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Further development of the Pasture Profit Index (PPI)



Key external stakeholders:

Grassland farmers, researchers and advisors
Irish grass seed wholesale companies
Department of Agriculture, Food and the Marine
Milk processors, National Universities
Agri-consultants and Advisors

Practical implications for stakeholders:

The use of the Pasture Profit index (PPI) enables the identification of varieties which will provide the greatest economic contribution to a ruminant grazing system. The sub-indices identify the relative strengths and weaknesses of individual varieties. The index ranks varieties based on their economic benefits and will ultimately result in an increase in the use of varieties which result in higher profitability for the industry as a whole. It allows grass seed retailers and farmers to choose varieties that will meet their requirements and maximise profitability. The index will be strengthened further by the adoption of commercial grassland farm data from PastureBase Ireland. These data will feed directly into providing more baseline production data and in addition will give the long term performance of grass varieties on commercial farms. It is important that the VCU protocol used by the DAFM in the evaluation of perennial ryegrass varieties reflects the requirements of the end users in the grassland industry. The use of protocols around simulated grazing and silage ensures that varieties which excel in either protocol can be identified.

Main results:

- Key traits included in the PPI were: DM production (Spring, Summer and Autumn), grass quality (April to July), silage DM production (first and second harvests) and sward persistency
- The relative emphasis within the PPI were (DM Yield) Spring 15.4%, Summer 5.7% and Autumn 9.3%; first cut silage DM yield was 9.4% and of second cut 5.5%; April grass quality was 0.4%, May 5.0%, June 7.8% and July 7.1%;. Relative emphasis of persistency was 34.4%.
- Large differences exist in the economic ranking of varieties within the PPI.
- Selection criteria for plant breeders will now have to change towards the main traits within the PPI.

Opportunity / Benefit:

The use of the PPI provides information to the end user in relation to economic merit of varieties ranked against one another, this facilitates a more advanced decision making process at industry level

Collaborating Institutions:

Department of Agriculture Food and the Marine

Teagasc project team: Dr. Michael O'Donovan (PI)
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1. Project background:

Evaluation of the most appropriate grass species for local conditions is widely conducted by many countries worldwide, including member states of the EU, New Zealand, Australia and individual states within the United States. In the Republic of Ireland, the Department of Agriculture, Food and the Marine (DAFM) are responsible for the Value for Cultivation and Use (VCU) grass variety evaluation trials which are part of the published Recommended List (RL) system. Varieties are submitted annually by grass breeders across Europe for performance evaluation under the Irish evaluation system. Prior to 1995 the RL focused solely on total dry matter (DM) yield. Since 1995 a number of economically important traits have been published including spring and autumn growth data as well as DM digestibility (DMD) and water soluble carbohydrate content of grasses. In response to industry requirements and establishing normality with other recommended lists, in 2014 DAFM introduced a simulated grazing management protocol (eight to nine harvests per year) in addition to the two-cut silage management protocol which was previously operated. The objective of the simulated grazing management protocol was to ensure that the protocol which varieties were selected under, matched production systems at farm level. Internationally, in the last decade, there has been a clear move to quantify the seasonal distribution of DM yield and an increased focus on grass DMD to improve animal performance through grazing in grass variety evaluation trials. Despite the improvements in plant breeding, long term sward persistency is a trait which requires more detailed investigation. This is despite the fact that reseeding is expensive and the length of time that a variety lasts in a sward has a significant effect on profitability.

2. Questions addressed by the project:

This study focused on identifying the most valuable traits affecting grass-based ruminant production in Ireland, putting an economic value on the individual traits and incorporating these traits together into a total economic merit index.

3. The experimental studies:

There were three main components present study which included:

- i) Trait definition and their capture in VCU protocols
- ii) Develop and describe a methodology to quantify the relative economic merit of each variety based on individual traits
- iii) Apply economic values to individual variety data and rank varieties based on their total economic merit

Four main trait groups which have a larger influence on grass based systems profitability form the basis of the PPI. These traits encompass various aspects of the grazing system, including DM production (Spring, Summer and Autumn), grass quality (April to July), silage DM production (first and second harvests) and sward persistency. The mechanism of how each trait's economic impact was calculated. In summary the economic values for a one-unit change in each trait were determined using the Moorepark Dairy Systems Model which simulated a physical change in each trait of interest independently. The difference between the farm net margin before and after the change was simulated and divided by the change in the trait of interest, in order to determine the economic value for a one-unit change in each trait.

4. Main results:

Sub-indices within the Pasture Profit Index identify the relative strengths and weaknesses of individual traits of varieties. Summing the merits of individual traits gives the total variety merit, but it is acknowledged that it is unlikely but possible that any one variety will possess all positive traits. But there are varieties with a number of strong positives on the main traits. Within varieties in the present study which was not the DAFM recommended list data, there was a range in total economic merit from -€31 to €213/ha per year. The highest ranking variety achieved the highest total economic merit even though it had a negative economic merit for persistency. The lowest performing varieties had several traits with negative values indicating weaknesses in a number of traits. As the index develops it will influence the direction of breeding and evaluation programs in a positive way and will ensure that a clear focus is placed on the requirements of grassland farmers.

5. Opportunity/Benefit:

The main benefit of this work is that farmers and the wider industry can choose varieties based on the strengths for use. There is clear differentiation of end use of varieties within the PPI. The PPI is now published in the DAFM recommended list and is the main ranking criteria for varieties to be added and taken off the recommended list.

6. Dissemination:

International conferences

Presented at many international conferences, invited and contributed, such as the European Grassland Federation and EAAP

National Conferences and seminars

Presented at the Agricultural Research Forums through the duration of the project and at national farmer conferences.

Open Day

Presented at all Moorepark open days.

Farmer discussion groups

Discussed at many farmer discussion groups and at advisor in-service training

Press

Results regularly presented in the Irish Farmers Journal, Farming independent, Today's Farm and TResearch.

Main publications:

Creighton, P. Kennedy, E., Hennessy, D. and O'Donovan, M. (2016). Impacts of sward renewal method with perennial ryegrass (*Lolium perenne*) on dry matter yield, tiller density and nitrate leaching. *American Journal of Plant Sciences* 7,684-694 ISSN 2158-2750

O'Donovan M, McHugh N, McEvoy M, Grogan D, Shalloo L (2017). Combining seasonal yield, silage dry matter yield, quality and persistency in an economic index to assist perennial ryegrass variety selection. *Journal of Agricultural Science* 2017:155(4):556-568; doi 10.1017/s0021859616000587.

Byrne N, Gilliland TJ, McHugh N, Delaby L, Geoghegan A, O'Donovan M (2017). Establishing phenotypic performance of grass varieties on Irish grassland farms. *Journal of Agricultural Science* 2017:155(10):1633-1645; doi Doi: 10.1017/s0021859617000740.

McDonagh J, Gilliland TJ, McEvoy M, Delaby L, O'Donovan M (2017). Nitrogen and white clover impacts on the management of perennial ryegrass-clover swards for grazing cattle. *The Journal of Agricultural Science* 2017;155(9):1381-1393; doi Doi: 0.1017/s002185961700051x.

Popular publications:

McDonagh, J. O'Donovan, M, McEvoy, M and Gilliland, T.J. (2016) Genetic gain in perennial ryegrass (*Lolium perenne*) varieties 1973 to 2013. *Euphytica* DOI 10.1007/s10681-016-1754-7

Cashman, P.A. Gilliland, T.J. McEvoy, M, Watson, S. And O'Donovan, M. (2016). Changes in plant morphological expression in 12 perennial ryegrass cultivars following frequent and infrequent cutting management. *Journal of Agricultural Science* 154:456-471.

Griffith, V. Gilliland, T.J. McEvoy, M and O'Donovan, M. (2016). Competitive dynamics in mixtures of perennial ryegrass cultivars during two growing seasons under two cutting managements. *Crop and Pasture Science* 67:225-235

7. Compiled by: Dr Michael O'Donovan