The dilemma facing breeders is not so much how to gather genetic information, but rather how to take advantage of the data that have already been collected. This is where ADGA is trying to make a difference. With the help of a USDA-AIPL and the internet, The American Dairy Goat Association has assembled a variety of tools to assist in genetic improvement of dairy goats. These tools include performance testing, linear appraisal, genetic evaluations, indexes which include identifying superior genetics, a young sire development program and DNA testing for identity and alpha s-1 casein. All of these items other than casein testing are included on ADGA's performance pedigrees, the “plans” so to speak in constructing a breeding program geared towards genetic improvement.

With several tools available, selecting the right one depends on the breeder’s goals. Producers have the information to make a more accurate selection of breeding stock than ever before. Because of this, the responsibility and the opportunity for breed improvement are directly upon breeders. The seedstock breeder, hobbyist and the commercial producer can all benefit from selecting seed stock based on fact --not just guesswork as the “eye” sees it. Every breeder can gain insight into the genetics of their selected breeding stock and can maximize genetic progress for economically important traits by using these aids.

Generally the first things to grab are the basics. With performance programs, the basics are production and type information. Without these two fundamentals in place, the rest of the tools cannot be utilized.

PRODUCTION TESTING has been available to producers for many, many years. From the Dairy Herd Improvement Handbook of 1985, the following is still pertinent. The herd is managed through DHI and provides:

- Performance goals. Information describing “what is desired”.
- Descriptive information. Information describing “what is”.
- Diagnostic information. Information describing “what is wrong”.
- Predictive information. Information describing “what if”.
- Prescriptive information. Information describing “what should be”.

DHI is a nationally recognized system for evaluating dairy records. There are various options available from management only to recognition from the registry. At ADGA, the ADVANCED REGISTRY and STAR volumes track generations of collected record information. 305 day and extended records are documented and are available on performance pedigrees. Recognition programs exist within the registry to identify breed leaders in volume, and components and screen with *M designation based on published minimums.

Information obtained from DHIR includes:

- Values for each milking doe & total herd
- Completed & projected records
- Customized features including reproduction, health records, & young stock programs
- Somatic cell count
- Persistency
- Interface with type scores
- Sire/dam/doe genetic values
- Action lists
- Selection objectives

Careful breeding decisions result in ADGA registered animals having records that are consistently higher than the national averages.
<table>
<thead>
<tr>
<th>BREED</th>
<th>MILK LBS</th>
<th>FAT % and LBS</th>
<th>PROTEIN % and LBS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DHIR</td>
<td>ALL</td>
<td>DHIR</td>
</tr>
<tr>
<td>ALPINE</td>
<td>2439</td>
<td>2122</td>
<td>3.2 / 78</td>
</tr>
<tr>
<td>LAMANCHA</td>
<td>2231</td>
<td>1877</td>
<td>3.9 / 87</td>
</tr>
<tr>
<td>NIGERIAN DWARF</td>
<td>806</td>
<td>NA</td>
<td>6.6 / 53</td>
</tr>
<tr>
<td>NUBIAN</td>
<td>1795</td>
<td>1338</td>
<td>4.8 / 85</td>
</tr>
<tr>
<td>OBERHASLI</td>
<td>2208</td>
<td>1786</td>
<td>3.7 / 81</td>
</tr>
<tr>
<td>SAANEN</td>
<td>2470</td>
<td>2032</td>
<td>3.3 / 81</td>
</tr>
<tr>
<td>SABLE</td>
<td>&lt;25 does</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>TOGGENBURG</td>
<td>2302</td>
<td>1843</td>
<td>3.0 / 68</td>
</tr>
</tbody>
</table>

ADGA’s LINEAR APPRAISAL PROGRAM is one that has evolved from classification to appraisal and is the other basic program in the toolbox. This system evaluates individual type traits that affect structural and functional durability in order to take full advantage of the potential for genetic improvement through selection. ADGA’s linear system evaluates each animal & trait individually, evaluates each trait from one observed biological extreme to the other, includes traits that have economic importance and are at a minimum, moderately heritable, and applied uniformly.

The linear appraisal system includes 13 primary traits, one secondary trait, as well as structural categories scored by the appraiser to evaluate functional conformation on mature does and bucks. An optional youngstock program as well as scoring of bucks is also available.

The final categories are determined by using the information from the separate linear traits along with the structural categories as they relate to functional type. The final score is then a mathematically derived score using the weight of the ADGA scorecard areas against the percentage applied in each category.

Crucial for this program in terms of genetic evaluation are 1) evaluation of defined heritable traits of functional importance, 2) Use of numerical scores from one biological extreme to the other, 3) scoring all contemporaries in the herd, 4) evaluation while the animals are still young and as they mature, 5) scoring without knowledge of sires or previous scores, and then 6) analysis at AIPL.

Appraisers are selected based on criteria found in the ADGA guidebook and in ‘pre-training’ sessions where individuals may be evaluated as to their readiness to be an appraiser. They are then trained rigorously, evaluating hundreds of animals both in front of a committee as well as in the field under the direction of senior appraisers. Each year, all appraisers must attend a refresher course. The expected outcome of the refresher session is that our appraisers are able to score animals independently and come within points of each other.

The purpose of a good dairy goat is to produce milk with ease and comfort, while maintaining good health, over many lactations. ADGA’s linear program is one that is important in shaping this kind of dairy goat, animals that are the right type in combining form and function. 40,000+ does have been evaluated since 2000.

GENETIC EVALUATIONS for milk, fat, and protein yields are calculated annually in July and December and evaluations for type from linear information provided by ADGA are calculated in December. These evaluations are provided to regional computing centers, the dairy goat association, and the general public through web access. Data flows from the farms through the regional centers to the Animal Improvement Programs Laboratory. Pedigree correlation is provided by ADGA to AIPL.
Genetic evaluations are reported as (P)redicted (T)ransmitting (A)bilities (PTA’s). A PTA is the genetic merit that an animal is expected to contribute to its offspring and is based on milk records from the Dairy Herd Improvement program and from linear appraisal data.

For yield, the numbers you see reported are actual pounds over the current average. For type, PTA’s are reported as a standard deviation using the final score. PTA’s have two purposes: to rank animals for genetic merit and to estimate genetic differences between animals. A doe with a PTA of 150 for milk is expected to produce daughters averaging 50 lbs per lactation higher production as mature does than daughters of a doe with a PTA of 100. The doe with a 150 lb PTA would rank higher than the doe with the PTA of 100. Only animals of the same breed can be compared. For type, a genetic evaluation of each linear trait with regard to predicted transmittal to offspring as well as final score is provided in the type evaluation. As the scorecard and biologic scale are applied to all breeds uniformly, evaluations are carried out similarly irregardless of breed.

Procedures used to calculate PTA’s account for environmental conditions, relative amounts of information from records, pedigree and progeny, and heritability, among other factors. PTA’s are compared to a genetic base or zero point, updated every 5 years and determined by average genetic merit of does born in that given year.

Genetic evaluations are important because they:
- provide a tool for uniform genetic comparison
- maximize the accuracy of prediction of genetic values and animal rankings
- are an essential tool for selection as well as planning breedings
- are a marketing tool that increases the economic value of the evaluated animals and their offspring
- once evaluations are provided, then all sorts of other tools become available for use.

ELITE RANKINGS – ELITE SIRE AND DOE LISTS are generated with the yield evaluations. These percentile rankings of dairy goats are based on Milk Fat Protein dollars (MFP$), which may one of the single most useful numbers published in the genetic evaluation. It is important as the MFP$ combines the traits for commercial milk production, weighted for economic value in a manufacturing milk market. The economic values used for calculating MFP$ are the same for dairy goats as for dairy cattle. Goat milk most likely has a higher economic value than cow milk, but the relative weighting in the formula is still useful.

For bucks to qualify for elite status, they must be in the top 15% of bucks with evaluation information on recent daughters. Does must be in the top 5%. PTA files are screened to locate does apparently alive before elite lists are produced. A breeder interested in production need only look at Rank Percentile to know about the choices that are available.

THE ADGA PERFORMANCE SUMMARY VOLUME is the blueprint in the toolbox. This information comprises the sire summaries, combining Production Testing records and Linear Appraisal scores, is printed by breed and has daughters listed underneath their sires. In addition, almost all of this information is also found online at adgagenetics.org although in a different and generally easier to use format.

Bucks are listed in alphabetical order, followed by a list of daughters with current DHIR and/or Linear Appraisal information, and sons who qualified for AR or ST awards. A buck can have up to six (6) lines of information, each daughter up to four (4). Fewer lines appear if there is insufficient data available.

For a buck to receive a USDA production summary, he must have at least five daughters with records. If all five daughters are in the same herd, there must also be daughters of another buck in that herd with current records, otherwise no USDA summary is made. USDA calculates type summaries for any buck with at least one daughter appraised.
An example of the information is as follows.

1. L0101010 *B ADGA’S SIRE EXAMPLE 0265629 AMERICAN DAIRY GOAT ASSOCIATION NC

2. BEST OFFICIAL RECORD AVG 9 28 01-07 161 1199 43 3.8 ETA 2:1 150 ETA 1:2 93

3. ALL OFFICIAL ME AVG 7 30 2266 87 3.7

4. USDA PROD: H 7 D 30 L 63 R 59 PTAM -45 PTAF 3 PTA% 0.03 PTAP -2 PTA%P 0.02 PCTILE 24

5. USDA TYPE: FS 0.4 ST 4.3 SR 0.2 DY –0.6 RA 1.3 RW 2.0 FA 0.6 RH 1.6 RA 0.3 MS 0.8 UD 0.4 TP 0.5 TD 2.2 16 DAUS FS 85


7. DAUS: ADGA’S JANE DOE 3*M AR42 CL42 L0202020 0265629 AMERICAN DAIRY GOAT ASSOCIATION NC

8. CURR LACT: 2-00 304 1699 65/3.8 59/3.5 B DAM AR41 L0102010 PTI 2:1 141 PTI 1:2 180

9. CURR APPR: 2-10 FS 78 A ++ A ST12 SR14 DY36 RA23 RW20 RL32 FA29 RH40 RA22 MS24 UD40 TP6 TD16 STCTG A A + V F V + V

10. USDA PROD L 3 R 41 PTAM 1 PTAF –1 PTAP 2 PTA%P 0.01 PCTILE 55

11. SONS: +B ADGA’S JOHN DOE L0201020 0265629

**LINE 1:** Buck’s registration number; award designations, if any; buck’s registered name; production testing volume reference number, prior classification/linear volume reference number; owner’s ADGA ID, name, and state of residence.

**LINE 2:** Best Official Records Average: number of herds; number of daughters; average age at freshening; average number of days in milk; average pounds (actual) of milk; average pounds (actual) butterfat; average percent (%) butterfat; PTI 2:1 and 1:2 or ETA 2:1 and 1:2.

**LINE 3:** All Official ME (Mature Equivalent) Average: number of herds; number of daughters whose records were used in this calculation; average pounds of milk; average pounds of butterfat; average percent (%) butterfat.

**LINE 4:** USDA Production Summary: H = number of herds; D = number of daughters; L = number of lactations; R = reliability; Predicted Transmitting Abilities for milk, PTAM; butterfat, PTAF; percent butterfat, PTA%; protein, PTAP; percent protein, PTA%P; percentile ranking within the breed.

**LINE 5:** USDA Type Summary with Predicted Transmitting Ability for final score (FS) and standard deviations for the individual linear appraisal traits; ST = stature; SR = strength; DY = dairyness; RA = rump angle; RW = rump width; RL = rear legs, side view; FA = fore udder attachment; RH = rear udder height;
RA = rear udder arch; MS = medial suspensory ligament; UD = udder depth; TP = teat placement; TD = teat diameter. This line ends with the total number of daughters appraised or classified (old system) and their average adjusted final score.

**LINE 6:** Buck’s 2003 linear appraisal scores: age at appraisal; final score; major category breakdowns (General Appearance, Dairy Character, Body Capacity); stature; strength; dairyness; rump angle; rump width; rear legs (side view). Last are the scores for structural categories (STCTG): head; shoulder assembly; legs, front; legs, rear; feet; back; rump.

**Daughter Information**

**LINE 7:** CH or GCH designation, if any; doe’s registered name; star milker designation, if any; reference to last Production Testing and/or Linear Appraisal volumes in which the doe appeared; doe’s registration number; owner’s ADGA ID number, name, and state of residence.

**LINE 8:** Current lactation: age at freshening; days in milk (305 or less); pounds milk; pounds butterfat; percent (%) butterfat; pounds protein; percent (%) protein; method of qualifying for a *M (B = both milk and butterfat, M = milk only, F = butterfat only); reference to volume in which the dam last appeared (AR volume reference only); dam’s registration number; doe’s PTI 2:1 and 1:2, or ETA 2:1 and 1:2, or PTAP. (NOTE: It is possible to have more than one “current” lactation appearing on a doe.)

**LINE 9:** 2003 linear appraisal scores: age at appraisal; final score; major category breakdowns (General Appearance, Dairy Character, Body Capacity, Mammary System); stature; strength; dairyness; rump angle; rump width; rear legs (side view); fore udder attachment; rear udder height; rear udder arch; medial suspensory ligament; udder depth; teat placement; teat diameter; structural category (STCTG) scores for: head; shoulder assembly; legs, front; legs, rear; feet; back; rump; udder texture.

**LINE 10:** USDA Production Summary: L= number of lactations; R = reliability; Predicted Transmitting Ability for milk, PTAM; butterfat, PTAF; percent butterfat, PTA%; protein, PTAP; percent protein, PTA%P; percentile ranking within breed.

**Son Information**

**LINE 11:** Award designations, registered name, registration number, owner’s ADGA ID (membership) number, name, and state of residence. (NOTE: For a buck’s son to be listed, he must have qualified for a +B or ++B designation based on his own daughters’ current production information.)

THE PRODUCTION TYPE INDEX (PTI) can be generated once the PTA’s are known. These PTA’s for yield and type are then combined into a Production-Type Index (PTI) that represents the merit of the traits evaluated for the animal. Fat Corrected Milk, based on an accepted conversion formula for milk represents production, and PTA for adjusted final score at appraisal represents type.

Two PTI’s, each weighted differently are provided by ADGA. One has yield weighted twice as much as type (2:1) and the other weights type over yield (1:2), which allows the breeder to choose the emphasis. PTI’s are a relative index, the numbers are relative to breed averages, and again, comparisons should not be made between breeds due to breed constants used in production. In order for a doe to have a PTI, she must have at least one completed DHI production record and have been type evaluated. A buck must have a sire summary for production and type, which requires at least 5 daughter records from the DHI program and at least one daughter with type information.

PTI index rankings are available online at both the ADGA member site and adgagenetics.org

THE YOUNG SIRE DEVELOPMENT PROGRAM is based on the PTA and PTI information. Merging the efforts of the herdowners participating in DHI and Linear Appraisal programs, the Sire Development
committee provides a powerful tool in selecting young bucks for use in the breeding programs based on ETA for young bucks. ETA’s, which are the basis for screening in the ADGA-SDP are the Estimates of a young buck’s Transmitting Ability before he has daughters that are of an age to contribute information regarding yield and type, and are based on production and type information of his ancestors. ETA’s are also weighted, emphasizing either yield over type, or type over yield.

The ETA calculation uses the PTI’s of the sire and dam and subtracts a Qualifying Level (QL) that is set for each breed by a calculation developed by the Sire Development Committee. The current QL’s for each breed are listed in the current SD pamphlet and on the ADGA website. New QL’s are set annually.

Each year, a list is compiled for bucks registered in each quarter that qualifies with a positive ETA in one or both of the two weightings.

Careful selection is the key in deciding whether to use young sires for genetic improvement. The young sires won’t replace the top proven bucks, but the best young sires certainly can equal the lower ranking bucks for genetic progress and eventually, with systematic use, will replace the proven bucks as genetic progress continues.

These merit type indexes (PTI and ETA) are easy to use for selection of sires and does. Animals with the highest values for the index chosen for use represent the best combination of traits to use in your breeding program. Consistent use of the top bucks and does will enable excellent genetic progress and still allow choices based on other qualities such as diversity, kidding ease, and secondary selection on other specific traits.

**THE SUPERIOR GENETICS PROGRAM** builds on the PTI indices. For Superior Genetics (SG), the animal must be in the top 15% (85th percentile ranking or higher) of their breed according to the Production/Type Index (PTI) ranking at least once during the life of the animal. The current listing starts with the 2005 PTI rankings as 2005 was the program’s starting point. To qualify, the ranking may be just in one area (PTI 2:1 or PTI 1:2) or in both areas, however for smaller breeds, a negative PTI ranking even if in the top 15% will not be recognized. Once earned, the SG or SGCH becomes a permanent prefix to the animal’s name and replaces show prefixes that may have already been a part of the animal’s name.

PTIs generally change twice per year, after the genetic evaluations are run by USDA. New SG will appear at those times. Once earned, even though the ranking may drop, the SG designation remains. The PTI calculation relies on breed constants for fat % and standard deviations for fat corrected milk so are only applied to distinct breeds and not Experimentals.

**DNA TYPING** is a tool to safeguard the investment into building a breeding program. ADGA provides an opportunity to identify & record genetic information at a reasonable cost. Benefits of DNA typing include:

- Permanent record of identification linked to ID & tattoo;
- Protects Registry Integrity;
- Invaluable for identifying later progeny through parentage verification;
- Increases an animal’s worth & the value of the herd information.

In addition, alpha s-1 casein testing is available. Knowing the specific genetic polymorphism at goat casein loci on breeding stock allows the breeder to set up breeding and selection programs targeted towards the improvement of cheesemaking yield by selecting for high expression alleles, or selecting for animals with low levels which may be of benefit to those with milk sensitivities.

The test is designed to detect low level variants for casein - E, F, and N. High level variants are then reported as A or B, which represent several specific alleles.
BENEFITS to the use of performance program tools and the construction of a successful genetic improvement program are:

- target traits of the population will have been moved in the desired direction,
- the population will have a national database with information that can be used for current and retrospective studies,
- objective decisions can be made on genetic, management, economics, and other issues,
- realistic projections as to genetic improvement, management, and economic plans can be based on a reliable source of information, and
- the population will show progress in all aspects related to genetic improvement.

Genetic improvement is permanent and cumulative, so it is a sustainable and cost-effective method of directing and stabilizing dairy goat performance according to each breeder’s goals. Accumulating data on pedigree, production, type and auxiliary traits from as many herds as possible provides for greater precision in evaluations. Accurate performance records, visual trait assessments and pedigree are needed to develop a complete portrait of our individual herds. These tools are a form of quality assurance for the selection of breeding animals.

WHEN THE COLLECTED INFORMATION IS USED CONSISTENTLY, GENETIC IMPROVEMENTS CAN BE MADE RAPIDLY AND PREDICTABLY.