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POLYPAY BREED IMPROVEMENT

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While living with my family in New Zealand a few years ago, we experienced many new things. One of these, which should be of great significance to this group, was that the per capita consumption of lamb, hogget, and mutton was higher than that of any other meat. I asked why. After some investigation, I found that the retail price of lamb and hogget was less than that of any other meat --- including chicken. Then, we might suppose that although this would naturally stimulate sales, the New Zealand sheep farmer would soon go broke unless he got better prices. However, that also has not happened. Then, how can we account for this apparent paradox?

The key to the competitiveness and success of the sheep industry in New Zealand (over 48 million breeding ewes), in a country about the size of Colorado, has been greater production efficiency, not higher prices. In fact, the sheep industry has been so efficient that New Zealand's agricultural development owes more to sheep farming than to any other enterprise. Initially, this efficiency was based on a well-adapted single bearing, easy care sheep (the Romney) on marvelously managed hill pastures. Their emphasis has been on the pounds of lamb and wool produced per hectare (2.47 acres) feeding little or no harvested feeds. Aerial fertilization of hill pastures is standard. Intensive rotational grazing is practiced to keep the shrubs under control. Lambing is timed to coincide with the growth flush of the pastures in the spring.

Beef, pork, and chicken have all required concentrate feed in varying amounts. Concentrate feeds are very scarce and expensive in New Zealand. According to projections by many world food experts, this may soon be true in the U.S. and the rest of the world.

During the period 1965-1978, scientists in New Zealand and other sheep-producing countries demonstrated the major influence of prolificacy on weaning percentage. This has stimulated crossbreeding and the development of new breeds (such as Coopworth and Perendale) in an effort to increase weaning percentage because of its important relationship to overall production efficiency and profitability.

The New Zealand Sheeplan cooperative breeder selection program, designed to increase the percentage and weight of lambs weaned per ewe per year, is well worth looking at as a means of improving a breed.

SHEEPLAN — 1976

OBJECTIVES: Each succeeding generation of sheep should, on the average, be more productive and profitable than the preceding generation.

PLAN: Selecting, on the basis of the performance information available, those parents which will make the greatest contribution to improving the productivity and profitability of the next generation.

PROCEDURE: 1) Measure traits of economic importance, 2) predict breeding value of the individual for the traits which are to be improved, 3) cull animals with poorest predicted breeding value. (Note: Recording service processes records supplied by breeder, producing breeding values. Breeder makes ultimate selection decision.)

SCOPE OF SHEEPLAN APPLICATION: Within-flock selection based on genetic rankings of animals.

MEASUREMENTS OF PRODUCTIVITY: 1) Number of lambs born or reared, 2) weight of lamb weaned, 3) winter (8-12 months) liveweight of ram lambs, 4) spring (12-15 months) liveweight of yearling lambs, 5) yearling fleece weight, fiber diameter, and color. (Note: Number of lambs born must be recorded by all members of Sheeplan. All other measurements are optional.)

SHEEPLAN PREDICT INDIVIDUAL BREEDING VALUES FOR: 1) Number of lambs, 2) growth, 3) wool production, and 4) overall productive merit (selection index).

GENETIC RESPONSE TO SELECTION BY THE PLAN PER GENERATION: (using best 2% of rams and best 60% of ewes with 2.75 years generation intervals.)

Trait	*Progress per generation*
Weaning weight	1.12 lbs.
Spring liveweight	2.76 lbs.
Yearling fleece weight	.07 lbs.
Lambing percentage	4.2%

[Note: Although number of lambs has a slow rate of response, the response expected is of greater financial value than for other traits included.]

When we recognize that this is a selection program with national impact, we can see why the per capita consumption of lamb in New Zealand will stay high --- because of increasing production efficiency and highly competitive retail lamb prices.

After some speculative years, since the release of foundation breeding stock by USDA, more propagation of Polypays has occurred than selection and heavy culling, which are essential to breed improvement. This has caused many dedicated and conscientious Polypay breeders to ask hard questions about not only where we are going, but also if we are going anywhere.

I have the difficult, but challenging, assignment to talk to you about breed improvement. There are others better qualified than I to address this subject. However, I have some very strong concerns and paternal instincts about this new and exciting breed.

Let me review the inception of the Polypay breed. Our initial objective was to test several breeds and crosses and identify the breeding group which would produce the greatest number and pounds of lamb per ewe per year --- when given two opportunities to breed per year. Although there is still merit in that goal, I, like many others, believe that the current and potential environmental base for efficient production of the Polypay is too broad for this single narrow goal. Consequently, there are a number of diverse opinions among our members as to the direction we should take and how we should get there.

Most of us visualize a highly productive and prolific sheep (based primarily on lamb and wool production) with the greatest emphasis on lamb. Some are interested in accelerated lambing in total confinement or semi-confinement systems. For others, one good twin lamb crop per year (under semi-confinement or extensive range conditions) best fits their program. Some believe that we should develop large, tall, long sheep that compete well in the shows and stud ram sales. Others are aware of studies that clearly indicate that selection for large size reduces lamb production, and recognize also that medium-size ewes can optimize the efficiency of lamb production realized from breeding to a large mutton-type breed, such as the Suffolk.

Although I enjoy looking at beautiful sheep, I subscribe to the idea of selecting for the production we want and letting Polypay sheep tell us what they will look like. Who would have known in advance, for example, that champion gymnasts would be extremely small people?

We must continually recognize the overwhelming importance of prolificacy relative to profitability. For many years, the average annual lamb crop has ranged between .95 and 1.01 lambs per ewe. Would we have experienced the great decline of the sheep industry in this country if the average annual lamb crop had steadily increased by 2% per year over the past 30 years?

There are several breeds of sheep that are maintained by hobbyists who support them from jobs in business and industry. They contribute much to the county fairs and 4H lamb fitting and showing which is very worthwhile. However, most of these breeds will contribute little of significance to the security and economy of the nation. I envision the Polypay to be a breadwinner, a commercial lamb producer efficient in the conversion of forages, and food by-products into highly nutritious, palatable protein at a nominal cost to the consumer.

It is very important, in my view, that we reach some degree of concensus on goals and unite organizationally to achieve common goals. This can best be done if we agree on and support a breeding improvement program aimed at achieving those goals. I have reviewed the Polypay Sheep Improvement Program developed by our association in 1983. It is an excellent program and very similar to the New Zealand Sheeplan which is proving very successful. Our plan implies lamb and wool production goals and avoids the entrapments of selection for fancy points which can greatly dilute progress in the economically important traits. It will process production data correcting for environmental differences (such as type of birth, age of dam, age of lamb, sex, etc.) and take into account the correlation among traits permitting each breeder to identify his genetically superior sheep --- so that he can select on genetic merit and maximize herd and breed improvement. It allows for selection within management systems and it makes it clear that the adjusted production trait values and indexes are valid only for selection within flocks and not among flocks. Yet, it provides the freedom so that if a breeder chooses to disregard the opportunity to select for the economically important traits, and instead develop stilt-legged giants, or pink-faced midgets, he can try.

This plan also provides exciting motivational challenges in producing "Elite" Polypay breeding ewes as well as making permanent genetic improvement in our personal flocks and in our breed in the economically important traits that can make the Polypay breed a true breadwinner and a source of high quality, economical food for a world in need. "Elite" ewes could be recognized within each of several management systems to minimize environmental discrimination.

In order to maximize the impact of the selection plan on genetic progress in the economically important traits so that we can have and maintain a truly superior lamb production breed, I recommend that we make the use of our Polypay Sheep Improvement Program automatic with membership in the APSA by making the suggested fees for SHEEPRECORDS a part of the cost of membership. If Polypays are to be truly polypay and a step above other breeds, we must have a solid, disciplined selection program based on sound genetic principles. We must also have a large number of sheep enrolled from each environmental management system to provide the data base for accurately adjusting production records.

LET'S DO IT NOW WITH ENTHUSIASM!!!

Now for the consideration of all of us, let me discuss a few of the principles contained in the genetic selection

plan.

1. IDENTIFYING SUPERIOR FLOCKS AS A SOURCE OF SUPERIOR BREEDING STOCK. Our program can identify flocks with superior production, but it will not and is not designed to identify flocks with superior breeding stock. This is because the environment of different production units is so different, so profoundly affects production, and cannot be measured accurately. Therefore, it cannot be corrected. In simple terms, some flocks are much more productive than others because the climate, nutrition, disease exposure, etc., are more optimal and not because they are genetically better. Take for example, Polypay sheep from the same source of origin raised in widely differing environments such as annual lambing on an arid range in the Southwest with no special care or attention at lambing time, no supplemental feed, and no protection from predators or poisonous plants as contrasted to a large farm flock on an accelerated program managed by a professionally trained and experienced shepherd. However, identifying the lambing schedule and basic management system of each flock will give some meager basis for identifying superior breeding stock within management system and climatological area. May I suggest a minimum of two management program categories to be added to the current three in the program outline:

4) Herded range with supplemental winter feed.

5) Fenced range with little or no supplemental winter feed.

2) QUALITY TRAITS. Some quality traits affect lamb and wool production and, therefore, must be considered. However, the degree of emphasis placed on them can markedly affect the rate of progress made in the economically important traits and therefore, should be minimized. Quality traits of importance not included in the SHEEPRECORD are: horns or scurs, bad jaws (overshot, undershot), britchiness and black spots or fibers in the fleece, badly crooked feet and legs, brown eyelid pigment (especially in the Southwest), and abnormalities (cryptorchidism, intersexes, etc.). Horns or scurs. Horns contribute to injuries to caretakers and other animals; complicate and increase costs of shearing and management. Scurs can be broken, resulting in fly blows. Solid knobs in the ewe are genetically equivalent to full horns in the ram. Horns occur at a very low frequency in most Polypay flocks, so culling all horned rams is not usually a serious problem. Long, undesirable scurs still occur at too high a frequency and do limit selection if severe culling is done for scurs. It is recommended that as a breed, we use care not to discard truly genetically superior rams because of scurs. However, rams with long scurs which are not in the top 4% of the potential stud rams can be culled without hurting our genetic progress. Bad jaws. Overshot or parrot mouthed sheep are not a serious problem genetically (low heritability), and unless it limits the individuals ability to eat or graze, they need not be culled. On the other hand, undershot jaws are relatively highly heritable and are a progressively increasing problem as sheep get older and teeth get longer. However, don't make the mistake of culling sheep with slightly undershot jaws that are on pelleted or ground feed. Most of these sheep will have normal jaws after being placed on a pasture or long hay. Britchiness and black spots or fibers in the fleece. Britchiness increases fleece variability as well as detracts from the appearance. We are probably justified in culling animals with obviously britchy, course thigh wool. Black in the wool is very undesirable, but of low incidence. It can, therefore, be selected against, with very little impact on genetic progress in the economically important traits. Badly crooked feet and legs. This is a real stickler with show ring judges and a problem for mutton breed stud producers. However, most normal sheep do not have straight legs and perform marvelous feats of speed, strength, and agility within a fairly wide range of shapes and slopes. I have yet to see any straight-legged Suffolk ram that can keep up with the normal range of crooked-legged, sloped-pasturned range ewes. However, crooked legs out of the normal range (the extremes) can limit performance and should be selected against. Selection should probably be a little more attentive for this problem in rams. Brown eyelid pigment. The intense sunlight and dusty conditions in the Southwest have led to eye irritations in "pink-eyed" Polypay sheep. However, fortunately Polypay sheep are about 43.8% Rambouillet origin, and Rambouillet sheep characteristically have brown pigment in their eyelids. Over 50% of all Polypay sheep have some brown eyelid pigment. About 25% are nearly completely pigmented. We selected our foundation Southwest Polypay flock for this trait and find that the trait is highly heritable. Very little subsequent selection has been required to achieve and maintain brown eyelids on our Southwest Polypay sheep. Eye irritation has not been a problem in our flock in New Mexico and Texas. Abnormalities. Fortunately, the incidence of serious abnormalities in Polypay sheep is very low. All serious abnormalities such as cryptorchidism, intersexes, etc., must be culled.

3) FACTORS AFFECTING RATE OF GENETIC PROGRESS: 1) Heritability, 2) selection differential, and 3) generation interval. Heritability. This is defined as that part of improvement in a trait that you reach for and that you obtain. For example; If the average adjusted weaning weight of all the lambs born and weaned in a flock was 80 lbs., and you selected and bred a ram whose adjusted weaning weight was 90 lbs. to ewes whose average adjusted weaning weight was 90 lbs., and the average adjusted weaning weight of the unselected offspring was 85 lbs., then the heritability would be 50% because you got 50% of what you reached for. The unaccounted for environmental variation makes it impossible to get all of what we reach for. Obviously, the higher the heritability of a trait the more rapidly that trait can be permanently or genetically improved. Some typical heritabilities by Hazel and Terrill in Rambouillet sheep are:

Trait	*Heritability*
Weaning weight	.30
Staple length	.40
Type	.13
Condition	.04
Face cover	.56

Fecundity 1	.10-.15

1 *Average figure from several sources.*

Selection differential. This is the difference in the average value for a trait in the unselected population as compared to the selected population which become parents in the next generation. For example, again, if the average weaning weight of the unselected population is 80 lbs. and the average of the selected replacements is 90 lbs., then the selection differential is 10 lbs. The greater the number of individual offspring in a population (other things being equal) and the fewer the replacements required, the higher will be the selection differential and, therefore, the more rapid will be the genetic progress. Generation interval. This is the average length of time (years) required to replace all of the sheep in a flock with selected replacements. Other things being equal, the shorter the generation interval, the more rapid the genetic progress. This is compromised, however, on the female side because older ewes produce more lambs enhancing the selection differential. The trade-off must be evaluated and the optimum age for replacement can be calculated. This problem does not occur on the male side and, normally, the fastest way to turn over generations is to use only ram lambs unless ram lambs reduce fertility or cannot be adequately evaluated at lamb age for the trait being selected, such as yearling fleece weight.

Annual genetic progress. The annual genetic progress can be estimated by multiplying the heritability by the selection differential and dividing by the average generation interval. This situation gives an important advantage to prolific sheep like the Polypay for two reasons: 1) The selection differential should be larger for Polypays than for most breeds because they produce more offspring per generation to select among. This is especially true in successful accelerated lambing programs. 2) The generation interval can be shorter because both ram and ewe lambs are fertile and productive at an earlier age than in most other breeds.

CONCLUSIONS

We are in the exciting business of making something good, better. Let us remember that the concensus solution to a problem consistently improves on the average achievements of individuals, and that in unity there is strength. Therefore, let us all work together and produce another truly great success story for American agriculture. May the progress of productivity and profitability be ever upward to constantly greener pastures. ★