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The Economic Optimal Weight for the Replacement Beef Female

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Market Report	Yr Ago	4 Wks Ago	4/25/08
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight.	$96.26	$87.93	$92.70
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb..	128.21	121.20	123.56
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	108.57	99.75	105.64
Choice Boxed Beef, 600-750 lb. Carcass.	161.54	139.99	154.49
Western Corn Belt Base Hog Price Carcass, Negotiated.	69.52	54.02	71.34
Feeder Pigs, National Direct 50 lbs, FOB..	72.76	46.31	50.00
Pork Carcass Cutout, 185 lb. Carcass, 51-52% Lean..	74.26	56.50	70.71
Slaughter Lambs, Ch. & Pr., Heavy, Wooled, South Dakota, Direct..	91.75	92.95	83.50
National Carcass Lamb Cutout, FOB.	243.47	257.11	250.92
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu..	4.73	9.52	7.95
Corn, No. 2, Yellow Omaha, bu.	3.44	5.27	5.49
Soybeans, No. 1, Yellow Omaha, bu.	6.73	11.82	12.81
Grain Sorghum, No. 2, Yellow Dorchester, cwt..	5.55	9.04	9.32
Oats, No. 2, Heavy Minneapolis, MN , bu.	2.78	3.54	3.96
Hay			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	135.00	135.00	*
Alfalfa, Large Rounds, Good Platte Valley, ton..	92.50	85.00	*
Grass Hay, Large Rounds, Premium Nebraska, ton.	90.00	*	*

* No market.

Determining the optimal weight for breeding replacement heifers has been a goal of researchers for decades. It is an important question because replacing cows in the beef herd is expensive.

Finding the answer is a complex problem because of the inter-related nature of the economic and physiological variables. Patterson et al. (1992) may have expressed the nature of the problem best when he said, "Although puberty in the female and the events that precede its onset may be fixed from a physiological standpoint, the animal and management environment in which it is placed are in constant transition." This indicates that the optimum depends on economic, as well as the biological factors.

Recent studies conducted by University of Nebraska researchers (Funston and Deutscher 2004, and Martin et al. 2007) at the West Central Research and Extension Center (WCREC) have shown the fertility rates between groups of heifers fed to different average sizes prior to breeding were not statistically different, while the feed costs for the heavier heifers was greater than that of the lighter ones. Thus, the economic analyses in these studies were based on the development cost of cattle groups. This study also suggested that optimal heifer size was less than the traditionally accepted 64 to 65 percent mature body weight (PMBW).

The data collected in the above WCREC studies was used to conduct a rigorous economic analysis of optimal breeding weight using classical economic optimization theory. A profit equation was the central tool, as suggested by Fuez (1991). This profit equation consisted of five revenue equations and three cost equations, all of which were affected by the heifer's pre-breeding size, PMBW. The complex nature of the profit equation required a numerical methodology to derive the optimal PMBW.

The revenue equations included sale of non-pregnant heifers, sale of cows that did not have a calf after the calving season, sale of cows that did not rebreed, sale of calves born to the heifers, and the value of pregnant three year-old cows (see Figure 1).

The three cost equations included the initial costs of securing the heifers, the cost of feeding them to the appropriate PMBW, and the cost of dystocia (calving difficulty) as seen in Figure 2. Other costs, such as opportunity cost and reduced pregnancies, were implicitly included in the revenue calculation.

These cost and revenue equations were developed using both ordinary least squares (OLS) and limited dependant variable (PROBIT) regressions. For instance, the relationship between PMBW and expected pregnancy rates, which decreased as PMBW decreased, was used to predict the number of heifers sold at the first pregnancy check.

Of all relationships among the many factors, only a few will be mentioned here. A complete report can be obtained from the authors.

Smaller PMBWs reduced the sale weights of all subsequent groups. The lower sale weights at first pregnancy check, and fall calf sales produced from these smaller cows increased the price per pound received, since lighter weight animals usually sell for a premium on a pound basis, but resulted in decreased revenue. A lower PMBW increased the incidence of dystocia among first calf heifers. It also led to a lower second pregnancy rate, resulting in increased cost.

The optimal biological reproductive rate was achieved at 62.9 PMBW, which is lower than the traditionally accepted recommendation. This difference may be due to the way PMBW is calculated. While others used an average herd size for each PBMW calculation, we used the actual mature weights for individual animals.

When the economic factors of revenue and cost are considered, the profit maximizing PMBW falls to 59.7. The implication is that the cost of obtaining a larger animal (62.8) is less than the value returned for that size, giving the smaller heifer the economic advantage (see Figure 3).

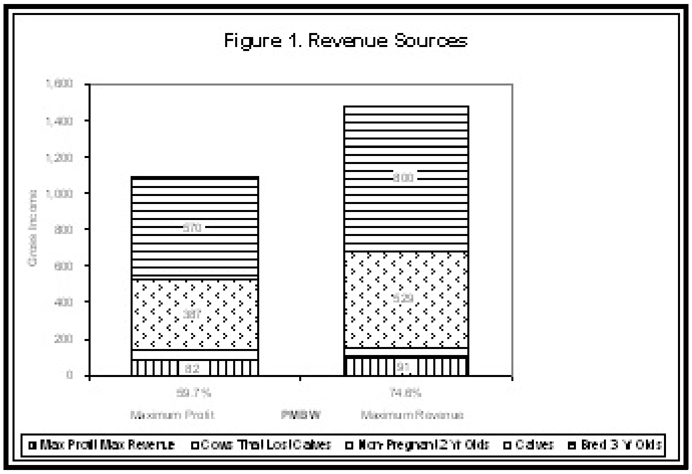

Figure 1. Revenue Sources

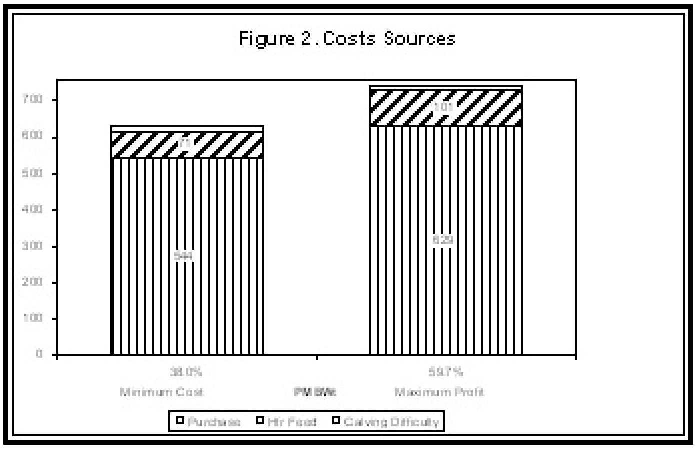

Figure 2. Costs Sources

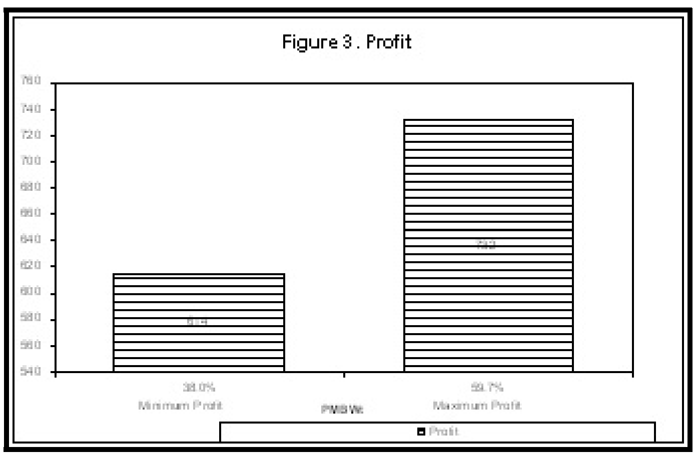

Figure 3. Profit

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