Deciding who makes the cut

A decision support tool co-developed by TEAGASC will aid farmers in choosing beef females for retention or culling.

Decision support tools founded on estimates of animal genetic merit have almost exclusively focused on identifying superior candidate parents to breed the next generation of more profitable progeny. One exception is the dairy Cow's Own Worth (COW) tool (*TResearch*, Spring 2018), which ranks dairy cows as candidates for culling. The framework for a decision support tool to identify which beef females (both heifers and cows) are likely to be most profitable for the remainder of their lifetime has now been developed by Teagasc in collaboration with the Irish Cattle Breeding Federation and AbacusBio, New Zealand; the new tool is called the Beef Female's Profit Potential (BFPP). Voluntary culling decisions are notoriously multifactorial, leading to the demand for the BFPP to aid producers in making more informed, data-driven decisions when choosing beef females suitable for retention and culling.

Beef Female's Profit Potential

The BFPP tool consists of four key modules, which, when combined, culminate in the predicted profit potential for each beef female, depicted as a single Euro value. These four key modules are: 1) the female's profit potential as a heifer, provided she has not yet calved; 2) the potential profit from her current parity, provided she has calved at least once; 3) the predicted profit potential from her expected remaining future parities; and, 4) the value of the beef female if she were to be retained within the herd and not voluntarily culled. The index is underpinned by information on a total of 17 different animal traits, providing the user with a comprehensive BFPP value for each beef female; nonetheless, the framework is sufficiently flexible to cater for any newly developed animal feature should it become available. While genetic evaluations only consider the merit of an animal that is directly transmitted to its progeny, the actual future performance of any given female is a manifestation of both her genes that are directly transmitted and how these genes interact, as well as non-genetic effects such as the age of the cow, the environment she performs in, and both her actual and expected calving dates.

> The gene variants that are transmitted from a parent to its offspring cannot be known *a priori*; however, predictions can be made.

Therefore, all of these factors are included in the estimation of the BFPP. Moreover, the performance of the beef female's progeny is also included in the BFPP, as this too will dictate her future profit potential, since some of her progeny will be directly processed for human consumption, while others may eventually graduate into the mature beef herd as cows. The gene variants that are transmitted from a parent to its offspring cannot be known *a priori*; however, predictions can be made. Similarly, by using mathematical approaches to combine cow-level features with historical population-level data, it is possible to estimate the expected remaining lifetime of a given female.

Table 1: Least squares means performance of beef cows when ranked on their Beef Female's Profit Potential value and the performance of their progeny for carcass traits (i.e., weight, conformation and fat); standard error in parenthesis.

		Beef female stratum			
	Trait	Best 25 %	50-75 %	25-50 %	Worst 25 %
Cow traits	Survival[1]	1.63[a]	1.49[a]	1.33[a]	1.00[b]
	Calving interval (days)	377.21 (0.55)[a]	372.38 (0.54)[b]	371.19 (0.53)[b]	368.88 (0.57)[c]
Progeny traits	Carcass weight (kg)	398.46 (0.85)[a]	398.48 (0.82)[a]	396.61 (0.80)[ab]	394.29 (0.83)[b]
	Carcass conformation (1 to 15 scale)[2]	7.19 (0.02)[a]	7.14 (0.02)[ab]	7.07 (0.02)[b]	6.94 (0.02)[c]
	Carcass fat (1 to 15 scale)[3]	7.94 (0.02)[a]	7.99 (0.02)[ab]	8.04 (0.02)[b]	8.04 (0.02)[b]

Different superscripts within row indicate significance difference P < 0.05:
[1]Odds of surviving to the next lactation relative to the worst stratum;
[2]Carcass conformation ranges from 1 (poor) to 15 (excellent); and,
[3]Carcass fat ranges from 1 (very low fat) to 15 (very high fat).

BFPP validation

The BFPP tool was validated on a population of 21,102 Irish beef females and their progeny based on their calvings in the year 2017. Each female was stratified into one of four groups based on her within-herd BFPP value. The beef females in the best 25 % stratum had a 1.6 times greater probability of surviving to next lactation relative to the beef females in the worst 25 % stratum, despite having a longer calving interval (i.e., only available on cows that survived – **Table 1**). The difference in performance between the beef females in the best 25 % stratum relative to the worst stratum was estimated to be worth an additional €32 profit per calving. This additional profit was a result of not only the beef female's own survival and calving interval performance, but also the performance of her processed progeny. The harvested progeny of the best 25 % BFPP females were, on average, heavier, with better conformed carcasses and less fat cover relative to the progeny of the worst 25 % BFPP females (**Table 1**).

A huge advantage of the BFPP index is that it includes a heifer module, which, in turn, facilitates the decision-making process when deciding which heifers have a greater lifetime profit potential and thus should be retained for breeding. Ranking the BFPP of both heifers and cows together identifies the point at which the next most profitable candidate heifer replacement is no better than the next least profitable cow; at this point, culling any more cows does not make economic sense. The BFPP was developed to be used complementary to the national breeding indexes. Therefore, once the decision has been made as to which animals will be voluntarily culled from the herd, the producer can progress to using the national Replacement Index to identify superior females for breeding replacements and the national Terminal Index to breed superior finishers.

Acknowledgements

Funding for this initiative originated from the Department of Agriculture, Food and Marine (DAFM) research stimulus fund (MULTIREPRO), a research grant from Science Foundation Ireland (VistaMilk), and Horizon 2020 (GenTORE). We are also grateful for the contributions of Paul Crosson and Laurence Shalloo.

Authors

Fíona Dunne
Postdoctoral researcher, Teagasc Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork
Correspondence: fiona.dunne@teagasc.ie

Donagh Berry
Principal Research Officer, Teagasc Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork