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The impact of 3 strategies for incorporating polled genetics into a dairy cattle breeding program on the overall herd genetic merit

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ABSTRACT

Dehorning in cattle has been associated with behavioral, physiological, and neuroendocrine responses indicative of pain. Unaddressed, the pain associated with a routine production procedure could contribute to a negative public perception of livestock production practices. Alternative considerations of dehorning include the selection of polled cattle within herds, thereby avoiding pain and production loss. As polledness results from an autosomal dominant pattern of inheritance, genetic selection for polled cattle could reduce the prevalence of the horned trait. Herein we discuss 3 strategies to incorporate polled genetics into a cow herd and the estimated impact on the overall genetic merit of the herd. Furthermore, the availability and genetic merit of polled artificial insemination bulls in the United States is summarized. Both Holstein and Jersey dairy bulls registered with the National Association of Animal Breeders from December 2010 through April 2013 were queried. Polled bulls were identified as either being homozygous (PP) or heterozygous (Pp) and the average net merit (NM) predicted transmitting ability (PTA) of each sire group was calculated. The percentage of polled calves born each year over a 10-yr period was calculated for the following 3 scenarios: (A) various percentages of horned cows were randomly mated to Pp bulls, (B) various percentages of horned cows were preferentially mated to Pp bulls, and (C) horned cows were selectively mated to PP bulls, heterozygous cows to Pp bulls, and homozygous polled cows to horned bulls. Additionally, the change in NM PTA of the cow herd was calculated over the same period. The highest percentage of polled animals (87%) was achieved in scenario C. An evaluation of the herd NM PTA highlights the trade-offs associated with increasing polled genetics. Given the current genetic merit of horned and polled bulls, increasing the percentage of polled calves will decrease the NM PTA in Holstein, but may have minimal impact in Jersey herds. Decisions regarding selective breeding to increase polled genetics will need to be evaluated in the context of production objectives, cost of dehorning, and impact on overall genetic merit.
Key words: polled genetics, dehorning, selection, animal welfare

INTRODUCTION

Dehorning is a commonly performed practice on both beef and dairy cattle production systems. Dehorning in older cattle or disbudding in calves is performed for a variety of reasons, including safety for handling, utility of headlocks, decreased incidence of carcass wastage due to bruising, reduced feeding trough space needed, decreased risk of injury to other cattle, increased value of the animal, and fewer aggressive behaviors exhibited (Stock et al., 2013). Management practices have been adopted to dehorn animals to better fit within the production system. Disbudding is a method of removing horns in calves up to 8 wk of age when horn buds are 5 to 10 mm long and can be removed with a heated disbudding iron (Stafford and Mellor, 2005). Once horns grow longer, they become attached to the underlying frontal sinus and must be removed by amputation. Three methods are primarily used to dehorn cattle: (1) amputation, using scoop dehorners such as Barnes, Keystone, gauges, saws, and gigli wire; (2) cautery, using an electrical-, gas-, or battery-powered hot iron; and (3) chemical application of caustic paste, usually consisting of a strong alkalotic agent such as sodium hydroxide or calcium hydroxide (Stock et al., 2013) Irrespective of which method of dehorning is used, the process requires intentional management intervention, which can be stressful to both the operator and the animal and may influence livestock health and production.

In a recent European survey, producers that were in favor of keeping horned cows were asked about the reasons for not carrying out dehorning (Gottardo et al., 2011). Aesthetic motivations (54% of respondents) and lack of time (24%) were the main reasons cited. All methods of dehorning have been associated with behavioral, physiological, and neuroendocrine re-

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sponses indicative of pain, irrespective of when this is performed (Stafford and Mellor, 2005, 2011) Recently, an increased societal concern and awareness for food animal welfare has influenced discussions regarding the humane treatment of livestock (Rollin, 2012). Routine procedures in cattle, such as dehorning, can cause negative public perception. Consequently, several countries, especially those belonging to the European Union, Australia, and New Zealand, have created dehorning welfare legislation (Stafford and Mellor, 2005). In North America, The Canadian Code of Practice for Dairy Cattle recommends the use of a local anesthetic combined with analgesia and sedation for dehorning calves; however, no current regulations exist for analgesic use in the United States (Bradley and MacRae, 2011). It should be noted that the American Veterinary Medical Association (2012) supports the use of procedures that reduce or eliminate the pain of dehorning and proposes that available methods of minimizing pain and stress, including the application of local anesthesia and the administration of analgesics, should be considered.

Survey evidence in the United States suggests that dehorning is a common procedure, often performed together with castration (92%) and usually completed without the use of analgesics (Coetzee et al., 2010; USDA, 2010). A survey of North-Central and Northeastern United States dairy producers indicated that 12.4% of respondents used a local anesthetic nerve block and only 1.8% use systemic analgesia at the time of dehorning (Fulwider et al., 2008). Additionally, another survey of United States veterinarians reported not providing analgesic drugs to 51% of beef and 37% of dairy calves dehorned at less than 6 mo of age (Fajt et al., 2011). A Canadian survey indicated that approximately 72% of veterinarians provided analgesia at the time of dehorning calves (Hewson et al., 2007). A recent survey of European farmers also indicated limited willingness to pay the cost of analgesia or to call a veterinarian to perform the procedure (Gottardo et al., 2011).

Recently, an expert committee appointed by the French National Institute for Agricultural Research to review the issue of pain in food-producing farm animals developed a "3S" approach, accounting for "suppress, substitute, and soothe," to minimize pain in livestock (Guatteo et al., 2012). In addition to identifying methods to substitute painful with less-painful procedures or soothing pain with analgesics, a key element of this approach is the suppression of any source of pain that brings no obvious advantage to the animals or the producers. This can be accomplished either through elimination of a painful procedure such as tail docking or through genetic selection to reduce undesirable traits that would ordinarily be mitigated by a painful procedure (EMEA, 2013). Although dehorned animals offer an advantage to both animals and producers, increasing polled genetics would support suppression of a source of pain. Using genetic selection is further supported by the recent recommendation of the American Veterinary Medical Association as an alternative consideration to dehorning (AVMA, 2012).

Although cattle are naturally horned for protective purposes, modern commercial industries decrease the necessity of these defenses. Within these production systems, for reasons listed above, cattle without horns can be more desirable. Horn growth is a genetically heritable autosomal recessive trait, and polled cattle result from an autosomal dominant pattern of inheritance that has been shown recently to be a result of allelic heterogeneity of the polled locus (Medugorac et al., 2012). Therefore, selection for polled animals could result in the decline of this undesirable characteristic (i.e., presence of horns) of intensively raised cattle. Selection for polled cattle has been observed in the beef industry, with a 58% reduction in beef calves born with horns from 1992 to 2007 due to producers breeding for polled animals (USDA, 2009a). However, this breeding selection has not translated into the dairy industry, with a reported 94% of dairy operations in the United States still dehorning calves (USDA, 2009b).

Despite the slow adoption of selection for genetically polled dairy cattle, interest in polled genetics is increasing and the AI industry of the United States is marketing an increasing number of polled bulls. The frequency of polled genetics will increase slowly as polled bulls that fit existing selection criteria are used. Alternatively, producers may wish to select bulls with the objective of producing polled calves. This can be easily accomplished by mating cows to homozygous polled (**PP**) bulls, but the availability and genetic merit of PP bulls limit the cost-effectiveness of this approach. Alternatively, heterozygous polled (**Pp**) bulls may be used exclusively or in combination with horned bulls to increase the frequency of polled calves while maintaining improved genetic merit of other economically important traits.

If the production of polled calves is an objective of a breeding program, consideration must be given to the percentage of cows to be bred to polled bulls, mating decisions relative to the polled locus, and the impact of using polled bulls on the overall genetic merit of the herd. The objectives of this study were to (1) summarize the availability and genetic merit of polled AI bulls available in the United States, (2) compare strategies for incorporating polled genetics into a dairy cattle breeding program, and (3) estimate the impact of polled genetics on the overall genetic merit of a cow herd.