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**Optimizing mate selection: A genetic algorithms approach**

Diego N. Fontoura<sup>1</sup>, Sandro S. Camargo<sup>1</sup>, Fernando Cardoso<sup>2,1</sup>

<sup>1</sup>Programa de Pos-Graduacao em Computacao Aplicada, Universidade Federal do Pampa, Bage, Brazil

<sup>2</sup>Embrapa Pecuaria Sul, Bage, Brazil

The Brazilian Association of Hereford and Braford provides to breeders a genetic evaluation and breeding program called PampaPlus. For selection, this program uses a Genetic Quality Index (GQI), which is calculated from weighted Expected Progeny Differences (EPD) for production traits. The choice of mating pairs is fundamental for the generation of the best progeny and consequent maximization of the average herd GQI. However, the number of possible combinations, defined by the product of the number of cows by times the number of bulls, and of genetic traits to be analyzed, makes the search for the best combinations of mating a difficult problem to be treated computationally in polynomial time, requiring a heuristic strategy for its resolution. This work presents an approach, based on genetic algorithm heuristics, which after the selection of bulls and cows belonging to a mating group, recommends the best combinations of mating to maximize the GQI, taking into account both: directional values of expected differences of progeny and penalizations on mating restrictions, such as inbreeding and poor expected performance on important traits. The data used to perform simulations were obtained from the Brazilian Association of Hereford and Braford breeders. Fourteen traits were available to be used in the composition of the breeding objectives: birth weight, weaning weight, weaning maternal weight, total maternal weight, post-weaning weight, post-weaning weight gain, cow weaning weight, scrotal circumference, musculature, body height, body structure, cow body condition score at weaning, navel size, and eye pigmentation. Moreover, the breeder can define a minimum and/or maximum use of each bull, for the mating period, in order to search for the best combinations of mating. The genetic algorithm takes into account a breeder-defined inbreeding constraint, which restricts incompatible matings. The processing time of the genetic algorithm varies according to the number of cows and bulls used in the simulation. For an experiment containing 148 cows and 17 bulls, typical average amounts cattle owned by breeders belonging to the association, the average time was 49 seconds on an i7 processor with 8gb RAM, and average GQI was improved from 4,63 to

11,25, representing an improvement of 140%. Among valid matings according to breeder objectives, solutions found by our approach typically reach a GQI maximization, considering the average of initial and final values, with improvement exceeding

100%. Analyzes of experiments show a satisfactory behavior of the genetic algorithm, since obtained results showed that it favors the choice of animals with the highest EPD values combination based on the weights determined by the breeding goal, while complying with the defined maximum and/or minimum use of the bulls and inbreeding restriction for mating recommendations.

**Keywords:** beef cattle, compensatory mating, evolutionary algorithm