PEER REVIEWED

SPA (Standardized Performance Analysis) Part 1: What Do the Production Numbers Mean?

Shan Collett, *DVM*
The Animal Center
PO Box 696
Alliance, NE 69301

Introduction

This is the first of a two part series on SPA calculations and interpretations. SPA is a systematic approach to tracking beef cattle production (SPA-P) and finances (SPA-F) on the ranch. SPA utilizes a standard set of guidelines for various production and financial measures. It has been endorsed by the National Cattlemen's Beef Association (NCBA) as an accurate method of calculating the factors which affect production and ultimately profitability. SPA is a part of the Integrated Resource Management (IRM) Program, and was developed by producer members of the National Cattlemen's Association (now known as the National Cattlemen's Beef Association) and the Cooperative Extension Service to establish a standardization of production and financial calculations for beef cattle operations.

The beef industry, in particular the cow-calf segment, now has an industry-wide method of tracking the economic influences on a ranch. SPA allows individual managers to monitor their own operation from year to year and compare it with other operations of similar size and location. It compares apples to apples. Up until this time, some of the individual production measures may have been calculated by different methods, thus comparing apples to oranges.

Beef cattle veterinarians can serve as an important source of information to producers. A 1997 NAHMS (National Animal Health Monitoring System) survey reported 60.8% of cow-calf operations regard the veterinarian as a very important source of information. As veterinarians, we must ask ourselves if we wish to continue to service our clients as a standardized information resource. As evidenced through personal and professional contact with practicing veterinarians, it is fair to say that we want to service our clientele in an informative manner to enhance their profitability. To work as leaders in this area of SPA, we must first understand how the numbers are put together and what they mean. In this article we will look at the production measures analyzed by SPA as seen in Table 1.

Table 1. A comparison of selected Standardized Performance Analysis (SPA) data for production, financial and economic measures of cow-calf beef operations from across the United States, *modified from B. A. Reeiting and J. W. Lemaster, Producing the calf: how much does it really cost? Proceedings 48th An. Beef Cattle Short Course. Gainesville, FL. 1997, 17-25.*

Production Measure	National[a]	FL[b]	IA[c]	MT[d]	NE[e]	TX[f]
Number of herds	388	32	72	31	27	135
Year(s) data were collected	91-96	91-96	93-95	95	91-94	91-94
Pregnancy Percentage	90.6	80.5	94.6	93.2	94.4	88.9
Calving Percentage	88.3	78.6	87.4	91.4	93.0	-
Weaning Percentage	84.1	74.9	82.9	85.4	89.7	83.3
Actual Weaning Weights	514	480	500	572	512	515
LB weaned exposed female	434	361	430	489	460	427

[a]National Spa Report Card; Cattle Fax, April 1997
[b]Florida Spa Report Card; Cattle Fax, April 1997
[c]Strohbehn, 1997
[d]Griffith, 1997
[e]Hamilton 1997 (Great Plains Veterinary Educational Center)
[f]McGrann, 1996

Production Performance Measures[a]

I. Pregnancy Percentage

Computation:

Pregnancy percentage =
[(Number of females exposed diagnosed as pregnant / Number of females exposed) X 100]

Accurate computation requires the following ad-

[a]References to all of the following measures can be found in the Cow-Calf IRM SPA Handbook.[2]

justments to the number of females actually exposed during the breeding season:
1. Subtract the number of exposed pregnant females sold or transferred out between breeding and pregnancy diagnosis from the number of exposed females.
2. Add the number of exposed females purchased between breeding and pregnancy diagnosis.

Interpretation:

This measure of performance is a good indicator of breeding performance in the herd. If the measure is lower than the average of similar operations, it may indicate that the nutritional program is inadequate, that bull power or fertility is inadequate, that there is disease causing early embryonic death, or that there is a mis-match between herd genetics and the environment (i.e., feed resources and management style). The significance of this percentage is greatly enhanced if it is kept by female age group since rebreeding is often only a problem with certain age groups, such as females exposed for their second or third calf.

Limitations:

1. As with any measure of reproductive performance, this value should be used only in comparing similar operations.
2. This value may only indicate that a problem exists with little indication of the cause of the problem.
3. There will be year to year variation due to environmental stresses, such as droughts, severe winters, etc.
4. This value will only be available to production systems that routinely diagnose pregnancy.
5. Adding exposed females may influence the pregnancy percentage.

Notes:

a) Do not count purchased females (pairs) which are not exposed and added to the herd between breeding and pregnancy diagnosis. Do include purchased females (pairs) which are diagnosed as pregnant or exposed and added to the herd between breeding and pregnancy diagnosis.
b) All death losses of exposed females should remain in the exposed female numbers.
c) Females intended to be culled that are identified before breeding should not be included in the exposed female number.

II. Pregnancy loss percentage

Computation:

Pregnancy loss percentage=

[(Number of females diagnosed as pregnant that failed to calve / Number of females diagnosed as pregnant) X 100]

Accurate computation requires the following adjustments to the number:
1. Females that abort between pregnancy diagnosis and calving should be included in the numerator.
2. Subtract pregnant females sold and add pregnant females purchased to the divisor.

Interpretation:

This measure is a good indicator of reproductive performance. If the measure is higher than the average of similar operations, it may indicate late pregnancy reproductive disease problems which cause abortions. When kept over time, this measure may point out a potential problem prior to its becoming serious. There may be nutritional inadequacies of feedstuff quality groups or a management problem with the females. It may also indicate inaccurate pregnancy diagnosis.

Limitations:

1. As with any measure of reproductive performance, this value should be used only to compare similar operations.
2. This value may only indicate that a problem exists with little indication of the cause of the problem.
3. There will be year to year variation due to environmental stresses, such as droughts, severe winters, etc.
4. This value will only be available to those who routinely diagnose pregnancy.
5. Accuracy is reduced if only a portion of the total herd is tested for pregnancy. The exposed females not tested may have a higher or lower pregnancy rate.

Notes:

a) Do not count purchased females or pairs which are open and added to the herd between pregnancy diagnosis and calving season.
b) All death losses of pregnant females should remain in the females diagnosed as pregnant numbers.

III. Calving Percentage

Computation:

Calving percentage=

[(Number of calves born / Number of females exposed) X 100]

Accurate computation requires the following adjustments to the number of females exposed during the breeding season:
1. Subtract the number of pregnant females sold or transferred out between breeding and calving from the number of exposed females.
2. Add the number of exposed females or pairs purchased between breeding and calving to the number of exposed females.

Interpretation:

This measure of performance is a good indicator of breeding performance and gestational management in the herd. If the measure is lower than the average of similar operations, it may indicate that the nutrition or grazing program is inadequate, bull power or fertility is inadequate, there are diseases causing embryonic death, or there is a mis-match between herd genetics and the environment. The significance of this percentage is greatly enhanced if it is kept by female age group since rebreeding is often a problem within certain groups (i.e. rebreeding first and second calf heifers).

Limitations:

1. As with any measure of reproductive performance, this value should be used only in comparing similar operations.
2. This value may serve only as an indicator of an existing problem but does little to pinpoint the cause.
3. Year to year variation will exist in this value due to environmental stresses.
4. This value is not related to the calving pattern. It does not relate to dates of birth or when calves were born during the calving season.

Notes:

All "term" calves born should be included in the number of calves born, even if they are dead on arrival.

IV. Calving distribution

Computation:

Calving distribution=
[(Cumulative number of calves born by 21, 42, and 63 days and those after 63 days of the calving season / Total number of calves born) X 100]

Note:

Compute calving distribution at these days. The starting date for the first 21 day period is 285 days following the bull turn-in date with the mature cow herd. If this is unavailable, then start the first 21 day period when the third mature cow (3 years and older) calves. All calves born, either alive or dead, should be included in this analysis.

Interpretation:

Since calf weaning weight and uniformity of the calf crop is greatly affected by calf age, this measure of calving distribution is an excellent measure of reproductive performance. This measure is very useful in evaluating the adequacy of nutrition during crucial reproductive periods, adequacy of bull power, herd health, and heifer development programs.

Calving distribution is most useful if calculated by age of females since the distribution pattern of certain groups, particularly second calf heifers, is often much more wide spread than for mature cows. Additionally, separate calculations by age of females may be necessary for meaningful comparisons when yearling heifers are bred prior to the cow herd.

Limitations:

1. This measure of performance may not be as useful in the southern part of the U.S. as it is in the northern part where pasture growth is more seasonal, however, a tight calving distribution offers many benefits in all environments, such as marketing of a uniform calf crop and concentration of the calving season, which helps reduce calving labor costs.
2. Calving distribution cannot be used in extensive grazing environments where accurate counts of calves born may be difficult to obtain.

V. Calf Death Loss

Computation:

Calf death loss based on exposed females=
[(Number of calves which died / Number of exposed females) X 100]
Calf death loss based on calves born=
[(Number of calves which died / Number of calves born) X 100]

Interpretation:

This measure of performance can be very useful in evaluating the herd health program, calving environment, nutritional program, and genetic selection program. The cause of death in each case would make the information much more valuable since calf losses may result from many factors at or following birth.

Limitations:

1. The type of operation, extensive versus intensive, should be considered when comparisons are made using this measure of performance.
2. The age make-up of the cow-herd could influence calf death loss and must be considered when comparisons are made between herds.
3. This measure does not distinguish between calf death loss at birth and death loss during the suckling period. Detailed records of when calves die provide more meaningful information for death loss analysis.

Notes:

Calf death loss should include those calves lost at birth and any that die up to weaning time. Abortions before calving should be included in the pregnancy loss percentage.

VI. Calf Crop or Weaning Percentage

Computation:

Calf crop or weaning percentage=

[(Number of calves weaned / Number of females exposed) X 100]

Accurate computation requires the following adjustments to the number of females actually exposed during the breeding season:

1. Subtract the number of pregnant females sold or transferred out between breeding and weaning from the number of exposed females.
2. Add the number of exposed females or pairs purchased between breeding and weaning to the number of exposed females.
3. Subtract the number of calves purchased and grafted on females from the number of calves weaned.

Interpretation:

This formula measures the reproductive rate of the herd; and since reproductive rate has been shown to be a major factor in profitability, it is the most important single measure of production performance. Since reproduction is largely a function of nutrition, it is an excellent indicator of the adequacy of the nutritional program. Additionally, it is an excellent indicator of how well the cows are matched to the available resources. The adequacy of the herd health program used and any disease problems can be, in part, evaluated by this measure. As with any measure of performance used in evaluating cow herd management, comparisons should only be made between herds with similar calving seasons, management systems, and environmental inputs.

Limitations:

1. This measure of performance is a good indicator of total herd output, nutritional adequacy and managerial skills or husbandry practices. It should be noted that this measure does not account for excessive use of feed and non-feed inputs.
2. Calf crop percent may not correlate with economic performance in cases where cull marketing decisions are made prior to times of high input costs. This can cause some erroneous conclusions when comparing this management style with those that cull at times after high input costs.

Notes:

a) All death losses of exposed females should remain in the exposed female numbers.

b) Females that are intended to be culled but remain in the exposed female herd during the breeding season should not be included.

c) The exposed females that were intended to be bred, but culled later when found open, must remain in the exposed number.

d) Do not include purchased grafted calves that are nursing cows in the number of weaned calves.

VII. Actual Weaning Weights

Computation:

Steer/bull calf weaning weight=

(Total weight of weaned steer and bull calves / Total number of weaned steer and bull calves)

Heifer calf weaning weight=

(Total weight of heifer calves weaned / Total number of heifer calves weaned)

Average weaning weight=

(Total weight of weaned calves / Total number of calves weaned)

Average age at weaning (Months)

Calving distribution should be considered when evaluating average age at weaning.

Interpretation:

While weaning weight is extremely difficult to interpret, it must be assessed to measure productivity and performance. As with any measure, it must be compared to similar operations in order to have any meaning. The best use of this measure of performance is to establish gross revenue for the operation and to evaluate the effect of changes in the breeding program or management. Also, since the environment and feed supply greatly affect weaning weights in any year, long term trends should be more useful than yearly changes. This should be considered a measure of the gene pool of calves, as well as individual genetic performance.

Limitations:

1. Since producers calve and wean calves at different times and ages, actual weaning weights are not standardized to age. However, including average age at weaning in the data serves as a guide in interpreting weaning weights for comparative purposes.
2. Due to pasture production and management, it can be difficult to compare weaning weights between operations. This is especially a problem when comparing fall versus spring calving herds in which calf weaning age may differ by 3 months. Where two calving seasons are used it is best to do a separate analysis for each season.
3. Weaning weights are greatly affected by annual environmental conditions. For example, such things as high and low levels of moisture and extremes in temperature, which are beyond the manager's control, can influence weaning weights more than all controlled management factors. Thus, producers should avoid placing too much emphasis on the weights for any single year and should concentrate on long term trends.

VIII. Pounds Weaned Per Exposed Female

Computation:

Pounds weaned per exposed female=
(Total pounds of calf weaned / Total number of females exposed)

Interpretation:

This calculation combines into one figure the herd reproductive rate, calf death loss, and genetics for maternal and growth traits. Thus, from a herd production standpoint, this is probably the best measure of performance. This measure is a tool to assist producers in managing the tradeoffs between growth rate and reproductive rate. In other words, concentrating on improving the number of pounds weaned per cow exposed should be more profitable than emphasizing either calf crop or weaning weight separately.

Limitations:

1. Since this measure is a combination of the measures used to analyze reproduction and production, it has some of the limitations of each.
2. Age at weaning and distribution of calving can influence this value a great deal, making it more valuable as a measure for an individual operation than for comparison between farms or ranches.

Note:

The number of females exposed must be adjusted for the same factors that were used in the calf crop percent calculation.

IX. Female Replacement Rate Percentage

Computation:

Female replacement rate=
[[(Raised replacement heifers exposed for first calf + Purchased replacement heifers and breeding cows exposed) / Number of females exposed] X 100]

Accurate computation requires the following adjustments to be computed:

1. Add the number of heifers purchased or retained and cows purchased between breeding and calving to the number exposed.
2. Include both heifers and cows in the number of females exposed, that is using the previously defined female exposed definition.

Interpretation:

This measure of performance is a good indicator of herd replacement rate and cow longevity. If this percentage is higher than the average of similar operations it may indicate the herd has reproductive problems or may be in an expansion phase. Generally, a high percentage will mean higher herd costs and lower productivity per cow because a larger portion of the herd is first and second calving females. Also, if this percentage is high it may mean the current genetic type does not match the resources, thus causing higher than normal culling rates and heifer retention. A lower percentage than normal may indicate the herd is in a liquidation phase or has excellent longevity of the cow herd.

Limitation:

1. As with any measure of performance, this value should be used only in comparing similar operations.
2. This value may only indicate that a problem exists with little indication of the cause of the problem.
3. Market fluctuation may cause this percentage to vary more than production factors in some herds.
4. Producers with herds in either an expansion phase or liquidation phase will find this percentage hard to compare and of less value.

X. Grazing, Raised Feed, and Crop Aftermath Acres Per Exposed Female

Computation:

Grazing and raised feed acres per exposed female=
(Total grazing acres + crop aftermath acres / Total number of exposed females)

Grazing acres per exposed female=
(Grazing acres / Total number of exposed females)

Raised feed acres per exposed female=
(Raised feed acres / Total number of exposed females)

Crop aftermath acres per exposed female=
(Crop aftermath acres / Total number of exposed females)

Pounds weaned per acre utilized by cow-calf enterprise=
(Total pounds weaned / Total acres utilized)

* Where land has more than one use such as corn grain production and corn stalk grazing, land use should be adjusted to the time actually used for grazing.

Interpretation:

This measures the primary input in the cow-calf enterprise, forage and land. It also provides a description of the production system that the producer can monitor over time. As a primary input, management of forages has an important impact on production costs.

Limitations:

1. Differences in acres of the grazing and feed sources are most valuable for the same operations over time. Operations in the same area can be a useful comparative analysis. However, these values have limited use in comparing different regions for land with different production capacity.

2. Acres of land do not reflect forage production quality or differences in production.
3. Adjusting for the time that land is used for grazing or growing another crop does require judgement. Consistency between years is important.
4. Adjustments in grazing time must be made when supplemental feeding and grazing are simultaneous, based on the portion of cow requirements being met by grazing.

XI. Raised/Purchased Feed Fed Per Breeding Cow

Computation:

Raised / Purchased feed fed per breeding cow=
(Total pounds of raised and or purchased feed fed / Number of breeding females)

Accurate computation of this performance measure requires the following:
1. Keep track of feed use on a daily or weekly basis, and then summarize for the year or use the inventory analysis procedure. The inventory analysis procedure is beginning year feed inventory, plus production and purchases, less sales and use by other livestock, less year ending inventory.
2. Conversion of high moisture feedstuffs (i.e. silage) to an air dry basis is necessary.

Interpretation:

This measure is an excellent indicator of efficient resource use and cost control. Because harvested and purchased feed fed represent a major expense in most operations, this measure, when compared to other operations within a region, can indicate either a strength or weakness in herd nutritional management. This measure would include feed fed to replacement heifers and bulls which support the cow-calf enterprise. If the feed needed per breeding female is higher than average it could indicate over-feeding, below normal pasture production or utilization, above normal feed wastage, below average feed quality, or above average female replacement rate. Herds with larger grazing resources will have lower quantities in this area, while herds with limited grazing resources will have larger harvested/purchased feed utilization. Caution should be exercised when one is comparing this measure between herds. This measure is useful for an individual operation when kept over a period of time so progress can be measured.

The number of breeding females is defined as mature females and heifers of breeding age shown on the beginning fiscal year balance sheet.

Limitations:

1. An accurate measure of feed fed requires either good feed use records or a good inventory and use analysis procedure.
2. Type of feed fed can vary greatly in energy and protein density from ranch to ranch or year to year, thus making comparisons less accurate.
3. For this measure, it will be difficult to measure herds in either expansion or liquidation phase.

Notes:

Feed being fed to replacement female stock and bulls needs to be included in the total quantity of feed utilized by the producing herd. It is important to convert all high moisture feedstuffs to an air dry basis. For example, 6000 lbs. of silage containing 60% moisture would convert to approximately 2760 lbs. of air dry feed with 13% moisture (6,000 X .40 dry matter = 2400, 2400/ .87 = 2758.6).

Discussion

The beef cattle veterinarian working with producers must be aware of the numbers which drive their production objectives, and how the various inputs will affect the numbers. We can no longer make spontaneous recommendations for improving production without knowing the impact on production costs and profitability. Different operations have different profit levels at which to operate. Making what seems to be a sometimes simple decision, such as improving weaning weight, depends on a number of factors. With appropriate analysis of the operation, better management decisions can be made regarding the economic feasibility of a change. Following careful analysis, it may be more profitable for the operation to stay at their current weaning weight or perhaps a lower weaning weight may be more profitable. Being aware of what actually drives the numbers is essential to making the best management decisions.

Some veterinarians have been reluctant to implement production medicine services in their practice, feeling that small producers are often lifestyle producers and don't need help in this fashion. Most producers, irrespective of size, want to control cost; many in fact want to produce a high quality calf. The size of the operation definitely has an influence on cost of production, as fixed expenses for the operation, both direct and indirect, can be spread over more individual units of production in larger operations. Farms with 100 to 199 cows have an average economic cost of production that is 16% above that of the 500 to 999 head group.[3] I submit that if we offer these services to smaller producers, they would be willing to listen to cost saving ideas.

The veterinarian must demonstrate competence in management and business skills. If a producer lacks confidence in your ability to manage your own clinic and financial affairs, he/she will doubt your ability to help their operation. Therefore our public perception is invaluable when we wish to offer this type of service. It is

key to remember that we are offering help to the ranch owner, not trying to take over the ranch.

For veterinarians who wish to broaden their knowledge of production management, there is a course offered through the University of Nebraska at the Great Plains Veterinary Educational Center, Clay Center, Nebraska, 68933. Also the Texas A&M IRM SPA Handbook & Software can be purchased through Dr. James McGrann, Dept. of Agricultural Economics, College Station Texas, 77843-2124. (409) 845-8012.

References

1. National Animal Health Monitoring System, Part 1: Reference of 1997 Beef Cow-Calf Management Practices, USDA, APHIS, pp 4-6, June 1997. 2. Integrated Resource Management (IRM), Standardized Performance Analysis (SPA), Commercial Cow-Calf SPA Handbook, Texas Agricultural Extension Service, SPA-16, March 1993. 3. Langemier, Michael R. PhD., Economies of Size in Cow-Calf Production, Agri-Practice 16(5):15-19, 1995.