

Estimate Progeny Differences: Advancing the Species, Benefiting the Farmer

By Susan Buser



We are just being introduced to a brand new concept for most of us: Estimated Progeny Differences, or EPD. Let's face it... most of us had no experience raising livestock prior to getting involved with the alpaca business, and so a concept like EPDs is quite foreign to us. We have learned about basic alpaca care, we have learned how to birth crias and handle any number of animal health situations we never could have imagined in our former lives. We may have even educated ourselves quite well in introductory genetics and how that applies to breeding animals, but.... EPDs? What in the world are EPDs? How do we find out what they are about, plus... are they a good idea for the alpaca industry? Let's take a little time to explore this together and to examine the pros and cons of EPDs.

First we need to understand what EPDs are all about. The Alpaca Registry, Inc. recently described EPDs this way: "Simply put, EPDs are a statistical estimate of how a particular alpaca's cria will perform in certain traits compared to other alpacas' crias, before a mating even occurs."¹

Mike Safley describes them this way: "An EPD is an estimate of the genetic merit of an animal for a single trait. The

EPD is the expected difference between the performance of an animal's progeny for a specific trait and the average progeny performance, for that trait, of all the animals in the breed at the time the genetic evaluation program is established."² Dr. Wayne Jarvis further informs us with this description: "Since each parent can only contribute 1/2 of its genes to the offspring, then on average that parent only passes on 1/2 of its breeding value to the offspring. So one half of the parents breeding value is the estimated progeny difference."³

Do we fully understand what all this means? Let's back up a little and start at the beginning, and try to understand both the concept and the process. The process first, and then we will explore the concept in more depth.

Initially a group of breeders must get together and decide they are interested in making an agreement to collect data for certain traits for the individuals in their herds. This will be, primarily, for the purpose of making breeding decisions. This group of people can be a breed organization of some sort, or any group of farm owners/breeders who either have similar goals for their breeding programs or can agree on the traits to be collected for, and therefore could benefit from a joint effort. It is helpful if there are a number of genetic connections across the group in order to effectively do cross-herd analysis. (F-EPDs are also possible: a "Flock" EPD, for one herd only).

Ideally this breeder group will have a common breeding goal and an agreement upon what is the "best" alpaca. Their definition should include "... animals that are sound, adapted to the climate where they will be raised, and focused on the economic traits of importance."⁴ With the end product of alpacas in mind, luxury fiber, the primary focus should probably be on the collection of fiber traits, according to the breeding goals of this particular group. Basic health and soundness of the animals is also important as well as hardiness for their particular environment.

Then this group (or individual farm) must approach a university that provides EPD collection and advisory services, or another organization that provides these same services. The group of breeders must then decide upon the traits of importance

to all of them for data collection. The breeders must also each commit themselves to accurate reporting of data and to reporting of data on ALL members of the herd. A method for data collection is then set up, with specific requirements for reporting certain measurements of traits on a certain schedule. A member of their group is chosen as a liaison between the group and the university. This person will help to solve problems if submitted data seems to be incorrect, a member questions certain EPD results, or other problems arise that need to be dealt with.

Data collection begins, and the collecting agency's team of geneticists and animal scientists provides the breeders with advice, direction, re-direction and analysis of the data throughout the process. As data begins to accumulate, breeders begin to receive information on the relative performance of each of their animals as compared to the other animals owned by the group of breeders.

Breeders can use this data to attempt to make the best breeding choices they can to produce genetically improved offspring. Individual farm's EPD data is normally kept secure and private, and passed on only to that farm owner. EPD summary data representing the entire group is passed on to the breeders for use in assessing the overall progress of the group. If the group desires, EPD data can be used to produce a list of top-performing sires in reference to certain traits.

But... how do EPDs result in genetic gain? By providing improved estimates of the result of any mating, so that the owner can make a well-educated choice for each breeding. EPDs are not a rock-solid prediction, but do provide the owner with additional tools for making important breeding decisions.

Think about how most mating choices are currently made in our industry... "His sire is Mr. So and So, therefore he Must be great! No, he doesn't have any crias yet, but his sire was wonderful, so he will certainly throw great crias!" Or.... "Well, he won three blue ribbons this year, and he is from Big Name farm" Or... "Ooh, I like that color" Or... "Well, he is nearby and I like his look"...

Unlike a decision made on pedigree alone, or upon a visual assessment only, a decision made using EPD data provides a fair amount of certainty as to what

traits that alpaca will pass on, not just what observable traits it possesses. Two animals with very similar pedigrees may produce very different quality offspring. Why is this true? Even though they are closely related, they may have significant genetic differences that will show up in their offspring.

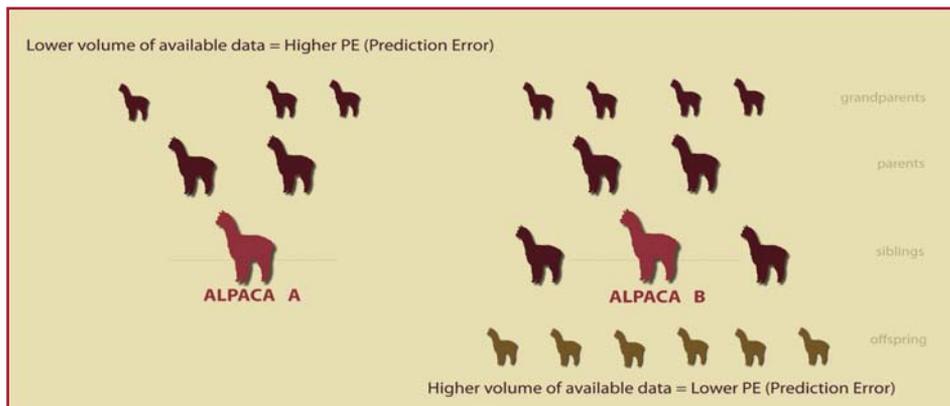
This is not to say that many of these things - pedigree, visual assessment, personal aesthetics, show standings - cannot factor into a decision. But, what if it was possible to have some fairly sound data that gave you a much better idea of what this animal would produce for you than the show ring or marketing currently does.... Would you be interested?

EPD data collection can be valuable because it requires the breeder to collect data on all herd members, year by year, and so, over time, provides a fairly solid body of information about any one individual animal and its expected performance. If data is collected on the sire, the dam, the individual, his siblings, and then his offspring, pretty soon you have a fairly good idea of what this alpaca might produce.

Now many of us may say, "Hey, I already do that!" One breeder wisely said to me: "Years and years ago, my dad kept track of birth weights and would put the heifers (maidens) with the bulls that consistently produced smaller birth weight calves. The process he used wasn't called Expected Progeny Differences back then, but that's exactly what it was." And, yes, many of us do this. Many of us know what traits different animals and lines on our farm are producing and we make breeding decisions accordingly.

When we have a visitor on our farm, we have them examine the individual animal they are considering, then walk them all around the farm, encouraging them to examine carefully parents, siblings and offspring. We point out the consistent reproduction of certain traits (especially fleece traits) in all of those animals to show the likelihood of the reproduction of those traits in the next generation. So if we already do this, what do EPDs have to offer us?

EPDs can give us more solid information to add to our already sound instincts. They may also help us to avoid that impulse buy of a breeding to a flashy



or well-marketed male that may not be able to back up his good looks with sound offspring. One glance at his EPDs may tell us to keep looking!

One thing we need to be aware of is this: The collection of data, the generation of EPDs from that data, and the use of that data by the breeder are all separate issues. A group of breeders may choose to collect a variety of data, but only generate EPDs on certain portions of that data. The information provided by the EPDs may be used differently by different breeders, since they may vary in their breeding goals.

EPDs are expressed as plus or minus values for each trait, with zero being the average for the population being tested. So your alpaca is being measured against your chosen group of peers, for each trait for which data is collected, and then EPDs are generated. A plus value is not necessarily good, or a negative value necessarily a bad thing. A minus two on a micron EPD would mean that your alpaca's fleece measures two microns less than the average of your testing group. A minus two on fleece weight would mean that your alpaca sheared two pounds less than the average of your group.

In addition, some breeders might be breeding toward different goals, so some might want to breed to a "minus" in a category, while another might want to breed to a "plus" in order to meet their breeding goals. Ideally, breeders within a data submission group should have similar breeding goals so that all could work together toward common goals.

Perhaps we will find that several different groups of breeders will choose to form groups, within which they will work together toward their chosen goals for excellence in alpacas. Perhaps this will be a means of the development of several

different, but equally excellent, true "breeds" within the huacaya family. They will have slightly different fleece traits (with a viable market for each unique type of fiber), as well as other unique traits that make them physically hardy within their native geographic area.

When evaluating EPDs, be aware that they come with a measurement of the estimated margin of error, a Prediction Error (PE). When volumes of data are small, the rate of error is naturally higher. As the volume of data grows, the accuracy of prediction improves. A young sire, for instance might have a very good EPD value for certain traits (based on data from his parents, siblings, and his own measurements over his first few years), but combined with a relatively high PE (since he has little or no progeny). An older sire might have a slightly less favorable EPD for certain traits, but with an almost non-existent PE. (His ability to pass on certain traits is firmly established by the reporting of data from many progeny, in addition to his own data and that of his relatives).

Although the younger sire might be tempting to choose, the risk that you will not get what you want out of that breeding is higher than with the older sire with solid statistics behind him. You may choose to take the extra risk, but the results of that breeding are less predictable than with the older sire with the greater amount of data available.

Understand also that an EPD is not a static value. As genetic improvement takes place within a testing group, the "zero" value remains the average among all members of the herd. Those above and below the average for that trait receive plus and minus values, based on the deviation from the average, not any relationship to a fixed ideal number or value. The hope is

EPD Values and Genetic Gain

The value of zero in an EPD always represents the average for that trait within a testing group. Plus and minus values represent the deviation of that individual alpaca from the average.



that the entire group will continue to improve, constantly raising the average (or lowering it, depending on the trait, i.e. micron measurement). Your animal's score will always tell you where your animal is in relationship to the average in the testing group.

Now for any of this data to be of any significant value, breeders must be totally committed to accurate reporting of data as well as to reporting of data on all members of the herd. Reporting of negative traits is as important as the reporting of positive traits, both for the accuracy of data for the reporting group as well as for the individual breeder's ability to accurately assess his animals and make useful breeding choices. Since most universities who handle EPD data provide secure means of collecting and disseminating data so that an individual farm has access only to their own data, this should be an encouragement to report accurately. Hopefully each farm's integrity would also compel them to report properly.

There is probably no way to absolutely ensure accurate reporting of data other than the use of independent verifiers and collectors of data, which would be cost prohibitive. Perhaps breeders will want to enter into arrangements with other farms they feel will abide by the terms of their mutual agreement.

If you are working with a large general testing group, collection of data from all members of a herd may be a problem, since we already know that many farms do not register any of their "fiber boys", any defective or low-value animals, or huacaya offspring of suri parentage. The collection of data would have to be based upon ALL offspring, not just registered offspring, to be of benefit. All participants would have to agree to provide full disclosure of information. If

this process is going to work, alpaca breeders will have to make a new commitment to the genetic improvement of the alpaca and be willing to put aside other considerations when reporting data. Forget marketing, just for a minute... and let's make a commitment to be scientific about this and do it properly. It will benefit all farmers in the long run by the improvement of their alpacas.

To achieve the most accurate EPDs possible, similarity of environment, feeding, and care is important. The most accurate predictions are obtained in livestock industries where a male animal may inseminate 30-40 females on a single farm. Since the environmental factors are the same for each animal, it is much easier to see the genetic effects of each mating combination. When breedings occur in dissimilar environments, the volume of data becomes important as a means of correcting for environmental factors. Once again, this is easier in those livestock industries where artificial insemination is used and so one male can be widely bred and thereby accumulate a large body of data to his credit.

In the alpaca industry, we will have to recognize that probably only a handful of the most widely-bred studs will have a large enough body of data to completely overcome the influence of environmental factors on the data. We will have to become comfortable with a certain level of error in our results (PE), and use EPD data as a supplement to our other established means of selection. Perhaps breeder groups will also choose to require a certain level and type of care and feeding for all the alpacas and farms entered in their group to help eliminate these factors. Breeder groups may also

choose to form from general geographic areas as well. This will help further eliminate environmental factors, as well as facilitate the development of separate breeds that are best adapted to survive and thrive in that geographic region.

Another factor to be considered in the use of EPDs in the alpaca industry is the slow rate of reproduction in alpacas. While this certainly has many advantages for us as an industry, it will mean that we will have to be a little more patient with this process. For small farmers (which is the majority of us) we may need to submit data for a couple of years before we accumulate enough to be helpful in making breeding decisions. If we have bred one of our sires widely on our farm, or among farms in our region, we may be able to collect enough data to be helpful sooner, taking into account the PE (prediction error). Or, if we have numerous histograms from previous years, or stored fleeces that we could test, we might be able to enter enough data to get off to a good start. But, we will have to be patient. We will be laying a foundation for the future of our herd.

What about economic considerations? What is the cost of this testing? One currently available testing service online lists a yearly herd fee of \$150 plus a yearly per animal fee of \$6.25. The National Sheep Improvement Program (which works with Virginia Tech and Dr. David Notter), lists the fees for sheep at \$50 a year per herd, and \$1.25 per animal. NSIP also currently works with some alpaca owners on a contract basis. NSIP would need to be approached with a specific proposal and then could provide specific pricing relative to alpacas and that proposal. Of course in addition to these fees, consider your costs for running histograms on your entire herd on a yearly basis.

Would the benefit of having EPD information be worth the cost and time invested in gathering data and running tests? I think for larger farms with ample funds, the answer is an immediate "Yes". If all information is accurately reported it could be very helpful in their breeding decisions. In addition, they would tend to have larger volumes of data, their sires would most likely be more widely bred, etc. so that PE would be less of a factor much earlier in the process.

What about small farms? Many owners might say “I am already on a tight budget; will this benefit me enough to be worth the extra expense?” This is a determination that each farm will have to make for themselves, but I think small farmers’ involvement in the process is important to the equity of the outcome of the planning for EPDs. I think EPDs will probably go forward with or without us, so we would be wise to be involved and to help guide the development process. I think there are ways that all this can be set up that will tend toward a benefit for everyone, and that there are ways this could be done that will tend to benefit only a few. We need to carefully examine the options, determine what we think is best for everyone (alpacas as a species and all farm owners), and then get involved in the process to ensure equity and the best possible outcome.

First of all, who should do the data collection? From discussions with Dr. David Notter at Virginia Tech it is my personal opinion that our best choice is to work with a university that has extensive experience collecting data, producing EPDs, and assisting breed groups in evaluating that data. This is not a simple process. It is not just a matter of having access to software that will run the data. Generating useful data and understanding how to put it into practice in a breeding program requires the help, and oversight, of a group of people experienced in this area. The National Sheep Improvement Program web site describes some of the functions provided by Virginia Tech and NSIP as: “geneticists run the complex software to calculate EPDs. They also archive all the NSIP databases in a secure mode... NSIP oversees and coordinates the entire process... develops new procedures and traits; it tests improved data collection and data evaluation techniques; it maintains the databases for security and archival purposes, and it coordinates genetic research with the data.”⁵ It seems that there might be tremendous benefit to using an experienced team.

As one example, during the course of collection of data, at some point it may be necessary to change the direction, change the type of data collected, etc. and we will need expert advice on how to do that. We think we know what we want, as far as outcomes. We may find out, however, as we go along, that there are unintended

outcomes associated. We may need to revise our goals and data collection.

For example, we all think that one of the ultimate fleece goals is achieving as much consistency as possible in the fiber. We are all breeding in that direction. Would you be surprised to hear from an expert who has been very successful at doing this with alpacas, that as you approach complete consistency, it starts becoming a negative trait? Why? Because the primary fibers we are so intent on breeding out have a biological function. They are associated with the sweat glands and so assist with the cooling of the alpaca. They also provide structure for the fleece; without primary fibers the fleece becomes very cotted (tangled).

The combination of the cotted fiber and the reduced sweat glands means that the alpaca cannot easily cool itself. This results in a less-than-hardy alpaca that has heat stress problems during the summer even in northern climates, and could not even begin to exist in southern regions. Clearly this is not what we want. But we thought we did. How do we know how to adjust for factors such as this that arise, other than with expert help?

Who should choose the traits to be collected? I think that individual breeders who are of like mind as to their breeding goals (and possibly also geographically related) should band together and form groups. They should then collectively choose the traits they deem to be most important to them and work with genetic experts to determine a set of collection data as well as which data will be used to generate EPDs. I don’t think that one set of EPDs for all huacayas, or for all suris, is the best answer. We have diversity within these groups that needs to be preserved, for the sake of the development of distinct fiber types that will be commercially viable and valuable and for the sake of the development of regionally hardy types of alpacas.

Could the use of EPDs help move us toward a viable fiber market? I think so. If we focus primarily on the collection of fiber traits rather than other more show ring-oriented traits, and if we understand that alpaca fiber must be marketed as a high-end luxury fiber and we work toward producing that quality of fiber while still allowing for variety.

So, what is the bottom line here? Can

EPDs be successfully implemented in the alpaca industry? Probably so, if we are willing to exercise some patience during initial data collection periods and if we allow for the development of a diversity of types within the industry.

Will the introduction of EPDs bring people from other livestock industries into the alpaca industry in droves? In my opinion, probably not. I think that the price point of alpacas is the main inhibitor, rather than the lack of focus on breed standards or EPDs in our industry. If a Merino sheep owner can get 20 lbs. of 18 micron fleece off of a \$500 sheep every year, how will the addition of EPDs tempt him to cross over into alpacas? I think we are a very different sort of livestock market. Our draw is very specific, and we need to continue to emphasize our uniqueness even while firmly establishing alpacas as livestock. If we add EPDs to our industry, we need to do it because we believe it will help the species progress toward excellence and will help current alpaca owners to succeed in their businesses, not for other reasons.

Where do we go from here? Let’s continue to learn about this subject, to share information and work toward an EPD implementation strategy that is beneficial for everyone. Let’s put our minds together as to the best way to proceed with this. Let’s meet with other breeders in our area, or breeders who share our personal breeding goals and talk about strategies. Let’s choose a way forward that better the species as well as promotes the well being of the alpaca farmer. Together we can do this.

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About the Author

Susan is an alpaca farm owner who is strongly committed to the education and success of new breeders in the industry. She was the founding President of the AOBA affiliate, the Alpaca Small Farm Network, where she dedicated three years toward the establishment of educational programs and networks of support for the farmers in the region. She and her husband Zac, are personally committed to helping farms in their area in any way they can - from education to hands-on help in an emergency. Susan and Zac enjoy raising their own huacaya herd plus a number of boarders on their farm, Abbondanza Alpacas, in Greenville, SC. Susan may be contacted at susanbuser@earthlink.net

References

1. *ARI Evaluates Software Addition, OneVoice*
2. *Mike Safley, What are EPDs? (Estimate Progeny Differences)*
3. *Dr. Wayne C. Jarvis*
4. *Mike Safley, A National Alpaca Improvement Program*
5. *National Sheep Improvement Program web site*
<http://www.nsip.org/>

Sources

David R. Notter, Animal and Poultry Sciences, Virginia Polytechnic Institute and State University; NSIP: The U.S. National Sheep Improvement Program at Virginia Tech: Operating Procedures and Parameters
Dr. Sara Via, Ph.D, Professor, University of Maryland; How EPDs Help You Breed Better Alpacas
Scott P. Greiner, Extension Animal Scientist, Virginia Tech; Understanding Expected Progeny Differences
Dr. Wayne Jarvis, Genetic Alpaca Improvement 102; Genetic Alpaca Improvement 103
Brett Kaysen, Colorado State University: Estimated Progeny Differences (EPDs), presented at Fiber to Fashion 2008
Mike Safley, A National Alpaca Improvement Program
Mike Safley, What Are EPD's? (Estimated Progeny Differences)
ARI Evaluates EPD Software Addition, OneVoice
Interview with Dr. David Notter, Virginia Tech
Interview with Julie Skinner, Snowmass Alpacas
Julie Skinner, The Making of Champions, Camelid Quarterly, Dec. 2007
National Sheep Improvement Program Fact Sheet (NSIP 006-01)
Interview with Amy McCroskie. A&A Alpacas
Interview with Linda Marie McWilliams, Inti Alpacas
Interviews with other alpaca breeders
Virginia Tech web site
<http://www.apsc.vt.edu/Faculty/Notter/WWW/nsip.html>
National Sheep Improvement Program web site
<http://www.nsip.org/>
Mulberry Alpacas blog
<http://www.mulberryalpacas.com/serendipity/archives/2008/02/P2.html>

Resources for further research

(These resources represent a wide variety of input from the alpaca industry, sheep industry and other sources. The author does not endorse any organization, individual, or data collection system connected with these resources. These resources are simply provided for your education.)
<http://www.nsip.org/> (National Sheep Improvement Program)
<http://www.epdlibrary.org> (information compiled by an Affiliate Congress committee, directed by Adrian Stewart)
<http://www.alpacagenetics.com/library.html>
<http://www.nsip.org/fs006.01.howtouseepds.pdf>
<http://www.ideal-alpaca.com/images/features/HowEPDsHelp.pdf>
<http://www.ext.vt.edu/pubs/beef/400-804/400-804.html>
<http://www.mulberryalpacas.com/serendipity/archives/843-Dr-Sara-Via-on-Alpaca-EPDs.html>
<http://www.alpacagenetics.com/faq.html>
http://www.omafra.gov.on.ca/english/livestock/sheep/faqs/info_sfip.htm