Performance Matters

Both Phenotypes and Genotypes Matter

by **Shane Bedwell**

Genetic prediction accuracy increases with what's known about individual animals.

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The American Hereford Association (AHA) continues to focus on delivering a reliable genetic evaluation. That effort includes the breed's commitment to Whole Herd Total Performance Records (TPR™), which began in 2001.

Undoubtedly, over time expected progeny differences (EPDs) have improved with the additional collection of phenotypes, the crux of Whole Herd TPR. Along with this, the inclusion of genomics has improved prediction accuracy for young/unproven animals earlier in their lives.

In a perfect world, a breeder would submit a few phenotypes and a genomic profile and the EPD would never change. Essentially, the bull would have a perfect 1.0 for accuracy before they sired their first calf crop. However, that is unlikely to ever happen.

Remember that an EPD is an estimate of an animal's ability to transmit specific genetics as a parent. Key to that statement is the word "estimate." The only way to create an EPD that is not an estimate — an EPD with no potential to change — would be to have complete phenotypes for the individual and for thousands of that individual's progeny.

Accuracy values that accompany individual EPDs indicate the reliability of the EPD. The higher the accuracy the more reliable the EPD. As illustrated in Table 2, the possible change for a Birth Weight (BW) EPD with a 1.0 accuracy would be 0.0. Conversely, a BW EPD is expected to be within 5.48 pounds — plus or minus — of the actual EPD if the accuracy is 0.0.

For example, if a bull's BW EPD was 3.0 and the accuracy was 0.0, then his EPD for BW could range from a -2.5 to 8.5 [(3 - 5.48 = -2.5) or (3 + 5.48 = 8.5)]. It is important to understand that no animal starts life with an EPD accuracy of 0.0 for any trait because their EPD is first derived from a pedigree estimate. An individual animal's initial EPDs and EPD accuracies reflect what they are projected to have inherited from their parents. From that point, EPD accuracy increases for individual animals as more information about their performance becomes available: their own phenotypes and those of their progeny; genomic data adds to the accuracy.

Table 1: Contribution of Phenotypes and Genomics on Expected Progeny Difference and Accuarcy Values

Traits included in the EPD and accuarcy calacualtion		CED	BW	WW	YW	DMI	SC	SCF	Milk	MCW	UDDR	TEAT	CW	BF	REA	MARB
P	EPD	-1.5	2.8	71	117	0.6	1.0	21.6	31	95	1.4	1.4	80	0.033	0.48	0.28
	Accuracy	0.24	0.23	0.22	0.22	0.08	0.14	0.13	0.14	0.13	0.17	0.17	0.03	0.03	0.03	0.03
P, BWP	EPD	-3.5	3.4	73	117	0.6	1.0	21.6	31	95	1.4	1.4	80	0.033	0.48	0.28
	Accuracy	0.31	0.36	0.22	0.22	0.08	0.14	0.13	0.14	0.13	0.17	0.17	0.03	0.03	0.03	0.03
P, BWP, WWP, G	EPD	1.8	3.7	77	129	0.7	1.0	20.1	39	0.15	1.4	1.5	90	0.054	0.63	0.33
	Accuracy	0.37	0.48	0.41	0.39	0.14	0.28	0.24	0.23		0.34	0.33	0.10	0.10	0.10	0.10
P, BWP, WWP, YWP G, IRF	EPD	2.3	3.9	77	127	0.7	1.1	22.1	38	108	1.4	1.5	88	0.083	0.59	0.47
	Accuracy	0.37	0.49	0.42	0.43	0.14	0.30	0.25	0.23	0.15	0.34	0.34	0.20	0.25	0.20	0.21

Key

P	Pedigree Esitmate	YWP	Yearling Weight Phenotype
BWP	Birth Weight Phenotype	G	Genomic Profile
WWP	Weaning Weight Phenotype	IRF	Intra-Muscualr Fat, Rib Eye Area and Back Fat (Scan Data)

Table 2: Possible Change for Various Accuarcy Values (Plus or Minus)

Accuracy Value	CED	BW	WW	YW	DMI	SC	SCF	Milk	MCW	UDDR	TEAT	CW	BF	REA	MARB
0.00	13.56	5.48	26.06	43.43	1.74	1.25	11.79	18.81	71.41	0.58	0.58	49.20	0.11	0.82	0.48
0.05	12.88	5.20	24.75	41.26	1.65	1.19	11.20	17.87	67.84	0.55	0.55	46.74	0.10	0.78	0.46
0.10	12.20	4.93	23.45	39.09	1.56	1.12	10.61	16.93	64.27	0.53	0.52	44.28	0.10	0.74	0.43
0.15	11.53	4.66	22.15	36.91	1.47	1.06	10.02	15.99	60.70	0.50	0.49	41.82	0.09	0.70	0.41
0.20	10.85	4.38	20.85	34.74	1.39	1.00	9.43	15.05	57.13	0.47	0.47	39.36	0.08	0.65	0.38
0.25	10.17	4.11	19.54	32.57	1.30	0.94	8.84	14.11	53.56	0.44	0.44	36.90	0.08	0.61	0.36
0.30	9.49	3.83	18.24	30.40	1.21	0.87	8.25	13.17	49.99	0.41	0.41	34.44	0.07	0.57	0.34
0.35	8.81	3.56	16.94	28.23	1.13	0.81	7.66	12.23	46.42	0.38	0.38	31.98	0.07	0.53	0.31
0.40	8.14	3.29	15.63	26.06	1.04	0.75	7.07	11.29	42.85	0.35	0.35	29.52	0.06	0.49	0.29
0.45	7.46	3.01	14.33	23.89	0.95	0.69	6.48	10.35	39.28	0.32	0.32	27.06	0.06	0.45	0.26
0.50	6.78	2.74	13.03	21.71	0.87	0.62	5.89	9.41	35.71	0.29	0.29	24.60	0.05	0.41	0.24
0.55	6.10	2.46	11.73	19.54	0.78	0.56	5.31	8.47	32.14	0.26	0.26	22.14	0.05	0.37	0.22
0.60	5.42	2.19	10.42	17.37	0.69	0.50	4.72	7.53	28.57	0.23	0.23	19.68	0.04	0.33	0.19
0.65	4.75	1.92	9.12	15.20	0.61	0.44	4.13	6.59	24.99	0.20	0.20	17.22	0.04	0.29	0.17
0.70	4.07	1.64	7.82	13.03	0.52	0.37	3.54	5.64	21.42	0.18	0.17	14.76	0.03	0.25	0.14
0.75	3.39	1.37	6.51	10.86	0.43	0.31	2.95	4.70	17.85	0.15	0.15	12.30	0.03	0.20	0.12
0.80	2.71	1.10	5.21	8.69	0.35	0.25	2.36	3.76	14.28	0.12	0.12	9.84	0.02	0.16	0.10
0.85	2.03	0.82	3.91	6.51	0.26	0.19	1.77	2.82	10.71	0.09	0.09	7.38	0.02	0.12	0.07
0.90	1.36	0.55	2.61	4.34	0.17	0.12	1.18	1.88	7.14	0.06	0.06	4.92	0.01	0.08	0.05
0.95	0.68	0.27	1.30	2.17	0.09	0.06	0.59	0.94	3.57	0.03	0.03	2.46	0.01	0.04	0.02
1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

More information, higher accuracy

Look at Table 1. You can see the impact phenotypes and a genotype have on the EPDs of an individual example animal. More importantly, you can see how much phenotypes and a genotype impact the accuracy of EPDs.

Note that some of the EPDs for this example animal were unchanged as more data became available. That reflects how closely the pedigree estimate matched subsequent performance for the trait. Some of the example EPDs changed minimally, compared to the possible change indicated in Table 2, which is reflective of most animals in the Pan-American Cattle Evaluation used by AHA for genetic evaluation.

Also notice that accuracy values improved for the example animal's EPDs every time new data was added. That demonstrates the value of turning in data and getting animals genotyped. Additional data continually proves how close genetic reality is to the initial prediction.

Buying bulls with as many phenotypes recorded as possible for their age and with a genotype mitigates buyer risk. In reality, you will never purchase a young bull that is a perfect 1.0 for accuracy. However, I hope these examples help illustrate the impact phenotypes and genotypes have on the reliability of a young bull's EPDs.

Simply put, higher EPD accuracy values should give you more confidence in an individual's genetic merit.

With the value of data in mind, in the fall and spring each year, the AHA recognizes breeders who are committed to Whole Herd TPR and go above and beyond when recording data. Take a look at 2021 fall Gold and Platinum Whole Herd TPR breeders on pages 12 and 14. Watch for the list of 2022 spring award winners, which will be published in the February *Hereford World*. HW