AMERICAN DAIRY GOAT ASSOCIATION

YEAR END REPORT **August 27, 2016**

COMMITTEE: GENETIC ADVANCEMENT

COMMITTEE CHAIR: Elizabeth Henning

COMMITTEE MEMBERS: Mark Baden, Lynn Benedict, Holly Buroker, Rebekah Clarke, Linda Colquitt, Lynn Fleming, Dan Greene, Anne Jones, Jeff Klein, Marshall Losey, Annita Puterbaugh, Ericka Ryan, Cara Sammons, Teresa Wade, Kathy Winters, Lisa Shepard (advisor)

1. **COMMITTEE GOALS & OBJECTIVES FOR THE YEAR**:

   a. Evaluate current bundling programs and continue to pursue additional options to increase the DNA database.
   b. Pursue additional ways to promote ADGA's genetic programs through member education.
   c. Highlight information concerning domestic and international genetic research that will provide our membership with a basis for understanding the need for ADGA's continued involvement in genetic research and the collection of genetic information.
   d. Encourage completion of the Breed Identification project.

2. **SUMMARY OF WORK**
   a. Articles educating the dairy goat community about ADGA's genetic programs have been published in both the Dairy Goat Journal and United Caprine News as space allowed in the publications.
   b. The committee prepared and approved a general policy regarding undesirable genetic factors in dairy goats. Committee Vote (13Y,0N,3NV) SEE EXHIBIT A
   c. Based on the approval of Exhibit A, the committee voted to refer to the Spotlight Sale and Colorama Sale committees a request that they consider adopting a policy regarding genetic defects. (Committee Vote 11Y, 0N, 5NV.) A copy of Exhibit A was subsequently provided to the chairs of Spotlight Sale and Colorama Sale committees.
   d. The committee prepared and approved recognition of the N-ACETYLGLUCOSAMINE 6-SULFATASE-DEFICIENCY (G6S) genetic defect in dairy goats. Committee Vote (9Y, 6N, 1NV) SEE EXHIBIT B
   e. The committee prepared and approved adoption of a policy regarding identification and reporting of Alpha S1 Casein alleles in dairy goats. Committee Vote (12Y, 2N, 1NV,1A) SEE EXHIBIT C

3. **FINANCIAL REPORT: COMMITTEE EXPENSES THUS FAR**
   None

4. **PROBLEMS ENCOUNTERED**
   The chair wishes to thank the committee for thoughtful discussion and a productive year.

5. **DECISIONS REQUIRING BOARD ACTION**
   a. Adoption of Genetic Defects General Policy – see EXHIBIT A
      Insertion in Guidebook, Bylaws Article XXI.
   b. Recognition of Genetic Defect G6S – see EXHIBIT B
      Insertion in Guidebook, Bylaws Article XXI, A.
   c. Approval of Alpha S1 Casein identification and reporting policy – See EXHIBIT C.

Insertion in Guidebook, Bylaws, Article XXII.

Current Bylaws Article XXI (Schedule of Rates) would become Article XXIII.

6. **WORK TO BE ADDRESSED BY NEXT YEAR'S COMMITTEE**:
   a. Continue to submit articles for publication that promote ADGA's genetic programs and genetic advancement in dairy goats.
   b. Continue to discuss and pursue additional means of increasing the DNA database and the use of ADGA's genetic programs. Consider ways to expand the ADGA Plus program by offering additional benefits to participants.
   c. Explore additional ways to generate funds to support genetic research.
   d. Continue to encourage completion of the breed identification project.

7. **LONG RANGE GOALS (5 YEARS) FOR COMMITTEE**:

   The International goat research community is actively pursuing numerous projects to map the goat genome and provide information concerning the genetic factors that influence not only production parameters, but also genetic resistance to parasitism and disease that negatively impact the quality and quantity of goat production capabilities. This committee must take a leadership role in examining and suggesting implementation of strategies that will ensure that ADGA is contributing to the database and ongoing research in these important areas that will have an increasing impact on the ability of our membership to compete genetically in the years ahead.

8. **POSSIBLE FINANCIAL IMPLICATIONS**:
   a. ADGA is realizing a substantial increase in DNA testing in part due to the availability of genetic tests at a reduced rate.
   b. Staff time is required to maintain the DNA database
   c. A fee for inclusion of DNA test results not contracted through ADGA will be necessary to offset additional costs during the "Grandfather" period.

9. **INFORMATION TECHNOLOGY EFFECT**:
   Other than the initial process for designed in ROSS for DNA markers and parentage requests, DNA has had no subsequent infrastructure improvements to handle new tests or results for any type of test. This all has to be handled manually to maintain the database. In order to keep up with the demand (up over 300% this year), this will need to be addressed as we work towards the rewrite for ROSS.

Elizabeth R Henning, **Chair**

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EXHIBIT A:

POLICIES REGARDING UNDESIRABLE GENETIC FACTORS IN DAIRY GOATS

Adopted: October 27, 2016

Reason for Policy

Genetic defects result
ing in disease have been identified in numerous animal species. These defects and diseases have wide-ranging effects, from mild and manageable to severe and terminal. Passing these genetic defects on to successive generations may cause unnecessary suffering and losses in productivity.

ADGA feels that it is important to proactively develop procedures and programs to aid in the identification and control of genetically related defects and diseases, and provide guidance in helping to identify and manage specific genetic defects in dairy goats.

Process for Identifying Undesirable Genetic Factors

In determining genetic factors that are undesirable, ADGA will consider all relevant data. In order to make such a determination, experts in the field shall be consulted, and their recommendations will be submitted to ADGA along with trait specific data. Upon consideration of this information, the Board of Directors may approve a policy designating procedures for the identification, recording and reporting of carriers of a genetic defect.
ADGA shall maintain a list of undesirable genetic factors that have been identified through genetic testing and for which a policy has been designated by the ADGA Board of Directors.

Process for Identification of Animals With a Genetic Defect

In addition to maintaining a list of undesirable genetic factors, ADGA will provide and update information that includes description of the condition resulting from the defect, inheritance patterns, and the genetic tests available to determine animal status. Information regarding testing resources will be made available through ADGA to its membership and the public. The testing process will incorporate requirements for approved tests, designated laboratories, test forms, and data release forms. Testing, using the approved test(s,) may be conducted by an alternative, approved laboratory.

To be accepted by ADGA, results must be reported from an approved laboratory directly to ADGA and samples must be identified with either the animal's registration number, or if unregistered, the animal's tattoo, DOB, breed, and gender.

ADGA shall maintain a database of accepted test results.

Process for Notification, Publication and Release of Information

Following recognition of a specific genetic defect by the ADGA Board of Directors and the establishment of policies for recording and reporting of that defect, testing results will be accepted by ADGA only if provided directly to ADGA by an approved laboratory. The date of implementation of these procedures and policies shall be made available to ADGA members and the public.

Policies regarding registration/recordation of designated carrier animals and/or their offspring shall be established by ADGA and approved by the Board of Directors for each recognized genetic defect.

Testing results and the identification of carriers prior to formal action by the ADGA Board of Directors may be accepted. Policies and procedures for accepting pre-designation testing will be developed for each specific defect as deemed necessary.

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EXHIBIT B:

ADGA - RECOGNIZED GENETIC DEFECT:
N-ACETYLGLUCOSAMINE 6-SULFATASE-DEFICIENCY (G6S, MPSIIID)

Recognized: October 27, 2016

WHAT IS G-6-S?

N-ACETYLGLUCOSAMINE 6-SULFATASE deficiency is an inherited metabolic defect known to occur in Nubian goats and related crosses. A mutation in the G6S gene renders the enzyme incapable of degrading complex polysaccharides which then abnormally accumulate in tissues such as central nervous system and viscera. Affected animals may exhibit a variety of symptoms including delayed motor development and growth retardation, and are not expected to live a normal lifespan.

The disease is inherited in an autosomal recessive fashion. Therefore, both sexes are equally affected and two copies of the defective gene must be present for signs of the disorder to be observed. Breeding two carrier goats, which are phenotypically normal but each possessing a single copy of the mutation, is predicted to produce 25% affected offspring. The predicted genotypic frequency for this disorder has been reported to be approximately 74.2% normal, 23.9% carrier, and 1.9% affected. G6S carrier status is determined by observation of a mutation, changing a C to T in codon 102 of the 559-amino acid G6S protein. This mutation leads to the formation of a defective, truncated protein. Testing is available at a contracted rate to all dairy goat owners through ADGA.

RATIONALE FOR POLICY

Because G6S homozygous (affected) animals may not be symptomatic prior to reproductive age, and heterozygous (carrier) animals have not been demonstrated to be symptomatic, both affected and carrier animals may reproduce and pass on the defect. Genetic testing for this disease is definitive and is available at reasonable contracted cost through ADGA.

With recognition by the ADGA Board of Directors of G6S deficiency as an undesirable genetic factor, information concerning the G6S status of potentially affected or carrier animals will become available to all dairy goat owners enabling them to limit carrier-to-carrier matings and manage the impact of the disorder within their herd and the dairy goat population at large.

ADGA G6S POLICY

ADGA offers G6S testing and carrier status recording to members and the wider goat community in order to track this disease in pedigrees, to reduce its incidence, and assist in eventual eradication of the defect. (See “Grandfather clause” below.) ADGA will maintain a list of approved testing laboratories, and that information as well as forms and instructions for sample submission will be provided upon request.

Upon receipt of testing results from an approved laboratory, ADGA will maintain a database of

G6S testing results. **Upon owner request**, G6S testing results will be included as part of the goat's pedigree information and will become part of the animal's permanent record in the ADGA pedigree database.

Designations shall be recorded as:

G6S-N/N = Homozygous normal: animals with this genotype are expected to be **normal** with respect to **N-ACETYLGLUCOSAMINE 6-SULFATASE** lysosomal storage disease.
G6S-N/G = Heterozygous for the mutation: animals with this genotype are **carriers** with respect to **N-ACETYLGLUCOSAMINE 6-SULFATASE** lysosomal storage disease.
G6S-G/G = Homozygous for the mutation: animals with this genotype are expected to be **affected** with respect to **N-ACETYLGLUCOSAMINE 6-SULFATASE** lysosomal storage disease.

Following current protocol regarding DNA samples, testing results will be reported as follows:

1. If semen, the submitter gets the report.
2. If registered and not owned by the submitter, documentation that permission has been granted by the owner will be required. Then, the submitter gets the report.
3. If not registered, the submitter gets the report.
4. If registered and owned, the owner gets the report.

As with all DNA information contracted through ADGA, ADGA retains proprietary rights to the results of G6S disease status testing for each animal. Samples submitted for analysis of G6S status through the ADGA shall become the property of the contract laboratory upon receipt and may be used for general research purposes. Persons submitting samples for G6S testing through the ADGA agree to indemnify and hold the ADGA harmless against any losses, costs or damages, including attorney fees arising from the results of the performed tests.

IMPLEMENTATION OF POLICY

Effective Date: October 27, 2016

"Grandfather Clause":

For a period of one year following the implementation of this policy, animals tested prior to implementation shall be entitled to have test results (G6S-N/N, N/G or G/G) included in the ADGA database upon submission of paperwork confirming test results issued by the laboratory that conducted the test. Information provided by the laboratory must include the animal's registration number, **OR** breed, gender, date of birth and tattoo information in addition to test results. **Upon owner request**, this information may also be included in the animal's permanent record as outlined above. A processing fee as well as the standard fee for certificate revision shall apply.

GENETIC ADVANCEMENT COMMITTEE – YEAR END REPORT 2016
EXHIBIT C:

ADGA ALPHA S1 CASEIN POLICY

WHAT IS ALPHA S1 CASEIN?

The α s1-casein is a protein polymorphism of goat milk first described in Europe, in the French Alpine and Saanen breeds, in the early nineteen eighties. These polymorphisms have been found to affect cheesemaking due to differences in protein content, renneting properties (faster coagulation and firmer curd) and a possible connection in relation to cheese flavor. In one study, the results of researches conducted on homozygous individuals for the various alleles confirmed the effects of genotype on the casein content in milk by showing the cheesemaking yield observed in milk produced by those animals with strong alleles was 7% higher in comparison with those with medium alleles and 15% higher than those with weak alleles. **In addition, there have been studies that suggest that the genetic variation resulting in low or null levels could contribute to milk with a lesser antigenic burden and be of potential benefit to those with milk sensitivities.**

ADGA has contracted with the Veterinary Genetics Laboratory, University of California, Davis, to provide the test at a discounted rate and is currently maintaining a database of results.

The test is designed to detect low-level variants for casein – E, F, and N, **along with O1, which is associated with the lack of alpha s1 casein production**. High-level variants are then reported as A or B, which represent several specific alleles.

Any combination of A and B variants will produce high amounts of alpha s1 casein. A combination of A or B variant with E, F or N variant will produce intermediate amounts of alpha s1 casein.
Any combination of E, F and N variants will produce low amounts of alpha s1 casein. Goats with two copies of the O1 "null" variant will not produce alpha s1 casein protein. The test is not designed to detect subvariants of A and B.

RATIONALE FOR POLICY

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.

ADGA ALPHA S1 CASEIN POLICY

ADGA offers Alpha S1 Casein testing and recording to members and the wider goat community. ADGA will maintain a list of approved testing laboratories, and that information as well as forms and instructions for sample submission will be provided upon request.
Upon receipt of testing results from an approved laboratory, ADGA will maintain a database of Alpha S1 casein testing results. Upon owner request, Alpha S1 casein testing results will be included as part of the goat's pedigree information and will become part of the animal's permanent record in the ADGA pedigree database.

A report would appear as follows along with Animal information:

ALPHA S1 CASEIN
RESULT = A/E

Following current protocol regarding DNA samples, testing results will be reported as follows:

1. **If semen, the submitter gets the report.**
2. **If registered and not owned by the submitter, documentation that permission has been granted by the owner will be required. Then, the submitter gets the report.**
3. **If not registered, the submitter gets the report.**
4. **If registered and owned, the owner gets the report.**

As with all DNA information contracted through ADGA, ADGA retains proprietary rights to the results of Alpha S1 casein testing for each animal. Samples submitted for analysis of Alpha S1 Casein status through the ADGA shall become the property of the contract laboratory upon receipt and may be used for general research purposes. Persons submitting samples for Alpha S1 Casein testing through the ADGA agree to indemnify and hold the ADGA harmless against any losses, costs or damages, including attorney fees arising from the results of the performed tests.

IMPLEMENTATION OF POLICY
Effective Date: October 27, 2016

"GRANDFATHER CLAUSE":
For a period of one year following the implementation of this policy, animals tested prior to the date of implementation shall be entitled to have Alpha S1 Casein test results included in the ADGA database upon submission of paperwork confirming test results issued by the laboratory that conducted the test. Information provided by the laboratory must include the animal's registration number, OR breed, gender, date of birth and tattoo information in addition to test results. Upon owner request, this information may also be included in the animal's permanent record as outlined above. A processing fee as well as the standard fee for certificate revision shall apply.