AGRI

New value-adding tools

New research from TEAGASC looked at transforming readily available big data into value-creating decision support tools.

The 'datafication' of the agri-food sector is presenting new challenges, not least of which is how to encourage smarter and better-informed decision making from the vast quantity of data originating from multiple sources. We know that the observed performance of an individual is a function of its DNA and the environment it has been exposed to. Geneticists have therefore preoccupied themselves with developing advanced statistical and mathematical methodologies to disentangle the genetic effects from environmental effects, and in the process, generate accurate estimates of the genetic merit of the individual. What have received less attention, however, are the support systems available for breeders and farmers to aid in value-generating decision making. In collaboration with the Irish Cattle Breeding Federation (ICBF), Teagasc geneticists at the Animal & Grassland Research and Innovation Centre, Moorepark, have embarked on the development of three complementary animal-level tools to assist on-farm decision making. These tools exploit readily available data on a large scale, and are equally applicable in dairy cattle, beef cattle and sheep.

Cow's own worth

Candidate dairy dams of the next generation are currently selected based on the Irish national breeding goal, the Economic Breeding Index (EBI). Animal-centric characteristics other than genetic merit, however, also affect the remaining lifetime profitability of a female. The cow's own worth (COW) tool was developed by Teagasc to rank females for use in culling decisions. It bases its ranking on prediction of a cow's remaining lifetime profitability, accounting for animal-specific factors such as age, level of heterosis, calving date and environment, as well the genetic merit of both the female herself and her female progeny. The index consists of three modules per female: 1) her expected profit in the current lactation; 2) her expected profit in her remaining lactations; and, 3) the net cost of replacing her with a heifer. Each female receives a calculated value based on the sum of the three components and is ranked within herd accordingly. The index is run 'on the fly' from the ICBF database via the farmer's personalised web service. The algorithms developed at Teagasc supporting the back end of the system exploit up-to-date information recorded within the database of the dairy females for a range of performance traits, as well as forward predictions on future functionality within the herd. Farmers are encouraged to input additional data such as health events and pregnancy diagnosis. Once inputted, the algorithm can be immediately re-run by the farmer and updated rankings will be provided. Use of the index in culling decisions has been shown to increase profit on farm. In the six weeks since its launch in October 2017, over 3,800 unique farmers have run the COW for their herd. A COW is now being developed for beef herds.

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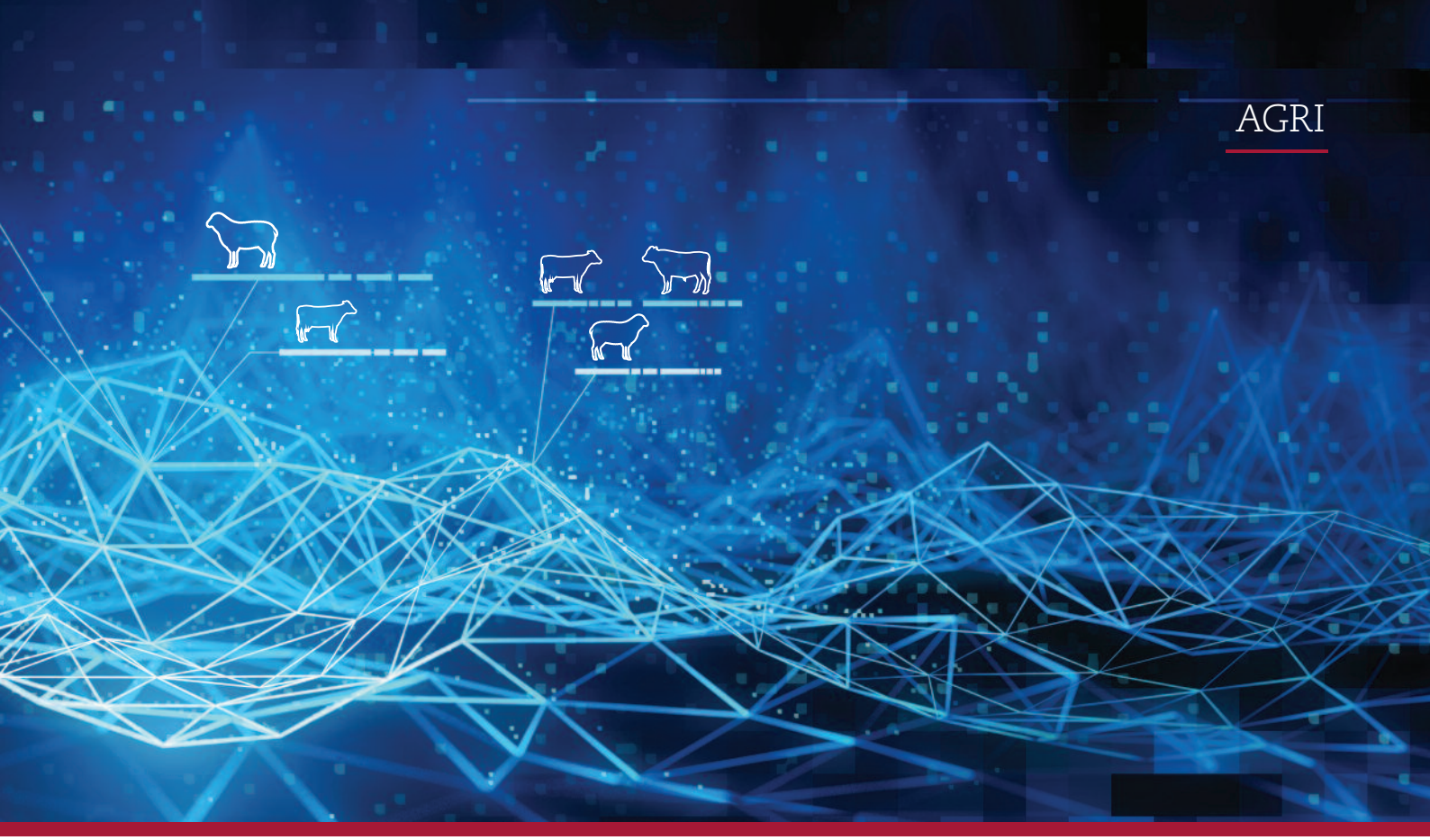
Sire mating advice

Genetic gain is based on the principle that the mean performance of the current generation should be superior to that of previous generations. In pursuit of this, breeders wish for the genetic merit of progeny from a given mating to be superior to both parents. However, genetic gain is also predicated on the availability of usable genetic variability. The objective of mating advice is to identify the most complementary match between all possible candidate parents to produce high genetic merit offspring. This



often has to be achieved within the confines of some parameter space (e.g., number of matings per cow and per sire), but also respecting some of the predefined criteria specified by the farmer. Teagasc geneticists have developed new algorithms constituting the back end of the revamped ICBF sire mating advice system to be launched for the 2018 breeding season. The algorithms are based on linear programming, which is a mathematical approach to maximise a function given a particular set of constraints. Furthermore, DNA information is now, for the first time, included in the mating advice tool, providing not only a more accurate estimate of the expected genetic merit of the progeny, but also a better estimate of the pairwise relationship among all candidate parents. Through a personalised web interface developed by the ICBF, the farmer specifies the sires(s) available to use and their proportional use in the herd. The output from the algorithms, which is downloadable, is a list of the recommended male–female matings to maximise genetic gain, as well as the expected reliability of the bull team used.

BLUPs v BLUEs

Irrespective of trait or species, genetic evaluations disentangle the observed performance of an individual into its genetic merit (termed best linear unbiased predictions (BLUPs)) and the contribution of environmental effects such as herd or flock (termed best linear unbiased estimates (BLUEs)). Animal breeders have almost exclusively focused on BLUPs, with each animal receiving its own BLUP, often called estimated breeding value (EBV) or predicted transmitting ability (PTA). BLUEs, which are analogous to an EBV for each herd, have received less attention. The incorporation of BLUEs within on-farm support tools can enable the evaluation of herd-level management by assessing the actual performance of the herd. Advisory services can therefore benefit from comparing the mean BLUPs and BLUEs of a herd to diagnose any herd-level issues. Such information can be used to improve Teagasc's advisory services through more tailored advice for individual farmers based on the farm-specific factors contributing to the observed performance.

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