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Economic considerations of breeding for polled dairy cows versus dehorning in the United States

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ABSTRACT

This paper examines the costs and benefits of selecting for polled dairy heifers versus traditional dehorning practices. Stochastic budgets were developed to analyze the expected costs (EC) associated with polled dairy genetics. The economic assessment was expanded beyond on-farm cash costs by incorporating cost and benefit estimates to generate industry-wide discussion, and preliminary economic evaluations, surrounding the public acceptance and attitude toward polled genetics versus dehorning calves. Triangular distributions, commonly used to represent distributions with limited data, were used to represent labor costs for dehorning, the likelihood of treatment of calf, and the cost of veterinary treatment. In total, 10,000 iterations were run using @Risk v 6.0 (Palisade Corp., Newfield, NY). The EC of the 4 traditional dehorning methods evaluated in this study ranged from $6 to $25/head, with a mean EC around $12 to $13/head. The EC of incorporating polled genetics into a breeding program ranged from $0 to $26/head depending on the additional cost, or premium, associated with polled relative to horned genetics. Estimated breakeven premiums associated with polled genetics indicate that, on average, producers could spend up to $5.95/head and $11.90/head more for heterozygous and homozygous polled genetics, respectively, compared with conventional horned genetics (or $2.08 and $4.17/straw of semen at an assumed average conception rate of 35%). Given the parameters outlined, sensitivity to individual farm semen and dehorning costs are likely to swamp these differences. Beyond on-farm costs, industry-wide discussion may be warranted surrounding the public's acceptance and attitude toward polled genetics versus dehorning or disbudding of calves. The value of avoiding dehorning may be larger for the industry, and perhaps some individual farms, than initially suggested if additional value is put on calf comfort and possible worker aversion to dehorning. If public perception of dehorning influences market access, the EC of dehorning may be large but that cost is unknown at present.
Key words: consumer perceptions, cost-benefit, dehorning, polled

INTRODUCTION

Increasing interest in animal welfare has placed many livestock production practices under enhanced scrutiny. One such practice is dehorning, or disbudding, which is common in both beef and dairy cattle production systems in the United States. According to the American Veterinary Medical Association (**AVMA**), dehorning cattle conveys a variety of potential benefits, including reduced risk of injury for handlers and other cattle, fewer aggressive behaviors, and reduced feeding trough space (AVMA, 2014). As evidence of these benefits, 94% of US dairy cattle producers recently indicated routinely dehorning cattle (USDA, 2009).

The majority (68%) indicated using hot iron disbudding to cauterize horn-producing cells before horn buds attach to the frontal sinus (USDA, 2009). Another 12% indicated using caustic paste disbudding to chemically destroy the horn-producing cells in the first few days of life (USDA, 2009). Dehorning interventions occurring later in life, specifically scoop or gouge dehorning (13%) and saw or wire dehorning (7%), were much less prominent given that as horns grow and become attached to the frontal sinus, the procedure becomes more invasive with increased risks of bleeding and infection (USDA, 2009; AVMA, 2014). See Cozzi et al. (2015) for a discussion of the current situation in Europe concerning dehorning.

Despite potential benefits of dehorning noted by the AVMA (2014) and the dairy industry, dehorning also

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results in changes in behavior that have been found to be consistent with acute stress responses from pain (Stock et al., 2013). As a result, these procedures may become a welfare concern for dairy consumers and the public. N. J. O. Widmar, C. Morgan (Purdue University, West Lafayette, IN), C. A. Wolf, E. A. Yeager (Kansas State University, Manhattan), and C. C. Croney (Purdue University; unpublished data) found that dehorning ranked equally with tail docking for the greatest concern, in terms of negative effect on dairy cattle welfare, among 12 dairy production practices investigated. Although dehorning is currently unregulated in the United States, several countries have created dehorning welfare legislation (Stafford and Mellor, 2005). Therefore, despite documented benefits and in light of recent prohibitions on docking tails of dairy cattle in the United States, the risk that consumer acceptance of dehorning will wane is significant.

If dehorning becomes unacceptable in the US marketplace, producers may seek polled dairy cattle. Polled animals have always existed in cattle populations, but intense selection for production attributes in the dairy industry has suppressed polledness in the population, making polled sires rare and often inferior in terms of production relative to their horned counterparts. Nonetheless, the genetic alteration responsible for polledness, contrary to previous speculation, does not appear to affect production performance (Cole et al., 2009; Windig et al., 2015). Incorporating polled genetics into a breeding program has been proposed by the AVMA (2014) as an alternative to dehorning given its potential to eliminate the welfare concerns and expenses associated with dehorning. However, no work has been done to quantify the costs and benefits of this strategy compared with conventional dehorning methods.

The first objective of this work was to develop stochastic cost estimates of selecting for polled dairy heifers versus dehorning. Stochastic budgets were developed to analyze the expected costs (**EC**) associated with polled dairy genetics. It was hypothesized that sensitivity to individual farm semen and dehorning costs were likely to overwhelm the cost differences between raising or acquiring dairy heifers with polled genetics versus dehorning. The second objective of this work was to expand the economic assessment beyond on-farm cash costs by incorporating both cost and benefit estimates to generate industry-wide discussion, and preliminary economic evaluations, surrounding public acceptance and attitude toward polled genetics versus dehorning calves. In other words, this work sought to determine the economic benefit of using polled genetics if the gap in genetic merit between polled and horned cattle were to disappear.

MATERIALS AND METHODS

In a simplified version of the decision-making process for dehorning, dairy cattle producers must first decide whether to use traditional dehorning practices to remove horns from calves or to incorporate polled genetics into their breeding program. Decision makers choosing to maintain a traditional dehorning program must then decide which dehorning method to use and whether or not to administer pain relief during the procedure. Producers choosing to use polled genetics face the decision of using a heterozygous or homozygous polled sire. Because polledness is an autosomal dominant trait, 100% of the offspring from homozygous polled sires will be hornless, regardless of dam genotype. Heterozygous sires, on the other hand, exhibit the polled phenotype but are carriers of the horned gene, creating uncertainty about the phenotype of their offspring (horned or polled).

A series of stochastic partial budgets was developed to simulate costs under 6 potential dehorning/polled genetics scenarios: hot iron dehorning with no pain relief, hot iron dehorning with pain relief, caustic paste dehorning with no pain relief, caustic paste dehorning with pain relief, incorporating homozygous polled genetics into a breeding program, and incorporating heterozygous polled genetics into a breeding program. The costs (C_j) for the first $j = 1,\ldots,4$ traditional dehorning scenarios were estimated as

$$C_j = MC_j + PR_j + LC_j + \left(TR_j \times TC\right), \qquad [1]$$

where MC_j is materials cost, PR_j is the cost of pain relief treatments, LC_j is labor cost, TR_j is the probability an animal will need to be treated for infection or incomplete dehorning following the procedure, and TC is the cost of this potential follow-up treatment. A different equation was used to estimate the cost of incorporating polled genetics into a breeding program to account for the additional cost, or premium, associated with polled genetics and the uncertainty associated with the phenotype of calves sired by heterozygous sires. The cost (C_j) of the $j = 5$, 6 polled genetics scenarios was estimated as

$$C_j = PG_j + \left(1 - p_j^p\right) \times \left[MC_l + PR_l + LC_l + \left(TR_l \times TC\right)\right], \qquad [2]$$

where PG_j is the additional cost of polled genetics, p_j^p is the probability that a calf exhibits the polled phenotype, which is determined by sire and dam genotypes,