoras. A yearling doe will more readily breed at weights below 65 lb than will aged does that are seriously underweight. The enormity of this problem is apparent when it is realized that in some years a high percentage of the Angora does in Texas weigh below 65 pounds. The high level of mohair production of the Angora goat ensures that this animal is almost always in nutritional stress under typical range conditions. Management practices which contribute to better development include proper stocking rate and other range management practices, parasi[illegible] control, and supplemental feeding. If optimizin[illegible] these practices fails to result in an adequate level of reproduction, it may be necessary to relax the selection for extreme mohair cover or fleece weight by selecting those animals that perform well under current maintenance conditions.

Failure to Conceive

Lack of conception was implicated in failure of 12.5% of the does and 19.9% of the ovum ovulated (Table 2). This varied from a low of 5.9% to a high of 23.2% 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.

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

Weight range, lb (shorn body wt at breeding)	Sonora data % kids dropped	Sonora data % kids raised	McGregor data % kids dropped	McGregor data % kids raised
Below 60	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[illegible]
Summary	74.7	69.1	128.1	94[illegible]

Source: Shelton and Groff (1974)

[2]Does often breed in a synchronized manner, so that most of them reach critical stages simultaneously, or respond similarly to certain management conditions.

Figure 6. 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.

First, 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 obviously is due to chance. The likelihood that any given ovum will become fertilized is less than 100%. If it is assumed that the chance is 80%, then the chance for both eggs of a twin ovulation would be 64%. However, if only one of two ova 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.

Second, some cases of apparent failure to conceive may be attributed to early and unobserved abortion.

Third, lack of libido and mating vigor of the male contribute to failure to conceive. Sterility is not a major problem among Angora males that are strong and have sufficient mating vigor (Fig. 6). 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.

Where numbers permit, culling of dry does is indicated (Fig. 7). 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 or poor feed conditions.

Abortion

Goats in general are more susceptible to abortion than sheep and cattle, and this is especially true with Angora. Although this was not found to be the case in some of the data reported earlier (Shelton and Stewart 1973), abortion is an important source of loss in reproductive efficiency in the Angora, although the phenomenon is not always observed. Losses related to the abortion phenomenon occur in three forms. The most important of these occurs as "abortion storms" in which a number of does ("stress aborters") abort within a short period of time. The majority of these losses occur in close proximity to 3½ months of gestation (90 to 120 days). Stress abortion is more likely to occur with young undeveloped does. Abortions that occur with range goats are

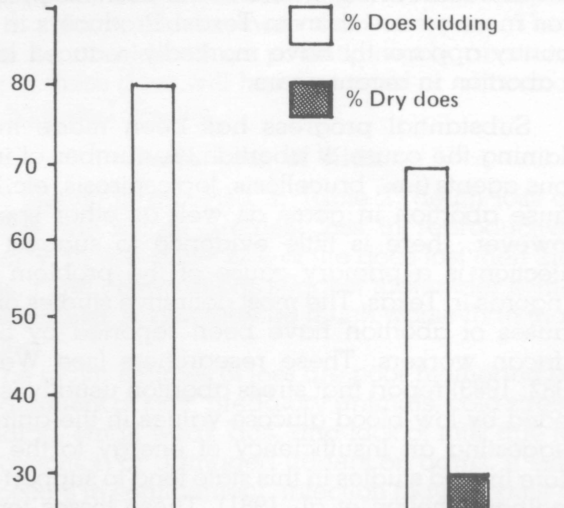

Figure 7. The relation of one dry season to breeding performance the following year. *Source: Shelton and Groff (1974).*

infrequently observed, but the presence of aborters in the flock can be ascertained from observing blood-stained hair on the tail or around the vulva. (It is important that blood stains be distinguished from urine or fecal stains.) However, some goats that have aborted will not be identifiable by this procedure.

A second form of loss is due to repeat aborters, i.e., the same does abort year after year. Although normally of low incidence, losses to repeat aborters could increase over the years if these does are not identifed and removed. This suggests that abortion losses will be greater among older does.

The third expression of the abortion syndrome involves does that either fail to conceive or lose their embryo unobserved, although the does are of adequate size and development. Any large mature or aged doe which fails to kid should be a suspect. Many of these show irregular estrus, suggesting early embryo loss. The occurrence of June or July kids results from early loss of the fetus followed by rebreeding; the subsequent kid is carried to term, aided by good feed conditions in the spring.

Most flocks suffer some abortion loss, but under good conditions, this may be in the range of 0 to 5%. The highest known losses recorded in experimental flocks for which the writers were responsible have been 16%. In one problem flock annual losses equaled approximately 16%. Individual U.S. producers have reported losses much greater than this, and van Heerden (1964) reports losses as high as 60% in South Africa, where in the past this problem was more severe than in Texas. Producers in that country apparently have markedly reduced losses to abortion in recent years.

Substantial progress has been made in explaining the cause of abortion. A number of infectious agents (i.e., brucellosis, leptospirosis, etc.) can cause abortion in goats as well as other species; however, there is little evidence to suggest that infection is a primary cause of the problem with Angoras in Texas. The most definitive studies on the causes of abortion have been reported by South African workers. These researchers (see Wentzel 1982, 1983) report that stress abortion usually is preceded by low-blood glucose values in the animals, suggesting an insufficiency of energy to the doe. More limited studies in this state tend to support their findings (Shelton et al. 1981). These losses tend to occur within 90 to 120 days of gestation, with the earlier fetal age coinciding with the stage at which rapid fetal development is initiated. These losses may occur as storms for any of several reasons. One of these is that the does often breed in a synchronized manner so that most of the does reach this critical state simultaneously. Weather, and working or handling the goats, may act on all the goats in the flock to interrupt their feeding pattern and cause nutritional stress. No doubt, in many cases, such

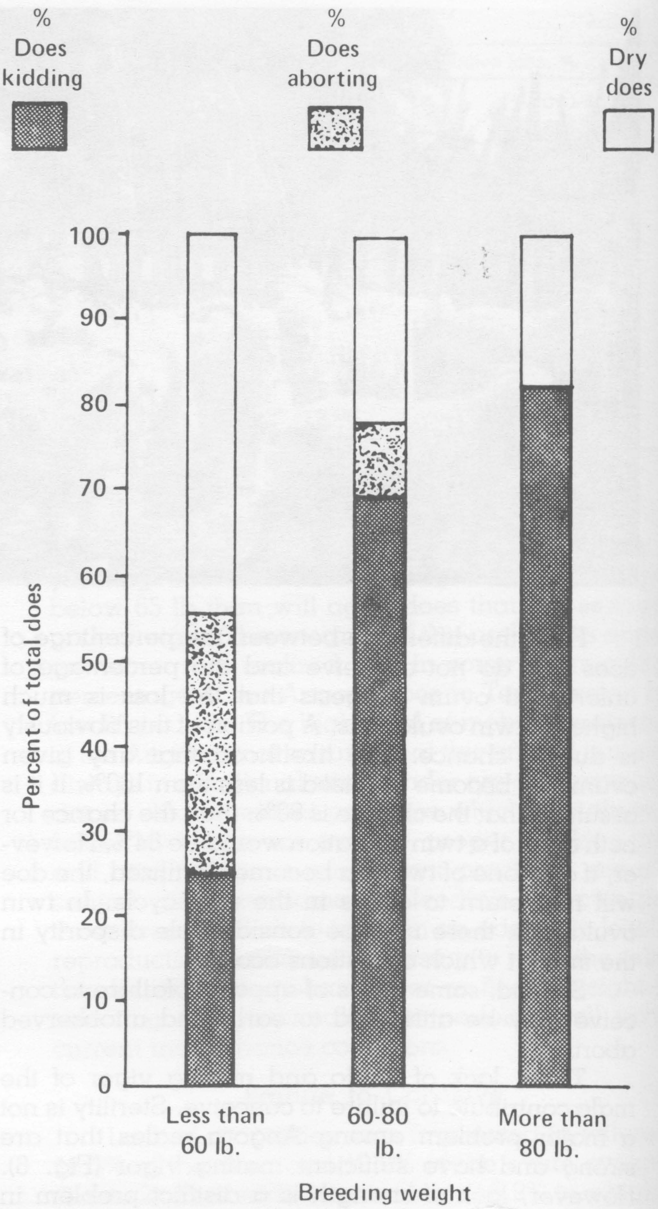

Figure 8. Reproductive performance of 218 doc[illegible]e experimental flock for the 1969 kidding season. Fifty-six percent of the does that mated in the below-60-pound weight class aborted as compared to 11.5% for those weighing 60 to 80 pounds and 0.0% for those weighing above 80 pounds. *Source: Shelton and Groff (1974).*

stress or disruptions can occur (freezing of water sources, prevailing wind pulling animals away from feed and water, predator disturbances, etc.) without the producer's knowledge. Stress abortions at 90 to 120 days of gestation will give rise to a fresh fetus which, if observed immediately after explusion, will show evidence of life. Other types of abortion, such as that due to chronic aborters or does in late gestation, will result in edematous or partially autolyzed fetuses which have been dead for some time before expulsion.

Figure 9. 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. *Source: Shelton and Groff (1974).*

Recommendations to Reduce or Prevent Abortions

1. Select as breeding stock only those animals, especially males, which remain strong and vigorous under the actual production conditions under which the flock is to be maintained. There is no evidence at present to suggest that it is possible to eliminate through selection the goat's tendency to abort, but it should be possible to breed goats which are in better harmony with their environment and thus less likely to encounter stressing conditions which cause them to abort.

2. Provide young replacement does with an adequate level of nutrition to ensure good development. Alternatively, do not breed young underdeveloped females unless feed conditions are likely to support growth to kidding. Otherwise, an abortion history may be initiated that could continue throughout the life of the doe (Fig. 8).

3. Provide the gestating doe with an adequate feed level, especially energy, to maintain the developing fetus (Fig. 9), particularly during late gestation.

4. Prevent undue stress during the latter stages of pregnancy. This would be particularly true for any type of stress which would interrupt normal feeding routine.

5. Identify and remove from stud flocks any does that abort. It has been shown that this trait may become habitual (Fig. 10). If habitual aborters are allowed to accumulate in the flock, losses of this type can become routine even though the flock is otherwise well managed. Again, there is no reason to believe that this practice will eliminate the tendency for Angora goats to abort, but it may accomplish two things: reduce the frequency of repeat aborters in the flock, and help develop a flock which is better adapted to the production conditions, thus not initiating an abortion history. In times of favorable mohair prices, the aborting does might be kept for mohair production, but preferably they would be kept in a separate pasture from which all offspring are sold. With weak or nonvigorous males, castration is recommended.

6. Remove from the flock large, well-developed does that fail to kid for more than one year. They should be considered as potential early aborters. Many of these does will have unusual or abnormal body type and fleeces.

Death Loss of Kids

In the study reported in Table 2, death loss of kids was the single greatest loss in reproductive efficiency. In this study 22% of the does lost their kid or kids. Field observations suggest that under some conditions loss of kids may be much worse than that reported.

The major sources of loss are poor mothering or abandonment of kids, predatory animals, cold stress at kidding, small-weak kids, and lack of milk due to poor condition or damaged udders on dams. If kidding occurs in confinement, infection may become a problem, but infection is thought to be rare under extensive or range conditions. It will be noted that a majority of these losses could be prevented by intensified and appropriate management practices. However, major problems are encountered in attempting to implement these practices under range conditions. Each of the suggested sources of loss will be discussed briefly.

Abandonment of the kids appears to be a major source of loss under extensive conditions. This is predisposed by the habit of does "planting" their kids. The term "planting" refers to the habit of bedding a kid down, leaving the doe free to feed on her own, returning at intervals to feed the kid. This practice may continue until the kids are several weeks old. If for any reason the doe does not return, the kid will surely die, and even if she does return the unprotected kid may have been taken by a predator. Apparently, a major stimulus for the doe to return to the kid is a full udder. Thus, if does are not milking well, they are less likely to return. Disruption of either the doe or the kid is a major cause of problems. Examples are predators or human activity such as feeding or attempting to gather animals in the pasture.

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 may be able to resist attacks by the small predators such as raccoons, foxes, or vultures. However, large predators such as the bobcat or coyote will continue to kill, with the latter readily taking adult animals. For these species, removal of the offending predator appears to be the only alternative.

Chill or cold stress is a major source of kid loss from does kidding on the range. Choice of kidding date or provision of some protection are suggested approaches to eliminate 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 alone decreases, but the chance of wind or moisture, or a combination of these, increases through April. However, delaying kidding past March 1 is not recommended because kids will not have gained enough weight for the summer season.

Birth weight. Underlying all causes of death losses of kids is the problem of birth weight and vigor of the kids (Fig. 11). Primary factors affecting birth weight are 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 energy and protein will almost always provide a positive response in birth weight and kid survival. When green forage is available to the doe, protein should not be lacking, but does will benefit from supplemental energy during late pregnancy, kidding and lactation.

Damaged udders are very common with Angora does. Many of these trace to the teats being cut during shearing. Thus, the obvious solution is care during shearing. However, many does will develop bad udders after several kidding seasons. Does with damaged udders should be culled.

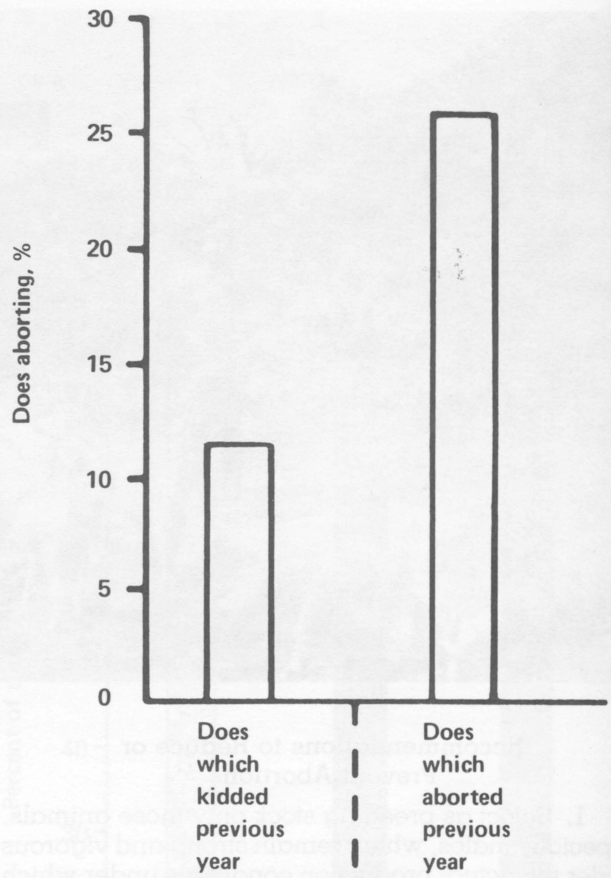

Figure 10. Influence of previous history on abortion rate in Angora does. (These data were taken from a flock which had an abortion history. In 1 year the aborting and kidding does were identified. The following year the overall abortion rate was 16.1%. The does that kidded the previous year had an abortion rate of 12.3%, whereas those which aborted the previous year suffered an abortion rate of 26.5%. *Source: Shelton and Groff (1974).*

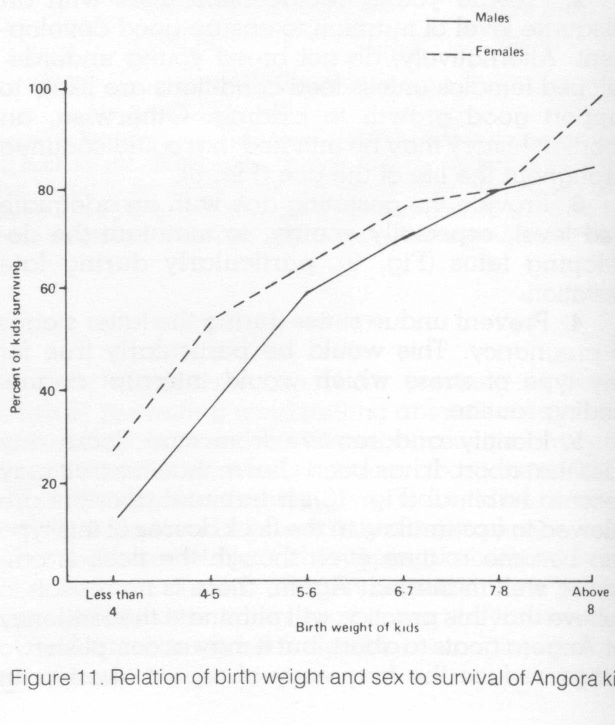

Figure 11. Relation of birth weight and sex to survival of Angora kids.

MANAGEMENT DURING KIDDING

It was stated earlier that death of kids is a major cause of loss, and that this could largely be prevented through management. The challenge is to ferret out those practices which provide an economic response. Ideally, management inputs may be varied depending on current prices for mohair and surplus breeding stock and the resources available to the producer.

Three management systems have been evaluated on a limited scale in experimental flocks maintained on the leased Hill Ranch in Edwards County. (Menzies et al. 1981) These are: traditional, or kidding on the range; kidding in small traps or "small camp" kidding; kidding in confinement.

Traditional Kidding

Kidding on the range has been defined as the conventional or traditional system and thus a detailed treatment is not given. However, a few suggestions can be made. Extensive predator control efforts should be carried out prior to the start of the kidding season. Control efforts may need to consider several potential predator species. Kidding occurs best in pastures which afford natural protection at times of inclement weather. There should be minimal disturbance in the pasture during kidding. Feeding or gathering stock are major sources of disturbance and should be avoided. Traditionally, good range management practices have called for placing feed, water, or salt at different locations in the pasture to stimulate more uniform range utilization; however, during kidding, animals should be encouraged to congregate at one point or to return to this point one or more times daily. Full or continuous feeding is suggested, encouraging the does to remain near a common point. In some cases it may be desirable to delay kidding until green feed can be expected. This may reduce the tendency for does to travel extensively in search of forage.

"Small Camp" Kidding

In limited experimental comparisons (Menzies et al. 1981), *kidding in small traps* or *"small camp" kidding* has provided the most favorable results, at least in economic terms (Fig. 12). Most producers are aware of the tendency for does to plant or bed down their kids, then move away from them. Small camp kidding prevents does from moving far away from their kids. In addition, a smaller number of does are run in one bunch, which reduces the number of kids lost through mismothering. Producers often ask what is a small trap and how many does can be put per trap. Definitive answers to these questions are simply not available. Research work (Menzies et al. 1981) was done with pastures of 30 acres or less in size and 50 or less does per group. Most commercial producers would not have an adequate number of such small pastures, but they might be able to work in this direction or to utilize the concept of kidding in smaller groups and smaller pastures.

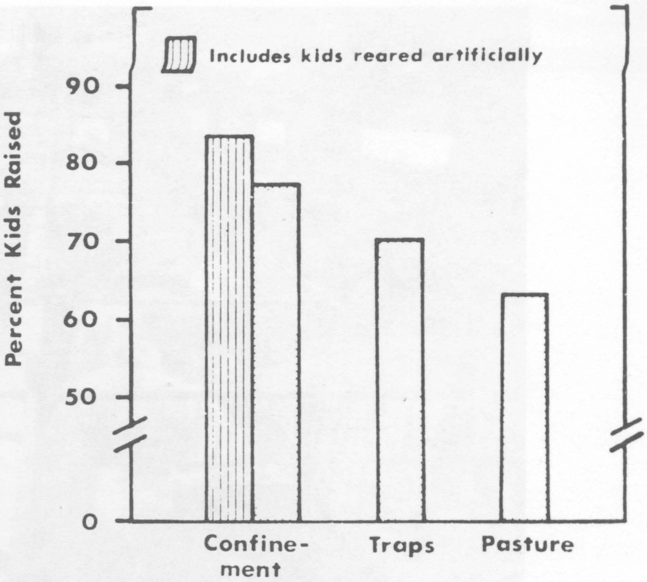

Figure 12. Percent kid crop raised in three kidding systems. These data are based on a small number of does over four kidding seasons. These data are thought to be an underestimate of the benefits of improved kidding systems, as no major or catastrophic losses to weather or predators occurred under pasture conditions during these studies. *Source: Menzies et al. (1981).*

Confinement Kidding

Confinement kidding (Fig. 13) has the potential to maximize the number of kids raised, but a poor job of managing does in confinement can result in losses exceeding those in pasture. Kidding in confinement has increased in recent years. The producers most likely to practice this raise purebred or stud breeders, or have smaller flocks which have barn or shed space available. The primary costs associated with confinement kidding are (a) increased feed requirements, (b) increased labor, and (c) buildings or facilities. The latter two may not be cash costs to a producer who has facilities available and is willing to do the work himself. Feed costs can be substantial if the does are maintained in total confinement during the kidding season, but may be modest if does are run in small traps or fields during the daytime and are confined at night and for a few days after kidding. This procedure generally is workable only for small numbers of does.

Producers are encouraged to adapt and utilize existing shed or barn facilities. However, several producers are building special facilities with special crates or jugs. Most of these are a 3x3- or a 4x4-foot construction of either wood or metal with watering and feeding facilities built into the cubicle.

Normally, crate numbers should equal approximately 10% of the breeding flock to ensure a workable situation. Crates may be of portable construction so that barn space may be utilized for other purposes after the kidding season. Many producers practicing confinement kidding obtain kid crops of 100% or more.

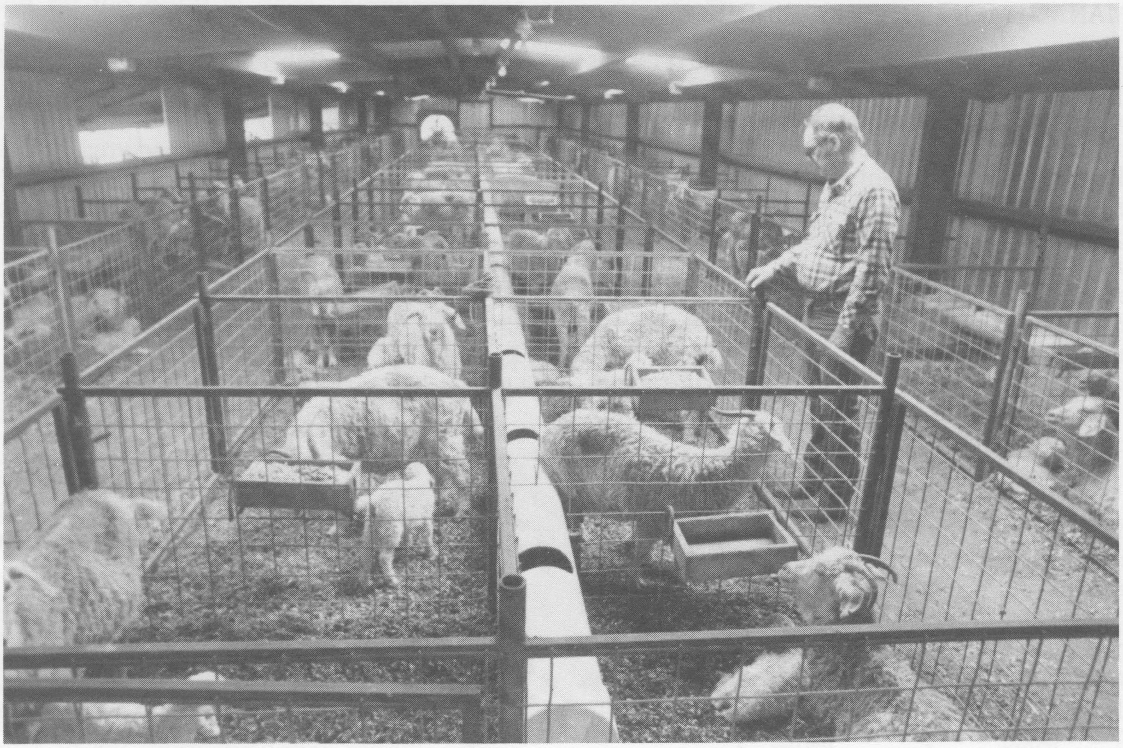

Figure 13. A facility for confinement kidding. Good results can be obtained with much less elaborate facilities. (photo courtesy of *Ranch Magazine*).

The confinement system allows for greater bonding between the doe and offspring during the first 2 days after parturition. Kids which are not receiving milk can be identified and assisted. Also, newborn kids have greater success in regulating body temperature during the first 24-36 hours after birth, thus reducing loss to cold stress. Grafting success with different offsprings to adoptive does is greatly increased and facilitated.

Mating at the First Versus the Second or Subsequent Estrus

Angora does may exhibit estrus any time after September 1, but normally do not start to cycle unless they are exposed to the male. Late in the season, some does may start to cycle either spontaneously or due to stimuli other than the presence of an active male. In any case, during the early part of the season, the male is responsible for the initiation of cyclic activity. The result is normally a synchronized group of matings approximately 8-10 days after placement with the males. This will be observed only if (a) the males and females previously have been kept isolated from each other, (b) it is within the breeding season, and (c) the does are in a healthy, vigorous condition permitting them to respond. A few does will occasionally show limited estrual activity within 4 days of exposure, but these are not fertile matings and the animals will return to estrus in a few days. This is often referred to as the "short cycle phenomenon" which is not fully understood, but is not critical to the current discussion.

Male stimulation and the resultant synchronization are demonstrable and controllable functions. Thus the important question is, how can this phenomenon be utilized to advantage by the producer? Synchronization may be advantageous to producers who wish to kid in confinement and to be present at this time. An example of synchronization in kidding is shown in Fig. 14. This is perhaps the highest degree of synchronization that could be expected from the male stimulation effect. In Fig. 14, the synchronization or concentration in mating was more marked since the data shown included the variation in gestation length. This synchronization tends to occur naturally if the conditions outlined earlier are met. Thus no particular initiatives may be required to exploit this phenomenon. On the other hand, if producers do not wish to practice confined or supervised kidding, they may prefer that the animals not be synchronized. This could be accomplished by placing sterile males with the flock well in advance of the breeding season.

A second possible means of exploiting the phenomena of male stimulation is to mate the ewes at the second or subsequent estrus instead of the first estrus of the season. It has been shown that does have a higher ovulation rate at the second as compared to the first estrus. The difference is on the order of 0.20 ovulation points per doe. Breeding at

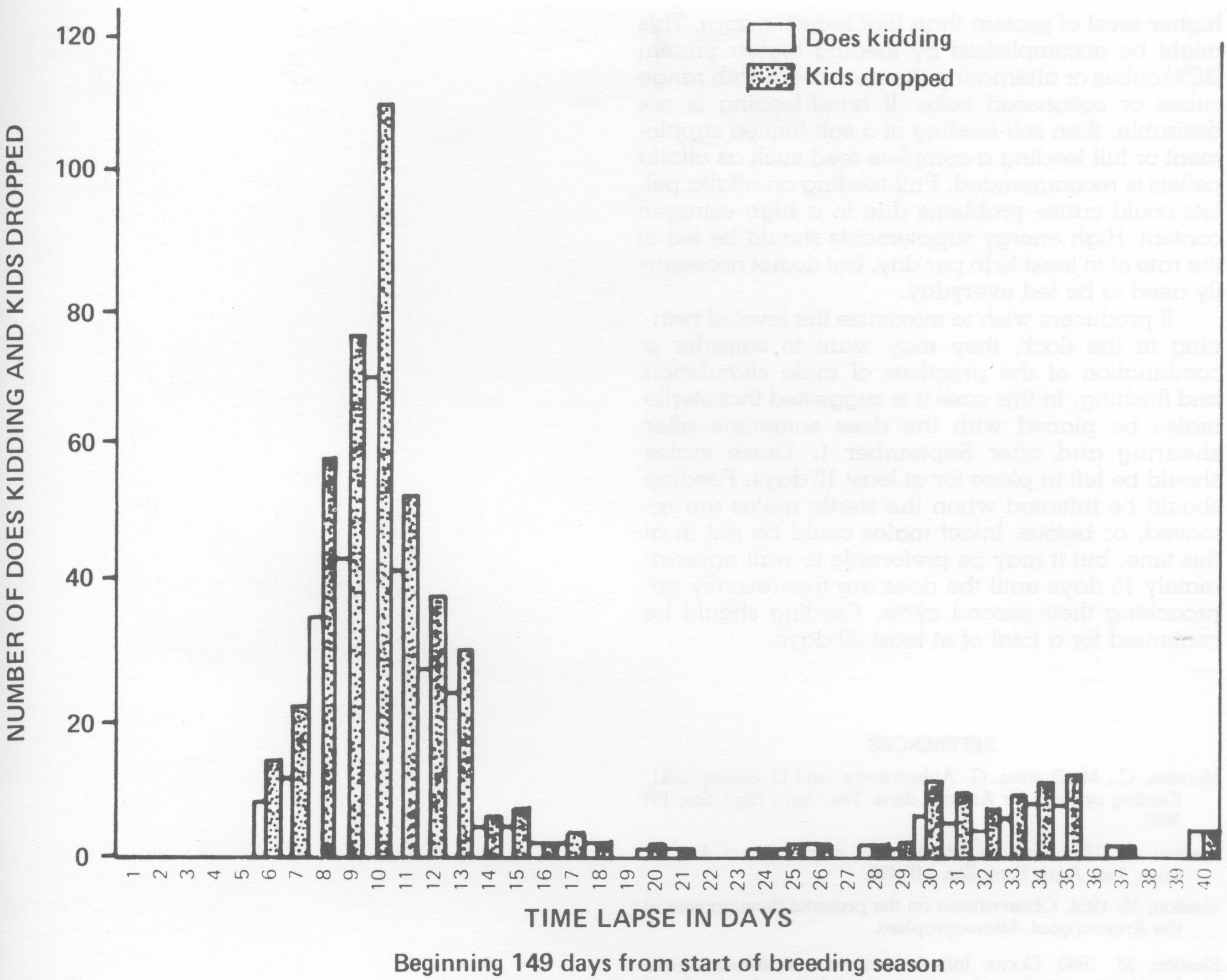

Figure 14. Distribution of birth for 497 kids (1956-58 kid crops combined) from the Texas Agricultural Experiment Station, McGregor.

the second estrus can be accomplished by exposing the does to a sterile male for at least 12 days before exposure to intact males. South African workers apparently accomplish much the same thing by delaying the breeding season, separating males and females but not isolating them from each other. Cross-the-fence contact has nearly the same stimulating effect as full contact, since sight, sound, smell, etc. are no doubt involved in the stimulating mechanism (Shelton 1980).

Flushing

Limited research as well as producer experience indicates that does will respond to flushing.[3] The expected response would be to increase twinning among the more mature does. The producer must decide if this would be desirable. It almost certainly would be desirable under good feed conditions or when does are kidded in confinement. There is more reason to question the desirability of twinning under extensive range conditions. The other expected response from feeding at breeding would be that some small underdeveloped does would have the chance to mate and conceive. Experience has shown that if such does which would not otherwise breed do so as a result of feeding, the improved feeding level should continue throughout gestation; otherwise, there is a risk that many of these small does will abort. If a producer is not interested in twin kids, he might consider flushing the smaller, lightweight does, which will usually be the younger does. A suggested sorting point would be approximately 60-65 lb. Under normal conditions a high percentage of the does fall below 65 lb.

If flushing is to be practiced, it should be started in advance of the breeding season by approximately 15 days. Energy feeds such as corn are likely to have the greatest effect on kidding. For this reason many producers feed shelled corn on the ground. However, shelled corn is below the optimum protein level for Angora. If range conditions are dry the animal will almost certainly respond to a

[3]"To flush" is to prepare animals for breeding by providing an increased feed level prior to breeding.

higher level of protein than that found in corn. This might be accomplished by feeding higher protein (20%) cubes or alternating the use of corn with range cubes or cottonseed cake. If hand-feeding is not desirable, then self-feeding of a salt-limited supplement or full feeding a complete feed such as alfalfa pellets is recommended. Full-feeding on alfalfa pellets could cause problems due to a high estrogen content. High energy supplements should be fed at the rate of at least ½ lb per day, but do not necessarily need to be fed everyday.

If producers wish to maximize the level of twinning in the flock, they may want to consider a combination of the practices of male stimulation and flushing. In this case it is suggested that sterile males be placed with the does sometime after shearing and after September 1. These males should be left in place for at least 12 days. Feeding should be initiated when the sterile males are removed, or before. Intact males could be put in at this time, but it may be preferable to wait approximately 15 days until the does are theoretically approaching their second cycle. Feeding should be continued for a total of at least 30 days.

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