Factors affecting pregnancy proteins

TEAGASC researchers investigated factors influencing pregnancy-associated glycoproteins in seasonal calving, pasture-based dairy cows.

In seasonal-calving systems of milk production, early pregnancy detection is a useful management tool to improve herd fertility performance. Pregnancy-associated glycoproteins (PAG) are proteins secreted by binucleate cells from the trophoblast of the developing embryo and are detectable in blood and milk four weeks after pregnancy establishment. The current gold standard for pregnancy diagnosis in cattle is based on transrectal ultrasound to visualise a viable embryo. PAG assays can be used as an alternative method to determine pregnancy status and embryo mortality. The PAG assay uses a plate reader to measure absorbance in both samples (S) with unknown PAG concentrations and negative controls (N) with no PAG present (i.e., a blank). The S-N absorbance value is used to indicate the presence or absence of pregnancy. Hereafter the PAG S-N value is referred to simply as PAG.

Pregnant dams have a well characterised PAG profile in blood and milk, with an initial peak at weeks four to six in pregnancy, followed by a decline to nadir between weeks seven and 10, and a recovery thereafter. The objective of this study was to investigate factors that influence PAG in seasonal-calving, pasture-based dairy cows. Spring-calving dairy cows (n = 499) located in three Teagasc research farms were enrolled in the study. Weekly milk samples were collected from each animal enrolled from weeks five to 21 after artificial insemination (AI) to determine PAG.

Dam and sire characteristics

There was a trend for declining milk PAG with increasing parity number (**Figure 1**). An interaction between parity and week post insemination was observed, whereby older cows (parity 3+) tended to have lesser PAG values at the initial peak and nadir compared to parity 1 and 2 cows. Cows with the greatest fertility sub-index had greater PAG at weeks 5 and 6 post insemination compared with cows with the least or intermediate fertility sub-indexes, but differences were not detected thereafter (**Figure 2**). Sires of the gestating embryo with the greatest daughter fertility sub-index had greater nadir PAG than sires with intermediate and least fertility sub-index values (1.46, 1.34 and 1.31, respectively), and reached nadir PAG later (weeks 10, 8 and 9, respectively). A significant effect of sire (**Figure 3**) was observed on initial peak PAG (range 1.4-2.2), nadir PAG (range 0.5-1.2) and post-nadir recovery peak PAG (range 2.0-3.0). An interaction between milk yield and week post insemination was observed, whereby PAG decreased as milk yield increased.

Calf characteristics

Pregnancies with female offspring had greater initial peak PAG (1.83) and lesser PAG values at post-nadir recovery (2.50) versus pregnancies with male offspring (1.67 and 2.56, respectively). Pregnancies that subsequently resulted in low birth weight calves (< 30 kg) had greater initial peak PAG (1.84) than pregnancies with medium (30-38 kg = 1.73) and large (> 38 kg = 1.69) birth weight calves (**Figure 4**).

Conclusion

The overall temporal pattern of variation in milk PAG values in seasonal-calving pasture-based cows is consistent with previous reports from high-yielding cows fed a total mixed ration. The majority of the variation observed in milk PAG profiles occurred before week 12 post
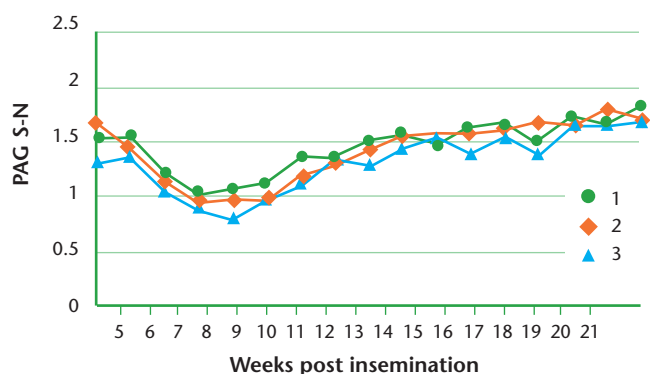
FIGURE 1: Pregnancy-associated glycoprotein profiles from five to 21 weeks post AI for parity 1 (●), 2 (◆), and 3+ (▲) lactating dairy cows.
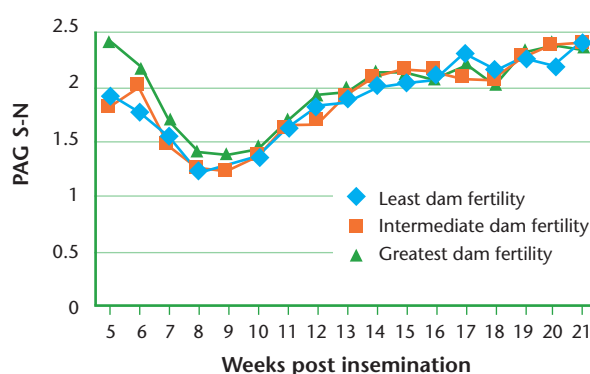

FIGURE 2: Weekly pregnancy-associated glycoprotein profiles in milk from five to 21 weeks post AI for cows with different dam fertility sub-index categories: least (< € 85); intermediate (€ 85-€ 120); and, greatest (> € 120).
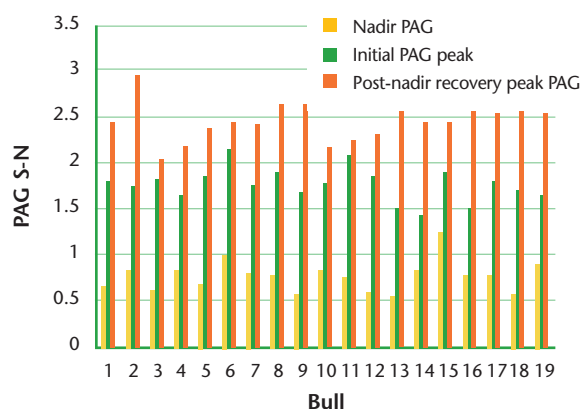

FIGURE 3: Variation between sires (n = 19) of the developing foetus on mean values for initial peak PAG, nadir PAG and post-nadir recovery peak PAG in milk.

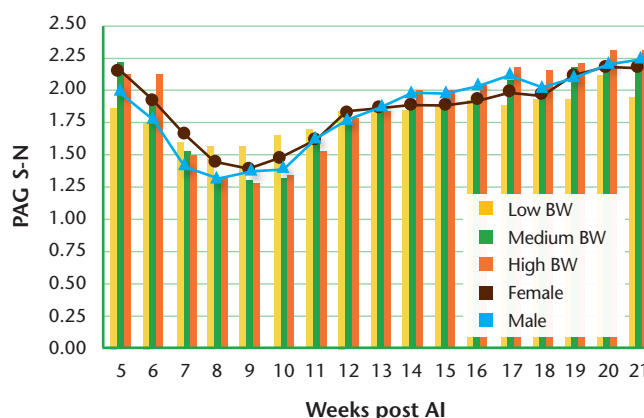

FIGURE 4: Weekly pregnancy-associated glycoprotein profiles in milk from cows with male or female calves (lines), or those with low (< 30 kg), medium (30-38 kg) or high (> 38 kg) birth weight (solid bars).

insemination. Our findings indicate that calf sex, calf weight, parity, dam and sire fertility sub-index, milk yield, and sire are all associated with milk PAG values observed from weeks five to 21 post AI. The use of a milk sample to diagnose pregnancy is a convenient method for pregnancy diagnosis, especially for farmers participating in milk recording, due to the low technical inputs required. The ability to determine pregnancy status through milk PAG may be useful to improve reproductive management in dairy herds.

Acknowledgements

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