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Thinking outside the box: Innovative solutions for dairy goat management

Carol Delaney, M.S.

University of Vermont, United States

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ABSTRACT

For the geneticist or breeder, the individual animal is like a potential masterpiece resulting from years of attention to physical details and planned matings. The importance of culturing and nourishing this individual to not only reach its potential but to pass its selected genetics on to progeny is paramount. Thus, all the investment in genetic improvement is now at the mercy of management. Once the goats are in the herd on the farm and the responsibility of the farmer or farm manager, the expression and proliferation of the genotype will be strongly influenced by environmental factors. If maximum milk production per lactation were the real and only goal that could promise farm business and land sustainability, genetic selection would be easy. However, the real goal on farms is to have healthy goats that produce efficiently and are adapted to their environment. This places the development of the goat breeding program in the hands of farmers. To aid farmers in moving beyond the use of total milk production per goat as the feedback mechanism to farm sustainability, the integration of more appropriate progress indicators could include longevity (which, in humans, is estimated at 20% genetic and 80% environmental), the amount of milk or milk component production per body weight of goat, and the degree of involuntary culling.

1. Introduction

Geneticists and elite breeders of dairy goats always position milk production level at the pinnacle of the selection process. Management at these breeding centers curates the results of genetic selection like a museum curates a painting. For the geneticist or breeder, the individual animal is like a potential masterpiece resulting from years of attention to physical details and meticulous data accumulation and analysis. The importance of culturing and nourishing this individual to not only reach its potential but to pass its selected genetics on to progeny is paramount. At the point in time when elite genetic stock is distributed out to commercial herds, the past investment in genetic improvement is now at the mercy of management of the production herd. The expression and proliferation of the genotype will be strongly influenced by environmental factors. For the farmer, to multiply the investment of the purchased dairy doe or buck investment, the productivity of the dairy goat includes not only the number of offspring but also the influence on future milk yield. More emphasis will come from advisors who make a table of breakeven milk production levels and how much profit is made as the milk yield increases. While no one will dispute the leading role that milk yield wields in breeding and selection, there is room for more supporting traits on the stage of animal productivity and farm profitability.

2. Selection for milk production

A cautionary tale of milk yield selection comes from a famous goat dairy farm in the US back in the year 1960. While it appeared that Lilian Sandburg lived in the shadow of her husband, triple Pulitzer prize-winning poet and author, Carl Sandburg, she created her own notoriety with her herd of dairy goats under the registered herd name “Chikaming.” Years before, in 1935, Lilian bought her first dairy goat and actively began breeding for higher milk production. In addition, she kept detailed records of good physical standards and felt confident applying line breeding very carefully to create the strength of body. Some of her original selection criteria for the body traits show up in the American Dairy Goat Association’s linear appraisal today (Fig. 1). It is interesting to note that some of her measurements of goat physique were based on units of the size of her own fingers showing that any farmer can institute a unique selection criteria.

Her methods of selection served her well because “Jon’s Jennifer II” was born in 1956 and gave progressively greater annual milk production that was more than anything she had seen before except with a related doe of similar age. At 4 years, Toggenberg “Jennifer II” set the world record for milk and fat production at 2608 kg milk, 3.3% fat or 86.8 kg fat and that record lasted 22 years. This even brought the attention of the dairy cow world. This doe had a 12.5% inbreeding coefficient from line breeding and she was not treated differently from other goats, Lilian said, yet she grazed, ate alfalfa hay, downed grain

E-mail address: cdhornofplenty@gmail.com.

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1. One hand, fingers spread, should fit easily between the front legs.
2. Forelegs should be straight with no swelling at the joints (no CAEV).
3. The heart girth (area around rib cage) should be large to accommodate lungs and heart.
4. One finger or two should fit between the ribs.
5. The neck should be long and lean (no fat).
6. The goat should walk squarely and gracefully.
7. The withers (vertebrae between the shoulder blades) should be sharp.
8. The backbone should be level and strong to support udder and pregnancy.
9. The loin (from shoulders to back legs) should be wide.
10. The rump should be long to support the ligaments of the udder and be level from hip to hip and hip to tail.
11. The escutcheon area needs to be wide to accommodate the udder.
12. The fore udder should have not pocket; the transition from the belly to the udder should be smooth.
13. The hocks should point straight (parallel with back).
14. The pastern should be short and strong.

Fig. 1. Physical selection criteria for dairy does developed by Lilian Sandburg. Printed in The Piedmont Dairy Goat Association's Newsletter, The Dairy Goat Gazette, November/December 2010.

and molasses water at a rate double the other goats.

What happened subsequently to this doe is a tale worth noting. Late in 1960, another respected goat breeder visited Mrs. Sandburg when "Jennifer II" was at the end of 10 months of lactation yet still milking 5.9 kg per day. Mrs. Sandburg wanted to dry the doe off to save her for the next year and did not heed the advice of a visiting colleague to dry the doe off slowly. Unfortunately, this exceptional doe developed massive mastitis and never produced milk again though she kidded for another five to six years and died at the age of 10.

One interpretation of this story is that farmers as well as researchers can select for high production and attain that goal. The second is that elite animals may not as individuals be sustainable under normal management in a commercial herd setting. The question remains on how one improves the production of commercial herd while honoring the reality of the environment on commercial farms driven to make a profit.

Before and after the infusion of new genetic potential on a farm, it is useful to ask what types of measurements (records) farmers should keep on individuals and on their farm to improve the production performance and to move toward a more sustainable business. Most farmers I know do not like to keep records but they do like to see milk production data as it is a very satisfying and simple indication of progress. It is a reasonable place to start for agricultural professionals advising farmers and evaluating farm businesses. Besides the personal pleasure of being able to influence higher milk production per animal, if you read most cow dairy farm business analyses, it is most often related to improved profits as long as milk quality and or pricing is maintained. That is the primary reason given for striving for more milk per animal.

The second reason we strive for higher milk production in goats is to help defray the high cost of energetic maintenance a dairy goat carries. As persuasively demonstrated by Cannas and Pulina (2008), a 60 kg dairy doe producing 600 kg of milk per year uses 62% of the NEL (net energy lactation) for maintenance and growth requirements allowing 38%of the NEL for milk production. The same size doe producing 800 kg of milk per lactation has closer to an even split of NEL rationing with 54% for maintenance and growth and 46% of the NEL for milk production. Another way to view it is that it would make more sense to feed one goat producing 800 kg of milk than two goats producing 400 kg of milk, if cost of feed and labor are influential cost factors. In summary, as milk production increases per animal, more of the energy from the feed can to make milk than to maintain the animal.

3. Selection for animal efficiency

While easy to demonstrate, these effects of increased milk production are the first superficial step to selection of superior animals and it is then effective and useful to continue to explore the idea of efficiency of milk production. To do this, look at the average annual milk production of the different dairy goat breeds on recorded milk testing. Often, people who want to start a new goat dairy ask themselves which breed of goats would be best for production. For discussion purposes, in the US in 2006, if you were to base your selection of a breed to start your dairy goat farm on total energy corrected milk, you would think that the Alpine, Oberhasli or the Saanen were the best breeds (Table 1).

Then, as an exercise, – this is not scientifically tested but a straight mathematical calculation – if you take the average body weight of the breed of goat into account, you can see that there are other breeds that are actually more efficient, if these numbers are accurate. The LaMancha, the Nigerian Dwarf and the Oberhasli are now looking to be the best choices for efficiency of milk production in terms of kgs milk per kg of kg of body weight (Table 2). This simple computation would indicate that knowledge of animal body weight is expedient and a good record to keep annually.

Before continuing much further on the subject of farm record keeping, an understanding human behavior leads us to encourage farmers to choose their own progress indicators. A progress indicator is a measurement that denotes success or improvement in a farm business and brings farmers closer to reaching their goals. Done this way, farmers are more likely to collect the data and patrol themselves in collecting the information regularly. The progress indicators can vary from personal goals of more time for vacation to less time milking goats to more yield of cheese per goat (Figure 2).

4. Selection for milk quality

Back to the discussion of milk production per animal as a progress indicator, if dairy farmers make cheese or receive a price for their milk based on the solids' content, the progress indicator should go beyond milk production and track total solids (fat and protein) produced per

Table 1
Official breed production records from 2006 American Dairy Goat Association.

Breed	Kg milk (range)	Fat %/kg	Protein %/kg	*ECM	Top Breeds for ECM
Alpine	1083 (514–2000)	3.3%/35	2.9%/31	**1030**	**Alpine**
LaMancha	973 (405–2009)	3.9%/37	3.1%/30	1017	LaMancha
Nig.Dwarf	340 (136–782)	6.5%/21	3.9%/13	483	Nig.Dwarf
Nubian	830 (277–1832)	4.7%/39	3.7%/30	988	Nubian
Oberhasli	1046 (391–1777)	3.6 5/37	2.9%/30	**1038**	**Oberhasli**
Saanen	1185 (491–2336)	3.2%/38	2.9%/34	**1121**	**Saanen**
Toggenburg	1024 (400–1991)	3.2%/32	2.7%/30	966	Toggenburg