



Cow's Own Worth - synergising data to provide a new tool to aid in culling decisions in seasonal dairy herds

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The ability to identify cows with the highest future profit potential will have a substantial impact on herd profitability and efficiency. The Cow's Own Worth (**COW**) is a decision support tool that was developed to aid producers in making informed decisions on dairy females for culling and retention. The COW ranks dairy females on expected profit for the remainder of their lifetime, taking cognisance of both additive and non-additive genetic merit, permanent environmental effects, and current states of the animal including the most recent calving date and cow parity. The objective of this study was to pilot the COW on commercial dairy herds and to conduct a survey to gauge farmer's impression and interest in this potential added value service from the Irish Cattle Breeding Federation (ICBF).

Abstract

The framework of the COW consisted of the profit accruing from:

1. the current lactation;
2. future lactations; and
3. net replacement cost differential.

The COW was generated from estimated performance values (**EPV**; sum of additive genetic merit, non-additive genetic merit and permanent environmental effects) of traits, their respective net margin values, and transition probability matrices for month of calving, survival, and somatic cell count; the transition matrices were to account for predicted change in a cow's state in the future. Transition matrices were generated from 3,156,109 lactation records from the national database between the years 2010 and 2013. Phenotypic performance records for 162,981 cows in the year 2012 were used to validate the COW. A pilot group of 83 commercial herds were recruited in 2016 to trial the COW and to conduct a survey on the potential delivery of an added service to data recording herds.

The Pearson correlation between individual animal COW value and national breeding index (EBI) value was 0.65. Month of calving in the current lactation explained 18% of the variation in the COW with parity explaining an additional 3 percentage units of the variance in the COW. Females ranking higher on the COW yielded more milk and milk solids and calved earlier in the calving season than their lower ranking contemporaries. The difference in phenotypic performance between the best and worst quartiles was larger for cows ranked on COW than cows ranked on EBI.

The response rate to a survey of randomly selected pilot users of COW was 52%. The results indicated that 91% of respondents would use the COW to help inform culling decision if it were to become a routine service from the ICBF. Furthermore, 93% of participants felt that their milk recording information had more value because the COW was available to them. Overall, 95% would recommend the national extension of the COW to all dairy milk recording herds in 2017.

The COW is a useful management tool to rank dairy females for culling decisions. COW integrates multiple sources of available data, and critically, is complementary to the EBI which identifies the most suitable females for breeding replacements. The COW offers future prospects to improve herd profitability by adding value to existing services such as milk recording and genotyping of dairy females. In order to maximise the efficiency of the COW, farmers need to fully engage in on-farm data recording for example inseminations, pregnancy diagnosis, and health (e.g. mastitis and lameness) events.

Keywords: culling, milk recording, genetic, permanent environment.

Introduction

The ability to identify cows with the greatest predicted future profit potential will have a substantial impact on herd profitability and efficiency. Dairy producers make significant investments in data recording (e.g. milk recording, pregnancy diagnosis and genotyping) but collating all these data sources into one value per animal is key to aid decision making. A decision support tool was developed to aid producers in making informed decisions on dairy females for culling and retention. The Cow's Own Worth (**COW**) combines multiple sources of information to identify the expected profit potential for the remainder of every dairy female's life. The COW generates a value for every cow within a herd and ranks cows using additive genetic merit (estimated breeding values), non-additive genetic merit, permanent environment effects and current states of the cow (i.e., lactation number, calving date, and predicted calving date from available inseminations or pregnancy diagnosis). Farmers can quickly identify under-performing females to cull, thereby retaining only the most profitable females. Other benefits of this management tool are the reductions in time, effort and resources farmers spend on culling and retention decisions while getting more value from their data recording strategies.

The Irish Cattle Breeding Federation (ICBF) operates a single shared database to meet the needs of the Irish cattle breeding industry and has the potential to integrate data to provide the COW as an added value service to dairy farmers. Information from multiple sources (e.g. calf registrations, milk recordings, inseminations, health events) can be collated and are readily available for each dairy female. The COW can be calculated for spring-calving milk recording herds. The COW was developed and validated by Teagasc Moorepark (Irish dairy research centre) and results indicated the validity and usefulness of this management tool (Kelleher *et al.*, 2015). The objective of this study was to trial the new management tool on commercial herds using ICBF's database. Results from this trial will determine the commercialisation of this service to the wider industry.

The framework of the COW consisted of the profit accruing from:

1. the current lactation;
2. future lactations, and
3. net replacement cost differential.

Full details of the formulation of the COW have been previously described by Kelleher *et al.* (2015). The COW was generated from estimated performance values (**EPV**; sum of additive genetic merit, non-additive genetic merit and permanent environmental effects) of traits, their respective net margin values (obtained from the Moorepark Dairy Systems Model (**MDSM**; Shalloo *et al.*, 2004), and transition probability matrices for month of calving, survival, and somatic cell count; the transition matrices were to account for predicted change in a cow's state in the future. Transition matrices were generated from 3,156,109 lactation records from the national database between the years 2010 and 2013.

Individual cow EBI values (national breeding index) and COW values were generated using the information from the April 2011 national genetic evaluations. Cows were categorised, within herd, into 4 groups based on their value for either the COW or EBI index. Only cows that had phenotypic performance data for the calendar year 2012 were retained. After editing, phenotypic performance records for 162,981 cows in the year 2012 were used to validate the COW.

A fixed effects linear model was also used to quantify the association between each quartile of the COW and EBI index separately (independent variable) with milk, fat and protein yield, as well as somatic cell score (dependent variable) using PROC GLM (SAS Institute, 2011). Quartiles for the COW or EBI index as well as parity were included as fixed effects in the model.

A pilot group of 83 commercial herds were recruited in 2016 to trial the COW. A random sample of herds were selected from farm holdings operating spring-calving systems, routine milk recording, as well as recording fertility events (i.e. inseminations and pregnancy diagnosis). Herd owners were contacted via email and invited to participate in the pilot study. The email included key pieces of information:

- A COW information leaflet.
- A COW report.
- On-farm performance results (milk records, fertility records, etc.).

A survey was conducted of these pilot users to gauge farmer impressions on the usefulness of the COW as an aid in decision making.

Materials and methods

Model

Validation

Commercial herd pilot study

Results and discussion

Validation

The Pearson correlation between individual animal COW value and national breeding index (EBI) value was 0.65. Month of calving in the current lactation explained 18% of the variation in the COW with parity explaining an additional 3 percentage units of the variance in the COW. Females ranking higher on the COW yielded more milk and milk solids and calved earlier in the calving season than their lower ranking contemporaries. The difference in phenotypic performance between the best and worst quartiles was larger for cows ranked on COW than cows ranked on EBI.

Commercial herd pilot study

The response rate to the survey was 52% from a total of 83 herds recruited for the study. Results were overwhelmingly positive, with 95% of farmers recommending a national rollout of the COW (Figure 1). Furthermore, 91% of respondents would use the COW to help inform culling decisions if it was to become a routine service from the Irish Cattle Breeding Federation and 98% would like the COW to be generated for their herd from now on. A high proportion (93%) of participants felt that their milk recording information had more value because the COW was available to them. Overall, 98% would recommend the national extension of the COW to all dairy milk recording herds in 2017.

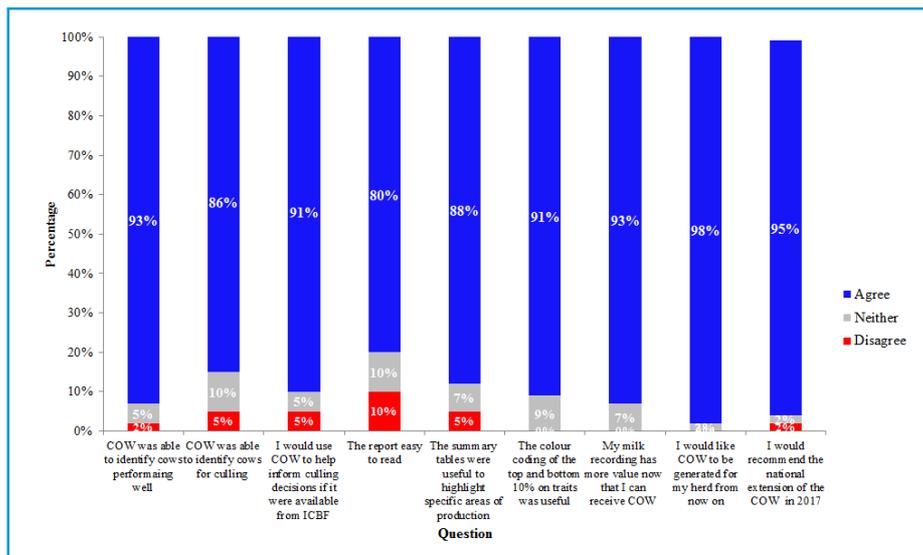


Figure 1. Responses to survey questions from commercial herd pilot study conducted by ICBF in 2016.

Commercial roll out

Overall, the impression of the effectiveness of the COW from the piloted commercial herds was exceptionally positive. The demand for the service justified the investment of resources to develop an on-line profile page for the COW for farmers with adequate levels of herd recording. To this end, farmers who have invested in recording services such as milk recording, inseminations, pregnancy diagnosis services, genotyping for example, will be offered the opportunity to generate an on-line live COW report for their herd. Using this service, the farmer can quickly identify under-performing females to cull thereby retaining only the most profitable females while getting more value from their data recording strategies.

The COW tool provides an excellent incentive for dairy producers to record traits that currently lack routine collection. Farmers who wish to generate a live COW reports using the ICBF Herdplus website can be prompted to update cow information such as inseminations, pregnancy diagnosis and health traits (e.g. mastitis and lameness events) prior to generating the COW report so that the most up-to-date information is used to rank dairy females within the herd. This will improve the accuracy of the COW rank of each cow in the herd for the farmer as well as provide an extra enticement to farmers to record more data (and potentially more accurate data). These additional data can be subsequently used for genetic evaluations, and will be of particular value for genetic evaluation of traits that are not routinely recorded currently.

The COW is a useful management tool to rank dairy females for culling decisions. COW integrates multiple sources of available data, and critically, is complementary to the EBI (Ireland's national breeding index) which identifies the most suitable females for breeding replacements. The COW offers future prospects to improve herd profitability by adding value to existing services such as milk recording and genotyping of dairy females. In order to maximise the efficiency of the COW, farmers need to fully engage in on-farm data recording for example inseminations, pregnancy diagnosis, and health (e.g. mastitis and lameness) events. The COW is currently under development as a profile page on the ICBF website. An on-line pilot scheme for the profile is underway. Commercial launch of COW are contingent on the results of the on-line profile pilot scheme.

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Conclusions

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