

Targhee
NSIP Notebook

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Number 1

The 2001 Targhee National Genetic Evaluation

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Introduction

Genetic analysis of the 2000 Targhee lamb crop has now been completed, and results of the analysis are ready for distribution to participating NSIP Targhee flocks. Genetic evaluation reports will be similar to those distributed last year, but with a few changes which will be described in this newsletter.

Targhee NSIP Data for 2001

Data for the 2000 lamb crop included records on 2,260 breeding ewes from 18 flocks: 13 from Montana and one each from Maryland, Michigan, Minnesota, New Hampshire, and Oregon. Records were received for 2,918 live lambs produced by 73 Targhee rams. Following editing, valid records were received for 763 60-day weaning and/or preweaning weights, 2,157 120-d weaning weights, 318 yearling gain records, 1,127 fleece weights, 608 fiber diameter (fleece grade) measurements, and 1,740 litter sizes.

The entire NSIP Targhee across-flock database now contains records from 40 flocks with 11,102 60-day weaning and preweaning weights, 19,800 120-day weaning weights, 5,331 yearling gain records, 11,730 fleece weights, 8,283 fiber diameter measurements, and 19,151 litter sizes. EPDs were calculated for a total of 32,206 animals, including 7,587 breeding ewes and 401 sires.

Means for reported traits are shown below. Weaning and preweaning weights (both 60- and 120-day) were adjusted to a single birth and rearing, adult dam, and ewe lamb basis. Yearling gains were not adjusted, but male and female lambs were placed in separate contemporary groups. Yearling fleece weights were adjusted to an age of 365 days. Fleece weights for older animals were adjusted to an adult animal and 365-day shearing interval basis. Fleece grades for yearlings did not receive any adjustments. Fleece grades for older animals were adjusted to an adult animal basis. For fleece traits, yearling and older animals, and males and females were placed in separate contemporary groups. Litter sizes were adjusted to an adult ewe basis.

Trait	Mean
60-day adjusted weaning/preweaning weight	55.7 lb
120-day adjusted weaning weight	87.2 lb
yearling gain (120 to 365 days)	.27 lb/day
fleece weight	8.6 lb
fiber diameter	22.2 microns
litter size	1.72 lambs

Complete data on the 2000 Targhee lambs were received at the genetic evaluation center on July 23, 2001. EPDs for yearling rams for the National Targhee Sale were returned on August 15, and EPDs for the rest of the Targhee were returned on August 24. Thus the total turn-around time for processing this year's Targhee data was consistent with our target turnaround time of 30 days.

EPD Reports

This year, each Targhee breeder will receive a single spreadsheet containing animal identification and EPDs for all animals in the flock. The format of the report will be similar to that used last year, except that now all animals will be included in a single spreadsheet. Animals in the spreadsheet will be listed in the following order:

- Breeding ewes
- Yearling ewes
- Breeding rams
- Yearling rams

The listing should contain all breeding animals listed on the preprinted data entry spreadsheet, any breeding animals that were added to inventory, and all surviving lambs from the current lamb crop. Animals that were culled or died will be identified; EPDs will be provided for these animals, but they will not appear on next year's spreadsheet.

The only meaningful change in reporting procedures for 2001 is the introduction of a new measure of accuracy of EPDs, the "prediction error". This measure has been introduced to hopefully do a better job of communicating information about the reliability of the EPDs. For this year, both accuracies and prediction errors will be presented to ease the transition from accuracy to prediction error. A detailed discussion of the properties of the prediction error is included below. We would welcome your comments on this new measure of reliability. Our current plan is to drop the accuracy measure in 2002 and to subsequently report only prediction errors.

The 2001 Targhee Sire Summary

The 2001 NSIP Targhee Sire Summary is likewise now available for distribution to breeders and other interested parties. In order to be eligible for the Sire Summary, a ram must have an accuracy value of at least .30 for weaning weight, yearling weight, or maternal milk or of at least .40 for fleece weight or fleece grade. This year's sire summary contains EPDs for 212 rams. From these, only rams born after Jan. 1, 1992 were listed in the main sire summary. This main list contains 114 rams, a 15% increase over last year.

Submitting Data for the 2001 Lamb Crop

No major changes are anticipated in submitting data for 2002. As for last year, each NSIP Targhee breeder will receive a new, preprinted data entry spreadsheet for reporting data on the 2001 lamb crop. All active animals from the flock, including breeding ewes, ewe lambs, breeding rams, and ram lambs will be listed in a single spreadsheet arranged in sections corresponding to the different classes of animals.

Again, use of the preprinted spreadsheet to report data is mandatory. Errors in animal identification (birth dates, tags, registration numbers, parents) can be corrected as needed and newly registered animals can have their registration numbers added. The objective is to avoid recopying animal identification information from year to year. In this way, we will know that reported changes in animal identification information do represent corrections made by the producers. Newly purchased animals can be added at the bottom of the spreadsheet with identification information and performance records.

Preprinted data entry spreadsheet for next year will be divided into the following four sections.

Section 1: Breeding Ewes. The breeding ewe section will include all active, adult ewes. An active, adult ewe is defined as a ewe that appeared on the last data entry spreadsheet and was not identified on that spreadsheet as having been culled or having died. This section should include the complete adult ewe inventory for the flock on the date you submitted your records for the 2000 lamb crop.

Section 2: Ewe Lambs. This section will include all ewe lambs from the last data entry spreadsheet that were not listed as sold or died on that spreadsheet. This section should thus include all your replacement ewe lambs

from the 2000 lamb crop as well as ewe lambs that had not yet been marketed at the time you submitted your data. It is important that you report accurate disposal codes for these ewe lambs. First, it will ensure that ewe lambs that have died or been sold are removed from inventory. Second, it will allow us to add your replacement ewe lambs to your active breeding ewe inventory. Also, it is important that you take this opportunity to update registration information on ewe lambs, including both those you kept and those you sold for breeding. Many of the 2000 lambs were not yet registered when records on these lambs were sent to NSIP. Registration information is critical to the across-flock analysis, both to provide accurate animal identification within flocks and to document the genetic ties between flocks that are necessary for the across-flock analysis. Therefore be sure to always add new registration information to the data entry spreadsheets.

Section 3: Breeding Rams. This section will list all rams that produced lambs in 2000 or that were listed as active on your last data entry spreadsheet.

The identification of “active” rams is more difficult than the identification of active ewes. We require that all rams used to produce lambs on your farm be placed on your inventory, but in some cases (borrowed or leased rams, AI) that ram may not be physically located on your farm. If you remove him from inventory, you will no longer get EPDs for that ram on your flock EPD reports. So we have instituted the following guideline for defining an “active” breeding ram. **If you want to have EPDs listed for a given ram, even if he is not physically located on your farm, leave him as active on your inventory (that is, do not enter a disposal code for him) or add him to inventory on the data entry spreadsheet.** If, at some point in the future, you are no longer interested in getting EPDs on a ram, then insert a disposal code and he will no longer appear on your flock EPD list. Our spreadsheets probably still contain some rams that you no longer care about. If so, just put in a disposal code for these rams, and they will not appear on your inventory again.

Section 4: Ram Lambs. This section will include all ram lambs from the last data entry spreadsheet that were not listed as sold or died on that spreadsheet. This section should thus include all your replacement ram lambs from the 2000 lamb crop as well as ram lambs that had not yet been marketed at the time you submitted your data. As for the ewe lambs, it is important that you report accurate disposal codes and update registration information for these ram lambs. As for the breeding rams, if you want to continue to see EPDs on a ram lamb that you sold or own in partnership, just leave him as active on the spreadsheet. You may also want to leave ram lambs that were sold for breeding on your inventory until their registration numbers have been assigned and reported to NSIP.

Introduction of "Prediction Error" as a Measure of the Accuracy of EPDs

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Introduction

The 2001 NSIP genetic evaluations introduce a new measure of the accuracy of EPDs. The measure is known as “prediction error” and is designed to avoid some of the confusion and misunderstanding that has been associated with the accuracy measures used in the past. The prediction error directly reflects the amount of future change in EPD that can be anticipated as more data accumulates on an animal, its relatives, and, most importantly, its progeny. Prediction error is expressed in the same units as the trait being evaluated (pounds for weight traits, microns for fleece grade, etc.). Thus each animal has a prediction error associated with the EPD for each trait.

Definition of Prediction Error

Recall that the EPD is an estimate of its genetic merit based on accumulated performance records. As more information accumulates, the EPD can change. When little information is initially available, future changes can be relatively large. But once a substantial amount of performance data accumulates, the EPD becomes increasingly stable. The prediction error is a measure of the anticipated stability of an EPD. It differs from the accuracy values used before in that it directly addresses the magnitude of possible future change in the EPD

whereas the accuracy gave only a relative measure of stability of the EPD. The prediction error was used for a time in the beef industry, where it was known as the "possible change", but was eventually discarded in favor of accuracy. In NSIP, where accuracy values are lower than in the beef industry, we believe that prediction error is a more useful measure of the stability of the EPD.

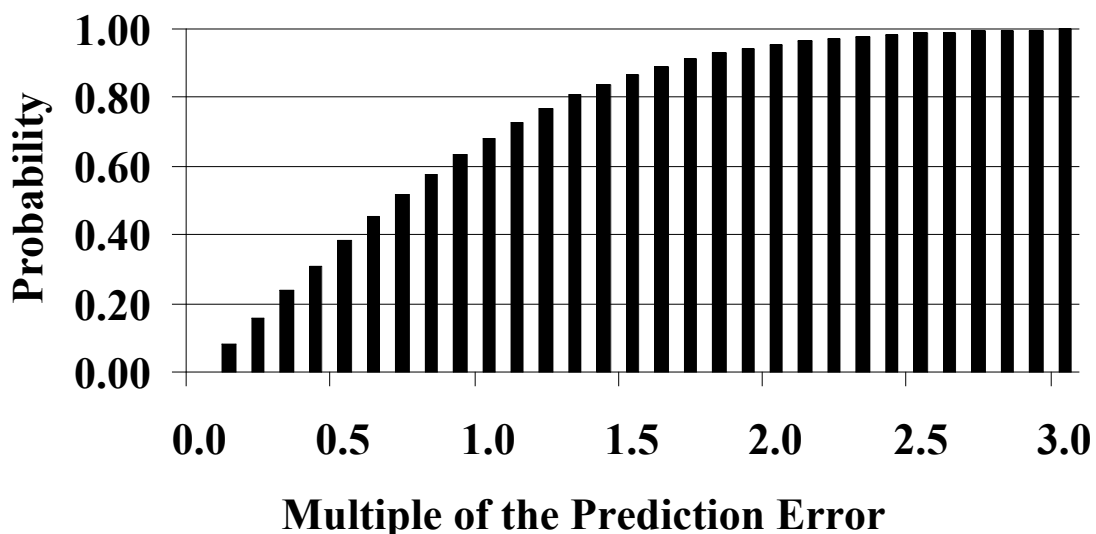
An EPD for an animal can be thought of as an estimate surrounded by error. The prediction error quantifies the magnitude of that error. The properties of prediction error can be summarized relatively easily:

1. There is about one chance in three (a probability of about .33) that an animal's EPD for a given trait will change (either increase or decrease) by more than the amount of the prediction error. The probability that the EPD will go down by an amount greater than the prediction error is thus about one chance in six. The corresponding probability that an EPD will go up by an amount greater than the prediction error is likewise about one chance in six.
2. There is only about one chance in 20 that an EPD will change by more than two times the prediction error.
3. An EPD is unlikely to change by more than three times the prediction error (about one chance in 385).

Figure 1 shows the probability that the true EPD will lie within the interval defined by the reported EPD plus or minus some multiple of the prediction error. For example, the true EPD is expected to be within the interval defined by the reported EPD, plus or minus .5 times the prediction error, about 40% of the time. As discussed above, the true EPD is expected to be within the interval defined by the reported EPD, plus or minus 1.0 times the prediction error about 67% of the time. The true EPD is expected to be within the interval defined by the reported EPD, plus or minus 1.5 times the prediction error over 80% of the time.

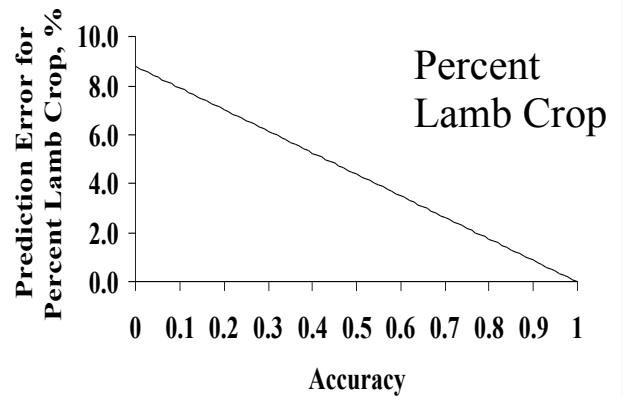
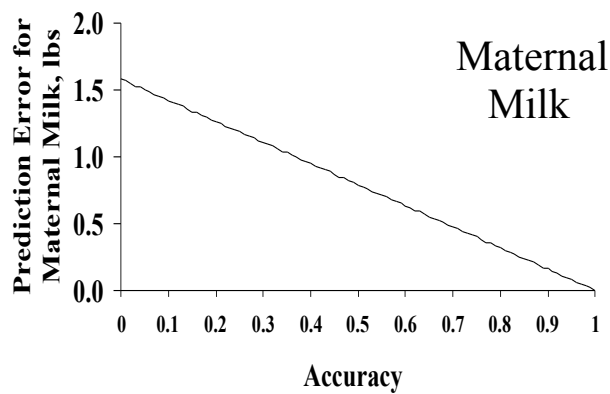
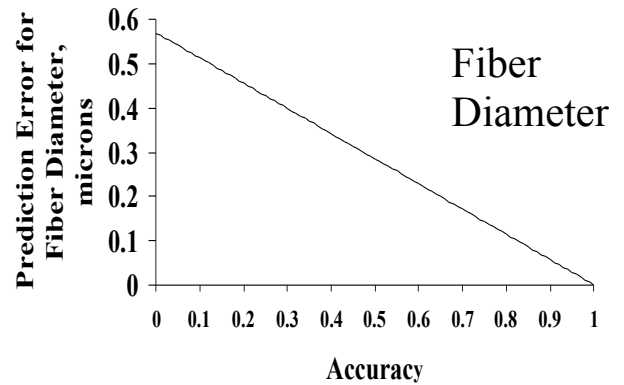
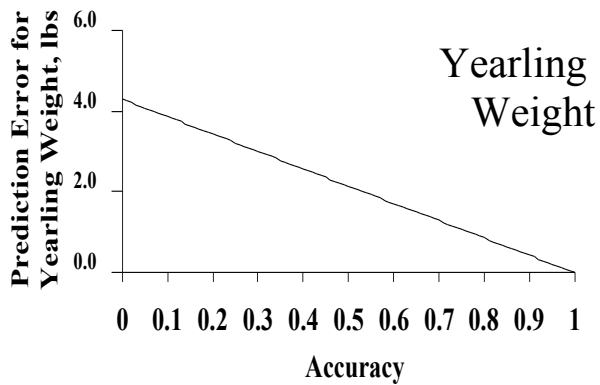
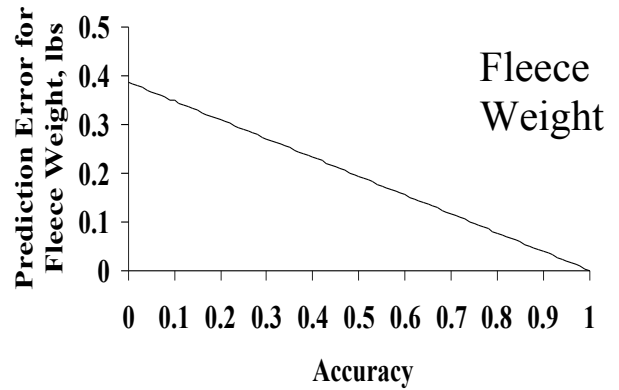
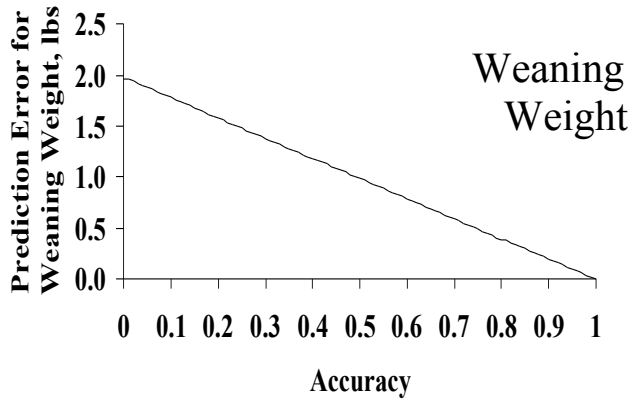
It is important to realize that the reported EPD is the best estimate we have of the true EPD, and the most likely value of the true EPD. When possible change is large, future changes in EPD may be relatively large. However, it is also important to recognize that the direction of these changes is not predictable. An animal with a large positive EPD and high possible change value could show a significant future drop in its EPD. Or its EPD could go up substantially. Either result is equally likely, which is why breeders should focus on the reported EPDs, and largely ignore accuracy and prediction error, when attempting to determine relative genetic merit. Prediction error should be used only as a risk management tool. If two rams being considered for use have similar EPDs but differ substantially in prediction error, the ram with the smaller prediction error is the less risky choice, since his EPDs are more stable. Prediction error alone is of no value; a ram with mediocre EPDs and low prediction errors is simply an animal that you can be confident will be mediocre.

Figure 1. Probability the true value of the EPD will lie within the interval defined by the reported EPD, plus or minus the indicated multiple of the prediction error



In order to assist with comparisons between the accuracy and the prediction error, Figure 2 shows the relationship between the two measures of reliability of the EPD for each trait. The maximum value for prediction error should not exceed the value shown for an accuracy value of zero. The only exception to this rule is for inbred animals. If an animal is inbred, its prediction errors will be slightly larger than those for noninbred animals.

Figure 2. Relationship between prediction error and accuracy



Examples

Table 1 shows examples of EPDs, prediction errors, and accuracy values for several types of animal drawn from last year's genetic evaluations. The animals chosen include:

- A) A trait-leader for fiber diameter
- B) The ram with the highest accuracy (lowest possible change) for weaning weight
- C) A yearling ram in the top 5% for weaning weight EPD
- D) A 7-year-old ewe in the top 1% for percent lamb crop EPD
- E) A 2-year-old ewe in the top 5% for maternal milk
- F) A yearling ewe in the top 5% for percent lamb crop EPD

Note that there is a direct correspondence between the values for accuracy and prediction error: within a trait, high values for accuracy are associated with smaller prediction errors.

For sires with progeny (animals A and B), accuracies are relatively high and prediction errors are often substantially below EPDs, indicating that the genetic superiority suggested by the EPDs is likely real and is unlikely to be lost as more information accumulates. Thus for animal A, the weaning weight, maternal milk, and fleece grade EPDs are 2.5, 3.3, and 7.2 times their prediction error. These values suggest that the probability that the true EPDs of these animals are actually at or below breed average for these traits would be only .0062 for weaning weight, .0005 for maternal milk, and less than .0001 for fleece grade. The fleece weight EPD and prediction error for animal A are $-.3 \pm .13$ which is consistent with the anticipated negative relationship between fleece weight and grade and, with a PE of 2.25 times the EPD, suggests this ram is genuinely below breed average for fleece weight. Animal B likewise appears to clearly be genetically superior for weaning weight and fleece grade.

The situation for animal C, the yearling ram, is somewhat different. This animal has relatively good EPDs for most traits, but prediction errors are larger than those for animals A and B, reflecting the fact that animal C has yet to produce progeny. Still, in many cases, the EPDs approach or exceed the prediction errors, strongly suggesting that this is a superior individual and a good risk for several traits.

EPDs and prediction errors for ewes (animals D, E, and F) demonstrate how difficult it is to achieve high levels of accuracy in evaluating individual ewes, although our level of confidence in evaluating the older ewe (animal D) is greater than that attained for a yearling ram (animal C). Thus genetic improvement in the ewe flock relies more on identifying groups of females with high average EPD values or on keeping sets of daughters of high EPD rams. Only a few older ewes will have enough progeny to achieve small prediction errors. Still, EPDs for percent lamb crop for animal D; weaning weight and maternal milk for animal E; and weaning weight, yearling weight, and fleece weight for animal F exceed their prediction errors, suggesting that these individuals can be used to improve these traits with only modest risk.

Table 1. EPDs, accuracies, and prediction errors for selected animals from the 2000 Targhee national genetic evaluation

Trait	Item	Animal					
		A	B	C	D	E	F
WW	EPD	2.2	2.6	2.6	-6	2.9	1.1
	Accuracy	.54	.63	.13	.22	.15	.15
	Prediction error	.90	.74	1.71	1.56	1.67	1.68
YW	EPD	2.4	1.7	2.5	.1	2.6	3.3
	Accuracy	.54	.66	.04	.23	.06	.12
	Prediction error	1.52	1.18	3.22	2.59	3.15	2.94
MM	EPD	3.3	-.7	1.9	.2	2.0	1.1
	Accuracy	.37	.51	.08	.23	.10	.06
	Prediction error	1.0	.78	1.45	1.22	1.43	1.49
FW	EPD	-.3	-.1	0	0	.1	.3
	Accuracy	.69	.76	.15	.41	.27	.31
	Prediction error	.13	.09	.33	.23	.29	.27
FD	EPD	-1.3	-.9	-.4	.3	-.2	.1
	Accuracy	.69	.80	.16	.49	.33	.39
	Prediction error	.18	.13	.48	.29	.38	.35
NB	EPD	4.7	-8.7	6.9	8.2	-5.5	7.2
	Accuracy	.44	.56	.09	.26	.10	.06
	Prediction error	4.95	3.80	8.0	6.5	7.9	8.25

Using Prediction Error

The main use of the prediction error comes when you are forced to choose between a young ram with very high EPDs but also with relatively high prediction errors and an older progeny-tested ram with good, but lower, EPDs and prediction errors. Again, the issue is risk aversion. If your goal is the leap to an elite position in the breed and if you are willing (and have the resources) to take some chances to get there, the younger ram will be the best choice. Over time, it is always better to go with the higher EPD animals, but when prediction errors are large, you may have to weather a few disappointments along the way. On the other hand, if consistency and reliability of production are key to you, you may pay more attention to prediction error, preferring to use proven rams with less risk of future changes in EPD. But overall genetic progress in the flock may be slower.

A rough guideline to assessing reliability of an EPD is that if the EPD exceeds the possible change value, an animal with a positive EPD is unlikely (one chance in six) to drop below zero in the future, and an animal with a negative EPD is not very likely to move above the average. Also, small differences in possible change are not worth worrying about. The issues of importance come when making choices between ram lambs and progeny-tested sires or between adult ewes and ewe lambs. Differences in prediction errors among ewes in the breeding flock are almost never large enough to be important. Focus on EPDs in selecting and culling breeding ewes. Don't worry about small differences in possible change!

Finally, realize that without widespread AI, the sheep industry will not have the large numbers of proven sires found in dairy cattle. In most cases, our objective is not to find a few exceptional rams, although when such animals do emerge, they will, of course, be welcome. Our goal is to select groups of replacement ewes and rams that will provide consistent genetic improvement. Thus flocks of reasonable size need to focus on the average genetic merit of the rams purchased or the ewe lambs retained each year.

The concept of prediction error can be extended directly to groups of animals. If a breeder goes out to buy four yearling rams, each with EPDs for weaning weight of about +1.5 pound, the prediction error for these rams will typically be around 1.7 pounds. For the group of four, the average EPD will still be +1.5, but the prediction error of the group average will now be only about .85 pounds. Thus, your new rams, as a group, can be expected to reliably enhance weaning weights in your flock. Similarly, if you purchase a group of 15 ewe lambs, each with EPD and prediction error of $.5 \pm 1.5$ pounds for maternal milk, the mean EPD of the group is still .5 but the prediction error of the group mean reduces to .4 pounds, giving you more confidence in the genetic merit of the set of ewe lambs. These examples demonstrate why larger flocks can pay less attention to prediction errors while relying on difference among individual animals to average out future changes in EPDs. In contrast, small, single-ram flocks will have to decide for themselves how much risk is acceptable when they only buy a new ram every year or two.