UNDERSTANDING AND USING GENEMAX ADVANTAGE RESULTS

GeneMax® Advantage™ is a genomic test created in collaboration between Angus Genetics Inc. (AGI), Certified Angus Beef® (CAB) and Zoetis to help inform commercial Angus replacement female selection, breeding and marketing. Features of GeneMax Advantage include: three comprehensive economic index scores; genetic predictions for ten individual traits; customizable Smart Outlier Reporting to identify animals with genetic merit that may be out of bounds for feed costs due to size and milk, docility and tenderness; and Sire Match to HD 50K and i50K™ tested Angus A.I. and natural service bull batteries. More detailed information about each of these features is available in the GeneMax Advantage Technical Bulletin.

GETTING STARTED - TESTING STRATEGY AND SAMPLE COLLECTION

Zoetis and customer experiences with different testing strategies generally suggests the following plan of action:

- Test the top two-thirds to three-quarters of the heifer crop that were earliest born and meet visual appraisal criteria (i.e. sound feet and legs, acceptable expressed growth and frame size, adequate body capacity, calm docility, etc.).

- Collect tissue (Allflex), blood card or hair (follicles from switch of tail) samples during pre-weaning, weaning or Bangs vaccination processing.

- Submit samples and completed order forms to AGI at least 30 days in advance of selection decisions. Information about DNA collection options, instructions and ordering are available at genemaxadvantage.com.

- Watch your email for results and a link to secured AGI customer login.

GENEMAX ADVANTAGE RESULTS

GeneMax Advantage results are delivered by email in a variety of formats, including:

- An attached printable PDF report sorted by Total Advantage Score.

- A link to online login, access, management and customization of results on the AGI customer website. An example screenshot of results and information about various interactive functions are included therein.

- **Exportable PDF and Excel® reports can be generated and downloaded from the AGI login – with customized outliers identified and sorted for desired purposes - which can be used for offline recordkeeping and decision making.**

SELECTION DECISIONS

Depending on the number of replacements needed, the simplest yet still comprehensive strategy is to select roughly the top one-half of tested heifers based primarily on their Total Advantage Score. For the majority of operations, this will generally propagate Angus-based cow herds (replacements) and feeder/fed cattle with multiple-trait advancement for the highest net returns across the complete CAB supply chain.

For producers with environmental constraints (i.e. regions of lower rainfall) that put a premium on cow adaptability, selection based on Cow Advantage Scores coupled with the heifer pregnancy trait prediction and close attention to Cow Cost outliers will limit cow size and milk while emphasizing reproduction and the resulting number of calves produced for sale at weaning. Alternatively, for producers with consistent feed resources and the opportunity to benefit directly from retained ownership or from special feeder

cattle marketing programs, added emphasis on Feeder Advantage and associated individual trait predictions will enhance feeder and fed cattle returns.
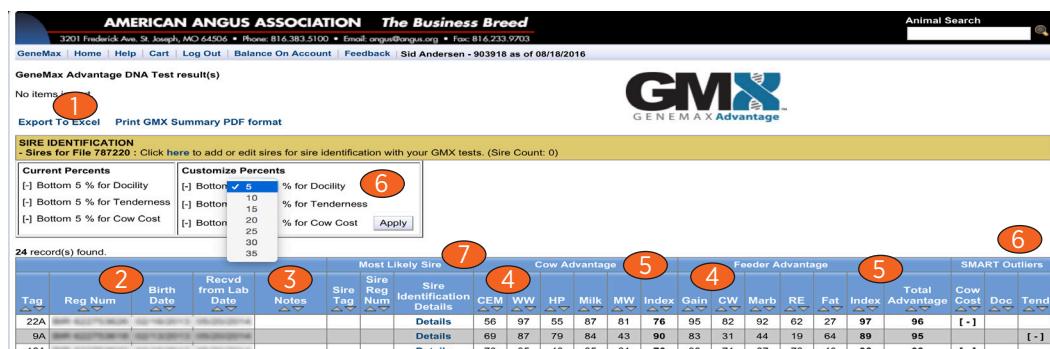
Increasingly, GeneMax Advantage results from tested heifers are helping customers fine-tune their Angus bull buying. When Advantage indexes, individual trait predictions or outlier identification point to specific opportunities for improvement (i.e. cow cost, marbling, docility), emphasis on associated GE-EPDs and $Indexes powered by HD 50K and i50K helps guide customers to the most complementary Angus bulls.

BREEDING DECISIONS AND FEEDER CATTLE MARKETING
GeneMax Advantage results enable a lifetime of more informed breeding (mating) and marketing decisions for greater net returns, including:

- Use of Sire Match information to avoid inbreeding and associated depression in performance primarily related to reproductive, survival and fitness traits.

- Annually throughout their lifetimes, tested females can be mated more wisely to A.I. sires and/or bull batteries that accentuate genetic strengths and correct weaknesses using Advantage Score, individual trait, outlier and Sire Match information.

- Annually, GeneMax Advantage information from tested heifers can be used to help inform marketing and price discovery of untested steer and unselected heifer mates through various feeder cattle marketing programs that integrate genetic and health information.

GENEMAX ADVANTAGE RESULTS

Tag	Reg Num	Birth Date	Recvd from Lab Date	Notes	Sire Tag	Sire Reg Num	Sire Identification Details	CEM	WW	HP	Milk	MW	Index	Gain	CW	Marb	RE	Fat	Index	Total Advantage	Cow Cost	Doc	Tend
22A							Details	56	97	55	87	81	76	95	82	92	62	27	97	96	[-]		
9A							Details	69	87	79	84	43	90	83	31	44	19	64	89	95			[-]
18A							Details	70	95	48	85	61	76	93	71	67	72	40	96	93	[-]		

1 **Export to Excel and Print GMX Summary PDF Format** – Within the secure customer section of the AGI website, select "Export to Excel" to download customized results in spreadsheet format. Click "Print GMX Summary PDF Format" to access a print-friendly PDF version of the results.

2 **Tag, Reg/Assn Num, Birth Date, Recvd from Lab Date** – Animal identifiers include the ranch tag number, American Angus Association (Assn) assigned commercial animal registration (Reg) number, birthdate and the date that results were received from the lab (Recvd) for internal monitoring of turnaround times.

3 **Notes –** The notes column is used to report Sample Failed and Resubmit information to customers.

4 **Individual Trait Scores –** GeneMax Advantage individual trait scores range from 1 to 100 and are based on underlying genomic predictions. Scores of 50

represent average genetic merit as benchmarked against the tested commercial Angus reference population (n=37,519), and generally higher sores are more desirable. Exceptions include predictions for milk and mature cow weight, where intermediate levels of genetic merit are often more optimal, and predictions for fat thickness where higher scores indicate less fat and more favorable contribution to USDA yield grade.

- **Calving Ease Total Maternal (CEM) –** Higher scores indicate greater likelihood of unassisted calving due to underlying genomic predictions for maternal (i.e. pelvic size) and direct (i.e. birth weight) effects on calving ease.

- **Weaning Weight (WW) -** Higher scores represent genetic merit for more growth - heavier weaning weight (lbs.), transmitted to progeny.

- **Heifer Pregnancy (HP) –** Higher scores correspond to higher probability of pregnancy at the end of the first breeding season due to genomic predictions for inherent fertility.

• **Milk –** Higher scores represent greater predicted genetic potential for the maternal component of weaning weight – which favorably impacts progeny weaning weights but unfavorably influences feed requirements, associated costs and possibly expressed future reproductive performance (if feed requirements are not met). Intermediate Milk score values are likely optimal for many situations.

• **Mature Weight (MW) –** Higher scores equate to genomic predictions for heavier mature cow weight, less favorable associated feed requirements and possibly expressed reproductive performance (similar to milk), but higher cow salvage value. As with milk, intermediate MW score values are probably optimal for many production scenarios.

• **Gain –** Higher scores mean more genetic potential for post-weaning growth – gain in the feedyard - transmitted to progeny. Typically, scores for weaning weight and gain are highly related.

• **Carcass Weight (CW) –** Higher scores indicate genetic merit for heavier carcass weights transmitted to progeny. While heavier carcass weights are generally more valuable, nonconforming excessively heavy carcasses - currently greater than 1,000 and/or 1,050 lbs. - are severely discounted. It follows that especially high CW scores adversely impact Feeder Advantage Score values.

• **Marbling (Marb) –** Higher scores are associated with genetic merit for more marbling and more favorable USDA Quality Grades expected to be transmitted to offspring.

• **Ribeye Area (RE) –** Higher scores communicate genomic predictions for larger ribeye areas (square inches) and more favorable associated USDA Yield Grades passed on to progeny.

• **Fat –** Higher scores indicate genetics for less fat thickness (in) as measured between the 12th and 13th rib on carcasses, and more favorable associated USDA Yield Grades, transmitted to offspring.

5 **GMX Advantage Index Scores –** GeneMax Advantage scores range from 1 to 100 (higher scores are better, average score = 50) and rank females for predicted net profit from combined genetic merit for the following stages of the production:

• **Cow Advantage –** Predicts differences in profitability from heifer pregnancy, calving ease total maternal, milk production, growth and costs due to cow size and milk, assuming progeny are sold at or shortly after weaning.

• **Feeder Advantage –** Predicts differences in net return of feeder calf progeny due to transmitted genetics for post-weaning growth, feed intake, carcass weight and CAB carcass merit (marbling and traits associated with USDA Quality and Yield Grades).

• **Total Advantage –** Predicts differences in profitability from genetic merit across all economically relevant traits captured in the Cow and Feeder Advantage scores.

6 **SMART Outliers –** The SMART Outlier Reporting section of the report identifies animals (using a minus sign [-]) that possess genetic merit for undesirable cow cost, docility and tenderness. The default threshold for identifying these animals is the least desirable 5% of the tested commercial Angus female reference population (n=37,519 head). GeneMax® Advantage™ customers may customize these undesirable outlier thresholds using the dropdown options of 5%, 10%, 15% … 35%, on the online report.

7 **Most Likely Sire –** The Sire Match feature reports the tag, registration number and name of the most likely Angus sire from the HD 50K and i50K-tested, registered and transferred Angus bull battery. Angus bulls may be tested and Sire Match may be included either before or after candidate daughters are tested with GeneMax Advantage. Commercial producers are encouraged to buy registered, transferred and HD 50K or i50K-tested Angus bulls to enable the Sire Match feature.

LEARN MORE

If you have any questions or need assistance as you get started with GeneMax Advantage, visit genemaxadvantage.com or angus.org/AGI - or contact your Zoetis or AGI representative.