APPRAISALS USING BEEF AND DAIRY CALCULATORS

ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS) VETERINARY SERVICES (VS)

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INTRODUCTION

Appraisals are important to animal disease programs because they help determine appropriate compensation for producers whose animals are euthanized in response to disease detections. There are many factors to consider in preparing an appraisal, including the animal's age, weight, breed, sex, general body condition, pregnancy status, and number of lactation cycles.

VS currently relies on trained appraisers to determine fair market value. The framework for the new approach to bovine tuberculosis and brucellosis proposes to use calculators in place of this traditional appraisal. To that end, VS has developed four cattle appraisal calculators: beef breeding, beef feeder, dairy cow, and dairy replacement. This paper explains how each calculator considers an animal's characteristics and the current market price to determine appraised value.

What is an Appraisal?

An appraisal is a two-step process to estimate an animal's worth. First, the quality of the animal is evaluated, and its value is estimated based upon the assessed quality. Appraisers often use a sales comparison approach, where recent sales of other animals of similar quality (comparables) are the basis for an animal's value. Appraisal calculators estimate the value of an animal based on a specific number of key animal characteristics and current market prices. Key features of any appraisal are accuracy, timeliness, thoroughness, and transparency.

Federal indemnity payments are based on the fair market value (FMV) of the animals that will be destroyed. Indemnity is the actual payment a producer receives and is a function of FMV with the actual amount based on regulations and policies. Indemnity at 100 percent of FMV provides for like-kind replacements—that is, animals of the same quality and age.

Why Use Cattle Appraisal Calculators?

VS is proposing to use appraisal calculators for several reasons:

- Increased transparency
- Reduced costs associated with hiring private appraisers
- Updated calculators with current market data
- Simplicity and speed of appraisal
- Fair and consistent treatment to all producers
- Success with calculators in other APHIS programs

With indemnity payments sometimes exceeding $1 million per herd, it is important for VS to demonstrate that the appraisal process is fair and transparent.

The speed of a calculator is an advantage when responding to disease detections. Ease of use allows a wide range of VS field personnel to conduct an appraisal, instead of waiting for personnel with specialized appraisal training or external appraisers hired by APHIS. Animals that may be infected can be disposed of more quickly, allowing cleanup to proceed, and owners can receive their compensation sooner.

Another important quality of appraisal calculators is their consistency. All animals with the same characteristics, located in the same region, during the same period receive the same value. Having different individuals doing appraisals, no matter how well trained they are and how closely they follow markets, can lead to differences in values received among owners.

Appraisal calculators will be updated frequently. VS will be conducting both monthly updates of prices as well as ongoing analyses of various cost, price, and quality relationships that are keys to determining value. VS personnel who use the calculators will be encouraged to provide feedback on their use.

Appraisal calculators have been used to valuate poultry since August 2007. There are appraisal calculators for broilers (meat and breeders), turkeys (meat hens, meat toms, breeder hens, and breeder toms), and table egg layers. A calculator is also used to appraise sheep and goats. Consequently, using appraisal calculators to valuate cattle can be viewed as an expansion of current VS methodology.

APPRAISAL CALCULATORS

Appraisal Calculator Characteristics

Each of the four cattle calculators does the following:

- Uses readily available public market prices, especially those that are reported by USDA's National Agricultural Statistics Service (NASS) and Agricultural Marketing Service (AMS).
- Converts the observable prices into appraisal values through various cost, price, and quality relationships that are analyzed on a continuous basis.
- Assumes animals are above average in quality but allows for adjustments (both up and down).
- Is updated monthly.
- Is easy to use; the user (VS' field force) simply enters relevant animal characteristics.

Beef Breeding Appraisal Calculator

The main price input for the beef breeding calculator is value of a cutter-cow carcass (90 percent lean) weighing 500 pounds or greater—as reported in USDA-AMS' *National Weekly Direct Cull Cow and Bull Report*. Cutter-cow carcass prices are reported for five zones: 1) West, 2) North Central, 3) South Central, 4) Midwest, and 5) East (Figure 1). The beef-breeding calculator uses these five zones. The value of a bred cow is a function of the cull cow value with the relationship being dependent upon changes in the national beef cow inventory. If beef cow inventory is stable, bred cow value is 122 percent of cull-cow value; 116 percent if inventory is contracting; and if inventory is expanding, 129 percent. Bred heifer and cow-calf pair values are a function of bred cow value. Bred heifer value is 111 percent of bred cow value and base cow-calf pair value is 129 percent of bred cow value[1].

These base-breeding appraisal values are further adjusted depending upon various quality characteristics. The adjustment characteristics for bred cows are age, weight, and body condition. The same adjustment factors, plus calf age, are used to adjust cow-calf pair values. Weight and body condition are the adjustment factors for bred heifers. Cows are assumed to be either bred or have a calf at the side. If neither condition holds, then the cow is considered a cull cow and is valued accordingly.

Figure 1. Beef Cull Cow Map

VS has revised the original beef breeding calculator to handle breed registered and seedstock herds (herds that supply replacement heifers and/or herd bulls to other herds). The basic premise behind the revision is that livestock owners desire to receive a value for their breeding animals similar to the prices they receive for the replacement heifers and herd bulls they sell. If they sell replacement bred heifers for $2000, desired valuation for their retained bred heifers would be $2000. Producers must provide documentation as to prices received for their bred heifers and percentage of heifers that were bred.

Actual bred heifer appraisal value is a function of average bred heifer selling price and the proportion of heifers bred for either sale or own-herd replacement. The percentage increase in bred heifer value is then applied to both bred cow and cow-calf pair values. Similar adjustments for weight, body condition, and calf age are made for seedstock females as for regular females. The age adjustment factor has an additional category for older cows. The calculator recognizes that no matter how valuable the cow, when she is at the end of a useful life her value approaches her cull value.

Quality adjustments for both standard and seedstock animals are summarized in Table 1.

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[1] Bred cow-cull cow price ratios are being monitored with the idea of using a 12-month rolling average instead of one of the three values based upon changing beef cow inventory.
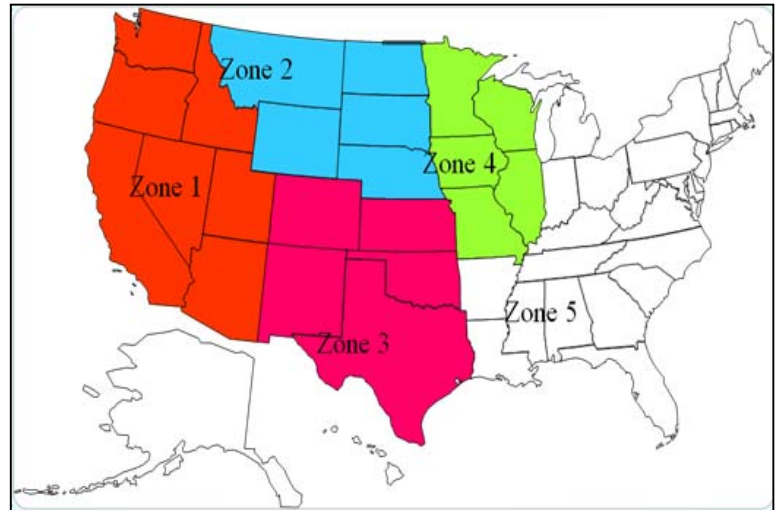
Table 1. Beef Cow Calculator

		Bred Cow		Bred Heifer		Cow-Calf Pair	
Base Value	Live weight	Regional cutter carcass weight divided by 44%		900-1150 pounds		Pair cow same as bred cow	
	Value multipliers	contracting cow inventory 116% stable cow inventory 122% expanding cow inventory 129%		multiply bred cow price by 111%		multiply bred cow price by 129%	
	Location multipliers	5 Zones		5 Zones		5 Zones	
Premium Value	Seedstock herds	base bred cow value ∗ premium bred heifer value / standard bred heifer value		premium bred heifer value = base heifer value ∗ % heifer crop not bred + average bred heifer sale price ∗ % heifer crop bred		base cow-calf value ∗ premium bred heifer value / standard bred heifer value	
	Carcass value (base)	Average weight and weighted average price for cutter grade carcass (90% lean) 500 pounds and up					
Adjustments for Commercial and Seedstock Herds	Weight	<150 pounds below average average >100 pounds above average	decrease 3% base increase 2%	<900 pounds 900-1150 pounds >1150 pounds	decrease 3% base increase 3%	<150 pounds below average average >100 pounds above average	decrease 3.5% base increase 2%
	Age	<4 years 4-7 years >7 years Seedstock > 9 years	increase 6% base decrease 11% no premium	*N.A.*		<4 years 4-7 years >7 years Seedstock > 9 years	increase 6% base decrease 4% ½ premium
	Body Condition	<average average >average Seedstock < avg. & > 7 yrs.	decrease 12% base increase 15% no premium	<average average >average	decrease 12% base increase 15%	<average average >average Seedstock < avg. & > 7 yrs	decrease 7.75% base increase 14% ½ premium
	Calf Age					<2 months 2-5 months >7 months	decrease 4.25% base increase 4.25%
	Final Price	Regional base or premium values plus sum of all adjustments					

Beef Feeder Appraisal Calculator

Based on statistical analysis of beef feeder prices, the highest beef feeder cattle prices are found in eastern Wyoming and western Nebraska. Prices decline moving away from this area, with prices in the East being the lowest. The country is divided into nine zones by grouping States that have similar beef feeder prices (Figure 2).

AMS' Oklahoma report is the best pricing point for beef feeders because of its robust market with good reporting by local markets. Prices and weights for the highest quality grade, Feeder Steers Medium and Large 1, are used.

Average weights and prices are reported in 50-pound increments beginning with 350-400 pounds and ending with 900-950 pounds. Four weeks of prices are averaged to determine monthly feeder prices, starting at 400 pounds and increasing to 900 pounds in 50-pound increments. Based on historical price relationships presented in Figure 2, calf (400-600 pounds) and feeder (650-900 pounds) prices for each region are determined. Feeder heifer prices are a percentage of feeder steer prices: 400-500 pounds (85 percent); 550-650 pounds (89 percent); and 700-850 pounds (92 percent). Holstein steer prices are assumed to be 75 percent of feeder steer prices based on analysis of markets where both beef feeder steers and dairy feeders were sold.
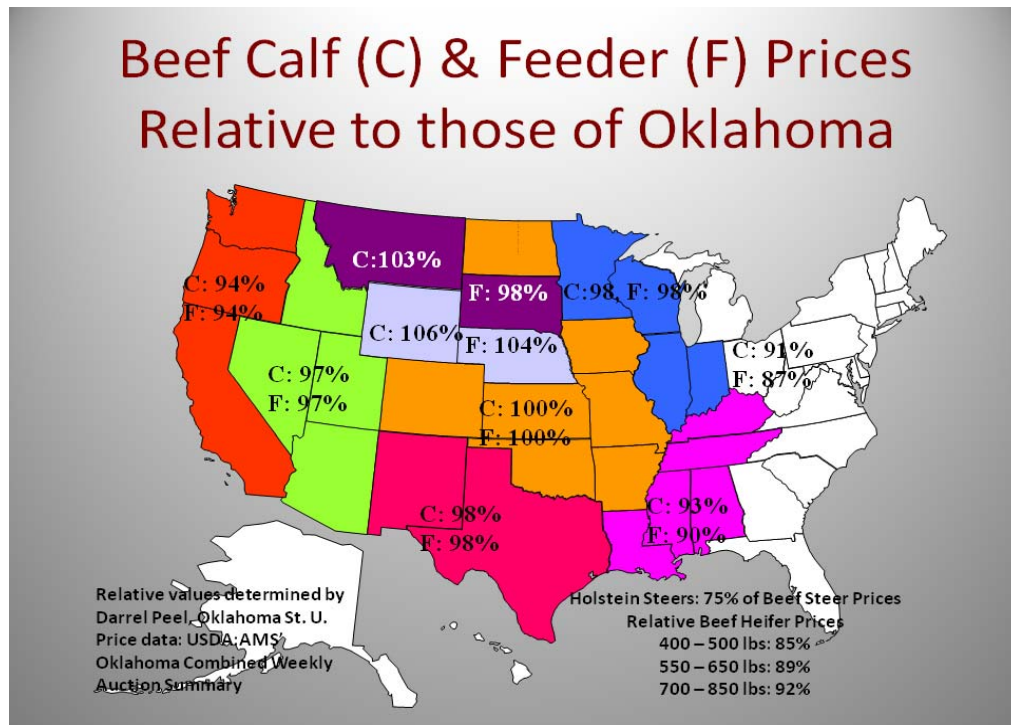

Figure 2. Map showing the nine zones grouped by States that have similar beef feeder prices.

Milk Cow Appraisal Calculator

The milk cow appraisal calculator has been used on a limited basis since February 2004 and has been revised several times, with the latest revision (4.1) completed in October 2011.

Three components make up the value of a dairy cow: future milk production (milk production premium), future calf production (calf production premium), and current meat value. The milk cow appraisal calculator estimates each component separately and then sums them to determine appraisal value. The calculator determines adjustment factors for each component. User-provided data are then used to determine individual cow (or group of cows) appraisal value. Data input used to determine component adjustment factors include: NASS' top 23 dairy States (Figure 3) cow replacement price[2] and per-cow annual milk production[3], AMS cull cow prices[4],

Figure 3. Top 23 Dairy States.

Agricultural Research Service Dairy Herd Improvement cow survival rates[5], AMS milk component prices[6], APHIS National Animal Health Monitoring System newborn dairy cow survival rates[7], springer weights[8],

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[2] USDA NASS. *Agricultural Prices.*

[3] USDA NASS. *Milk Production, Disposition, and Income Summary.*

[4] USDA AMS. *National Weekly Direct Cow and Bull Report.*

[5] Hare, E.; Norman, H.D.; Wright, J.R. 2006. *Survival rates and productive herd life of dairy cattle in the United States.* J. Dairy Sci. 89(9):3713-3720.

[6]Available at http://www.ams.usda.gov

[7] USDA. 2007. National Animal Health Monitoring System Dairy 2007 Study, Part IV. USDA:APHIS:VS:Center for Epidemiology and Animal Health; National Animal Health Monitoring System. Fort Collins, Colorado.

and cull cow weights[9]. For information on how the milk premium adjustment factor is calculated see Table 2.

Since the calculator is estimating value for three separate components, it requires the most user provided input. Inputs provided by the user include:
    Breed
    Cow weight
    Probability of being pregnant by 305 DIM[10]
    Current lactation
    Cull-cow quality grade
    State
    Days-in-milk (DIM)
    Relative calf value[11]
    Number of cows with same characteristics[12]
    305 ME or daily milk production
    Breed registered[13]

See Table 2 for a summary of how individual cow milk-production premium, calf production premium, and cull value are calculated to determine individual cow-appraisal value.

It is possible that a user will not have access to all of the information required to calculate an appraisal value. Consequently, the calculator provides default values for each user-entered parameter. Some of the default values are breed specific; see Table 3.

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[8] Heinrichs, J. and Lammers, B. 1998. *Monitoring Dairy Heifer Growth.* College of Agricultural Sciences, Pennsylvania State University.

[9] Ahola, J.K.; Forster, H.A.; VanOverbeke, D.L.; Jensen, K.S.; Wilson, R.L.; Glaze, Jr.,J.B.; Fife, T.E.; Gray, C.W.; Nash, S.A.; Panting, R.R.;Rimbey, N.R. 2011. *Quality defects in market beef and dairy cows and bulls sold through livestock auction markets in the Western United States: II. Relative effects on selling price.* J. Anim. Sci. 89:1484-1495.

[10] Instead of a simple open-pregnant classification, the calculator uses probability of being pregnant by 305 DIM. As the number of days open increase the probability of the cow being pregnant declines. Cows with zero probability of becoming pregnant will be culled at the end of current lactation.

[11] For registered herds that sell excess heifers and herd bulls. Relative increase in newborn-calf value increases milk-cow appraisal value. Commercial herds and registered herds that do not merchandize their excess stock relative calf value is at 100 percent.

[12] The calculator handles up to 10 cows at once. If whole herds are to be appraised it is suggest to place cows into groups with similar characteristics. Since the calculator provides a total herd appraisal value, the number of cows in each lot must be indicated.

[13] There is a premium for being registered, but most of the increased value for having superior genetics will be through increased milk production and relative calf value.

Table 2. Dairy Cow Calculator

Individual Dairy Cow Appraisal Value		Calculations	Comments
Milk production premium	Actual 305 ME milk production (pounds)	∫(daily milk production, % butterfat, days-in-milk, lactation)	305 ME from records or determined by calculation
	x Expected remaining lactations	∫(expected remaining lactations after current lactation, survivability of current lactation, portion of last lactation with culled, % chance of becoming pregnant, days-in-milk)	
	= Expected milk production		
	x Butterfat adjustment factor	∫(market share, skim price, fat price for milk Classes I-IV, actual % butterfat)	Butterfat adjustment factor adjusts milk production to reflect the influence butterfat has on received milk prices.
	x Milk premium adjustment factor		See below for calculation of milk premium adjustment factor.
	= Milk production premium		
Calf production premium	Expected calves to be born	∫(remaining calvings calculated from DHI survivability study, % chance of becoming pregnant, calf death loss at birth, relative calf value)	
	x Average calf price ($/head)		From dairy replacement calculator
	= Calf production premium		
Cull cow value	Weight (pounds)		
	x Slaughter price ($/cwt)	∫(regional cull price, quality grade, weight)	
	= Cull cow value		
Final appraisal value	**∑(milk production premium, calf production premium, cull cow value)**		

Milk Premium Adjustment Factor	Calculations/Comments
base value	NASS cow replacement price ($/head, assume cow replacement price is for a recently freshened Holstein springer heifer)
minus cull cow value ($/head)	Springer heifer weight (1200 pounds) x regional cull prices (AMS Weekly Cow and Bull Report)
minus expected calf value ($/head)	Expected remaining calvings for just freshened springer (DHI Cow Survivability Study) x 48 hour calf survivability x newborn calf price ($/head)
Milk Premium ($/head)	
divided by expected total milk production of a just freshened springer (pounds)	
Milk premium per pound of milk production (Milk Premium Adjustment Factor)	

Table 3. Milk Cow Appraisal Calculator Default Values

Breed	Milk Production (lbs)	Butterfat (%)	Weight (lbs)			
			1st Lactation	2nd Lactation	3rd Lactation	4th + Lactation
Ayrshire	18,238	3.85	1,100	1,125	1,175	1,200
Brown Swiss	21,736	3.98	1,200	1,300	1,400	1,500
Guernsey	17,269	4.41	1,100	1,150	1,200	1,250
Holstein[1]	25,635	3.63	1,200	1,300	1,400	1,500
Jersey	18,315	4.62	900	950	1,000	1,050
Milking Shorthorn	17,607	3.65	1,100	1,150	1,200	1,250
Red & White	23,402	3.70	1,200	1,300	1,400	1,500

Breed common default values: 2nd lactation; 152 days-in-milk; probability of becoming pregnant, 100%; relative calf value, 100%; cull quality: 1st lactation, commercial; 2nd lactation, utility; 3rd + lactation, cutter

[1] Default breed

Dairy Replacement Appraisal Calculator

The dairy replacement appraisal calculator relies heavily on reported market prices from across the country. Currently, 31 markets across 16 States[14] are monitored. Each market reports springer values; some report values for milk cows, short-bred heifers, open heifers, and calves. Most reported prices are for Holsteins, but occasionally other breeds or crossbred prices are reported. Only prices for above-average springers are used. Springer prices across the 16 States are averaged to obtain a national average price.

Some of the markets report short-bred heifer (1-3 months pregnant) prices which allows for the calculation of a short-bred-to-springer price ratio. This price ratio is then used to determine national short-bred heifer price. National mid-bred heifer (4-6 months pregnant) price is the average of short-bred and springer-heifer prices.

Heifer and bull calves are collected and used to determine values for newborn calves, 1-2 weeks old calves, 3-4 weeks old calves, 5-6 weeks old calves and 7-plus week old calves.

Individual price and weight of open heifers are gathered together into a dataset that is used to estimate the relationship between weight and price, i.e., the following equation is estimated:

$$price \ (\$/head) = intercept \ (\$/head) + price \ slope \ (\$/pound) \ x \ weight \ (lbs).$$

The estimated equation is then used to determine open heifer prices from 200 to 1200 pounds in 50-pound increments.

Individual prices for the top 23 dairy States for heifer and bull calves, open heifers, and bred heifers are based on their relative NASS dairy cow replacement price. Each State's NASS dairy cow replacement price is divided by the national NASS dairy cow replacement price. The national prices for calves, open heifers, and bred heifers are then multiplied by this State-national NASS cow replacement price ratio to determine State-level appraisal values for these replacement animals. Appraisal values are rounded to the nearest $5.

The above method is for Holstein replacements. A few non-Holstein prices are reported, usually for Jerseys and crossbreeds, often Holstein-Jersey. Whenever a non-Holstein price is reported, the ratio of non-Holstein price to a corresponding Holstein price is determined. These price ratios are then averaged to determine a national non-Holstein/Holstein price ratio. The national non-Holstein/Holstein price ratio is then used to determine appraisal values for non-Holsteins.

For high-valued seedstock herds, the relative calf-value percentage from the milk cow calculator can be applied to the replacement calculator. This ensures that all replacement animals for the herd would be increased by the same percentage as the calves.

For additional details on how dairy replacement values are determined, see Table 4.

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[14] CA, CO, GA, IA, ID, IN, KY, MI, MN, MO, NY, PA, TX, UT, WA, and WI.

Table 4. National and State Level Dairy Replacement

	Bred Heifers				Not Weaned Calves			
Description	**Above Average Quality Springer**		**Short-Bred**	**Open Heifers**	**Heifer Calves**		**Bull Calves**	**Non-Holstein**
Collect auction data* **Determine State-level values** **Determine national average values**	Multiple grades – Average prices for the above average grade	Single grade – Average of top price and middle price	Springer price ratio		Light weight (<100 pounds)	Heavy weight (≥100 pounds)	Light weight (<100 pounds) · Heavy weight (≥100 pounds)	Holstein price ratio whenever non-Holstein prices are reported
Calculate national values for various weight-age categories	**Short-breds** springers value x short-bred-springer ratio **Mid-breds (4-6 months pregnant)** average of short-bred and springer prices **Springers** National average determined above			Collect price ($/head) and weight (pounds) of all reported open heifer prices. Use observations to estimate the equation: price ($/head) = intercept($/head) + price slope ($/pounds) x weight (pounds). Use equation to determine values from 200 to 1200 pounds in 50 pound increments.	**Heifer and bull calves** Newborn = light weight value 1-2 weeks old = light weight value x 75% + heavy weight value x 25% 3-4 weeks old = light weight value x 50% + heavy weight value x 50% 5-6 weeks old = light weight value x 25% + heavy weight value x 75% 7+ weeks old = heavy weight value x 25%			
Determine individual State-level values for each class and category	**Individual State values are calculated for categories of bred heifers.** Prices for each class and category of dairy replacement animals of the top 23 dairy States equal the ratio of the State's NASS cow replacement price to U.S. NASS cow replacement price.			**Individual State values are calculated for categories of open heifers.** Prices for each class and category of dairy replacement animals of the top 23 dairy States equal the ratio of the state's NASS cow replacement price to U.S. NASS cow replacement price.	**Individual State values are calculated for categories of heifer calves and bull calves.** Prices for each class and category of dairy replacement animals of the top 23 dairy States equal the ratio of the State's NASS cow replacement price to U.S. NASS cow replacement price.			**Individual State values are calculated for non-Holstein categories** Values for Holsteins multiplied by the non-Holstein – Holstein price ratio.

Seedstock Herds: Standard appraisal values are multiplied by the relative calf value from the dairy cow calculator

*All auctions report springer prices, other prices are partially reported. Prices are collected for springer (7-9 months pregnant) heifers, short bred (1-3 months pregnant) heifers, open heifers, not weaned heifer calves, and not weaned bull calves from 31 auctions located in 16 States. The number of auctions per State ranges from one to seven. Prices are for Holsteins unless otherwise specified.