

## Experiences with NSIP in the Virginia Tech Flocks

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The registered Suffolk and Dorset flocks at Virginia Tech are utilized heavily in the teaching, research and outreach missions of the Department of Animal & Poultry Sciences. The Suffolk flock has been selected for sheep that excel in the traits that have made the breed popular- growth and carcass composition. In addition to these fundamental traits, moderate mature size, maternal performance, longevity, structural correctness and eye appeal, genetic resistance to scrapie, and spider-free genotype are also important in our balanced-trait approach. The Dorset flock is maintained as a fall-lambing flock, with emphasis on out-of-season breeding, maternal ability, growth and carcass traits, and moderate mature size. Extensive performance records, as well as selection technologies such as EBVs and DNA genotypes, are used in the selection decisions for both flocks.

### Overview

The flocks have been enrolled in NSIP since its inception in 1990, with complete recording of all ewes and lambs since 1999. Performance data recorded includes birth, weaning, and post-weaning weights, along with post-weaning ultrasound fat thickness and loin muscle depth. Over the past two years, fecal egg count (FEC) and mature ewe weights have also been included in NSIP. "Total flock enrollment" is practiced, whereby available records from all animals are included for NSIP analysis. The Virginia Tech flock has been utilized in the development of procedures and protocols for NSIP traits, such as adjustment factors for ultrasound scan data.

The National Sheep Improvement Program, which provides Estimated Breeding Values (EBVs) generated through LAMBPLAN in Australia. EBVs provide estimates of the genetic value of an animal as a parent (EBVs are similar to EPDs- an EPD is half the value of the EBV). Specifically, half the difference in EBVs between two individuals predict differences in performance between their future offspring when each is mated to animals of the same genetic merit. All known information on a particular animal is used to calculate its EBV, including performance data (weights, lambing records, carcass ultrasound) on the animal itself, information from its ancestors (sire and dam, grandsire, great grandsire, maternal grandsire, etc.), collateral relatives (brothers and sisters), and progeny (including progeny that are parents themselves). EBVs are reported for the following traits:

**Weaning Wt. EBV:** predicts genetic merit for weaning growth potential (measured in kg). A ram with a +2.0 WW EBV would be expected to produce progeny that average 1.0 kg heavier at 60 days of age when compared to a ram with a +0.0 WW EBV (ram transmits half the difference of the EBV difference to progeny)

**Post-weaning Wt. EBV:** Provides indication of post-weaning growth potential, and reflects differences in progeny weight at 120 days of age (expressed in kg).

**Maternal Milk EBV:** Estimates genetic differences in mothering ability and milk production. EBV reflects differences in daughter's lambs weaning weight (kg) primarily due to superior milk production.

**Maternal Lambs Weaned EBV:** EBV indicates genetic potential for fertility and lamb survival, and is expressed as a percentage. Comparing an animal with a +10 Lambs Weaned EBV vs. an animal which is +5, the animal with +10 Lambs Weaned EBV would be expected to produce daughters which wean 2.5% more lambs (half the difference in their EBVs)

**Loin Muscle Depth EBV:** EBV reflects genetic merit for loin muscle depth (mm) at constant live weight. Larger EBVs indicate more muscularity. EBV is derived from ultrasound scan data.

**Fat Depth EBV:** EBV predicts genetic merit for fat thickness at 12-13th rib at constant live weight (expressed in mm). EBV derived from ultrasound scan data.

**Fecal Egg Count EBV:** EBV predicts genetic merit for parasite resistance based on worm egg counts. Animals with low FEC EBVs are expected to have greater parasite resistance. EBV is expressed as percentage.

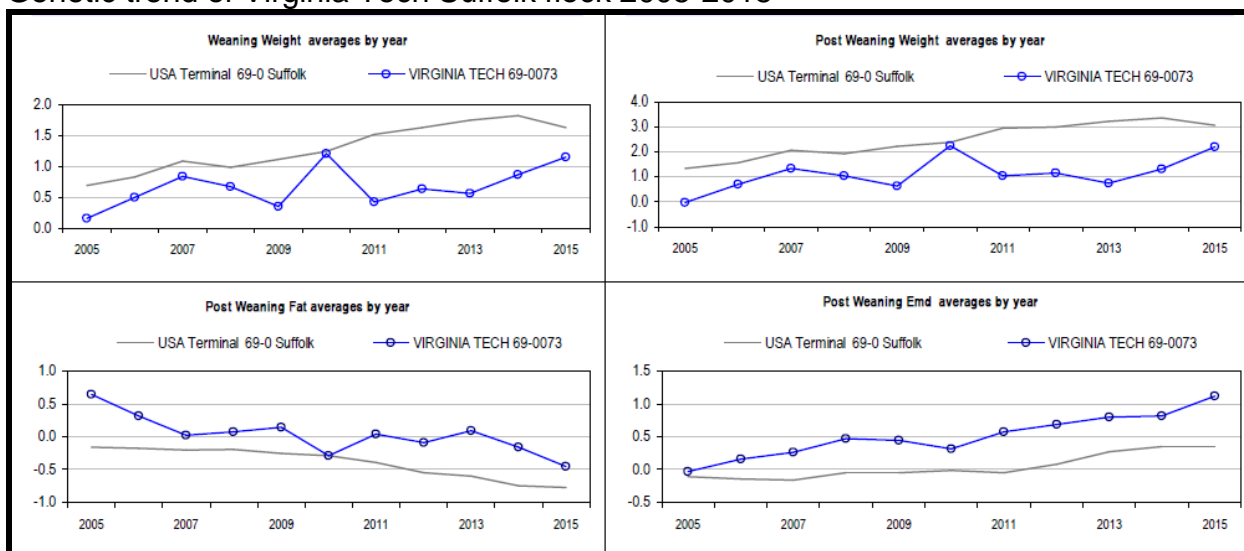
Given the importance of parasite control to sheep enterprises, a concerted effort to establish the genetic merit of both the Suffolk and Dorset flocks for parasite resistance was initiated. The goal of this effort has been to characterize the current status of both flocks relative to their genetic merit for parasite resistance, with long-term goal of utilizing this as selection objective. This was accomplished through the collection of FEC in both the mature ewe flock as well as lamb crops. Protocols for data collection and reporting in NSIP were followed utilizing protocols established for the Katahdin breed. FEC were collected on mature ewes post-lambing, and FEC measures taken on ewe lambs in early fall prior to breeding. In both cases, FEC was measured under natural infection. Ram lambs from the flock are developed at the Virginia Sheep Evaluation Station (Ram Test). In 2015, all ram lambs were artificially challenged with parasites and FEC response measured utilizing standard research protocols. Additionally, a subset of Dorset and Suffolk rams participated in the Southwest forage-based ram test, and FEC data from these animals was also utilized. In total, over the past two years approximately 300 sheep with FEC data have been included in NSIP for the development of FEC EBVs on the VT flocks.

## **Results**

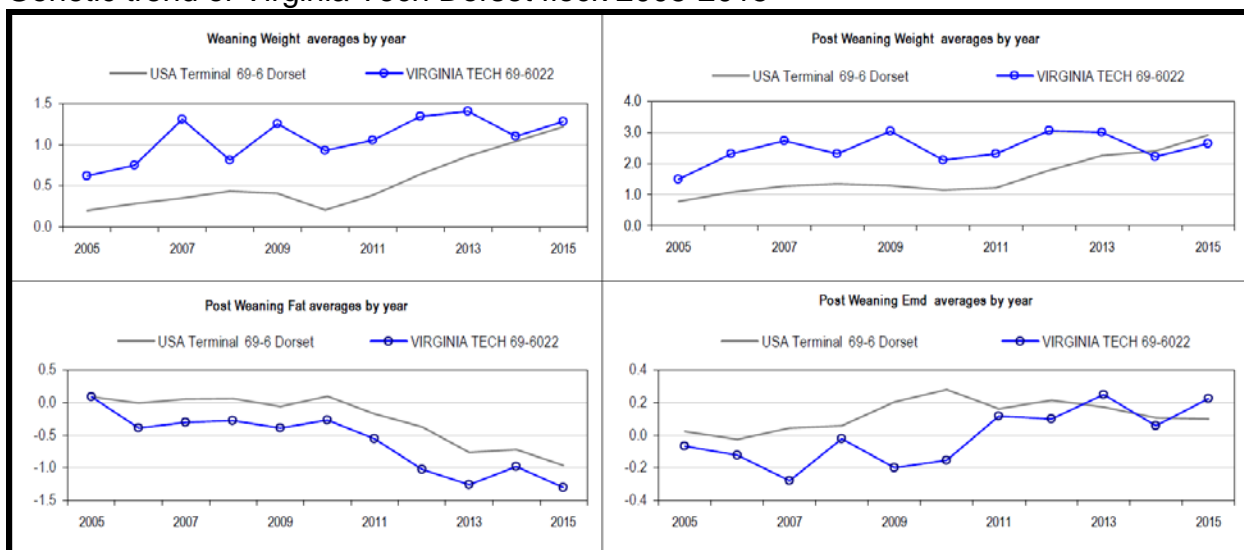
The following graphs depict the genetic trend in the Virginia Tech flocks for growth and carcass traits. Growth traits in the Suffolk flock have followed breed genetic trends, although the mean EBV for both weaning weight and post-weaning weight is lower in the VT flock compared to breed average. In contrast, the VT Suffolk flock has steadily improved loin muscle depth (Emd), accompanied by reduced carcass fatness. Trends are similar for the Dorset flock, although the VT Dorset flock is higher in growth relative to other NSIP Dorset flocks. Most importantly, these graphs indicate that selection to improve these traits is taking place, as genetic merit indicated by EBVs are improving over time. Additionally, these graphs illustrate the differences in breeding goals between the two flocks compared to their breed. The VT Suffolk flock has concentrated on a

balance of growth and muscling, and not selected for extremes in growth (and potential accompanying mature size).

### Genetic trend of Virginia Tech Suffolk flock 2005-2015



### Genetic trend of Virginia Tech Dorset flock 2005-2015



The following tables summarize the EBVs on the 2015 lamb crops for both flocks. Flock average EBVs provide insight as to the average genetic merit of the current lamb crop, which can be compared to the breed based on percentile ranking. Percentile rankings indicate both flocks are very strong in their genetic merit for muscling and milk, and are slightly below breed average for growth. The VT Suffolk flock is lower in birth weight than the Suffolk NSIP population. The range in EBVs indicate there is opportunity to move the flock in either direction in all traits, as there is substantial variability. Therefore, sires and potential replacement ewe lambs can be selected to make specific genetic change in all traits based on breeding goals and objectives.

## VT Suffolk flock 2015 lamb crop EBV summary (n = 123).

Trait	Mean EBV (breed percentile rank)	EBV range
Birth weight, kg	-0.13 (top 25%)	-0.8 to +0.6
Weaning weight, kg	+1.1 (top 60%)	-1.5 to +5.6
Post-weaning weight, kg	+2.2 (top 60%)	-3.1 to +9.2
Maternal milk, kg	+0.2 (top 20%)	-0.9 to +1.5
Maternal no. born, %	-2.2 (top 80%)	-10.7 to +5.5
Maternal no. weaned, %	-0.5 (top 70%)	-6.2 to +5.8
Muscle depth, mm	+1.1 (top 25%)	-0.8 to +4.0
Fat depth, mm	-0.4 (top 65%)	-2.7 to +2.1
FEC, %	+6	-75 to +236

## VT Dorset flock 2015 lamb crop EBV summary (n = 144).

Trait	Mean EBV (breed percentile rank)	EBV range
Birth weight, kg	+0.14 (top 65%)	-0.3 to +0.7
Weaning weight, kg	+1.3 (top 55%)	-3.0 to +4.3
Post-weaning weight, kg	+2.6 (top 65%)	-6.5 to +8.7
Maternal milk, kg	+0.2 (top 25%)	-0.9 to +1.5
Maternal no. born, %	-2.8 (top 80%)	-12.5 to +3.8
Maternal no. weaned, %	+0.2 (top 80%)	-5.6 to +4.3
Muscle depth, mm	+0.2 (top 15%)	-1.6 to +2.8
Fat depth, mm	-1.2 (top 20%)	-4.0 to +1.1
FEC, %	-1	-39 to +139

As stated earlier, the goal over the past two years has been to collect pertinent data to characterize the VT flocks for FEC. As of December 1, 2015 with the most recent analysis conducted by LambPlan, all 2015-born Suffolk and Dorset lambs now have a FEC EBV. The range of FEC EBVs in the above tables provide evidence of the tremendous variation that exists within a flock, and also quantifies the opportunities that exist to improve parasite tolerance through selection. This is further emphasized in the tables below with provide the EBV profiles of the existing stud ram batteries for both flocks. Focusing on FEC EBV, it is evident that certain sires are superior relative to others. Note that all of these rams listed are proven sires, with progeny data included in the analysis.

## EBV profile of current VT Suffolk stud rams.

Sire	BW	WW	PWW	Milk	NLB	NLW	PMD	PFAT	FEC
BH 2896	0.3	4.8	9.1	-0.1	-2.1	-4.4	1.23	-2.92	98
MGR 9094	-0.2	0.5	-2.0	0.1	-6.9	+6.2	2.76	1.05	18
MGR 3007	-0.9	-0.9	-0.5	-0.8	-7.9	-2.9	3.37	0.40	56
Kimm 13073	-0.2	0.5	1.2	1.3	-2.3	-5.5	1.32	-0.40	-20
SU 328	0.0	1.0	1.5				1.05	-0.92	48
VT N221	-0.2	1.2	0.2	-0.2	-6.0	+3.3	2.23	0.47	-61
VT S277	-0.1	0.8	1.1	-0.2	+1.3	+0.4	0.31	0.32	-41

## EBV profile of current VT Dorset stud rams.

Sire	BW	WW	PWW	Milk	NLB	NLW	PMD	PFAT	FEC
HTR 5887	0.1	0.7	2.4	-0.9	0.0	+4.2	1.58	-3.75	-13
HEIS 1263	0.3	2.9	4.8	-0.8	-0.2	-1.4	-0.84	-0.09	-25
HEIS 3083	0.2	-1.2	-3.0				-0.43	0.13	5
VT S036	-0.1	1.0	2.9	0.4	-7.8	+0.7	1.58	-2.33	44

Several excellent resources exist for additional information on NSIP and EBVs and their application and utilization:

NSIP website- <http://nsip.org/> (details on enrollment, current breed and flock information, educational resources)

Katahdin NSIP- <http://www.katnsip.com/index.html> (collection of educational resources applicable to all breeds)