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Factors influencing dairy farmers' adoption of best management grazing practices

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ABSTRACT

Understanding of farmers' influences relating to the adoption of innovations is imperative for the Irish dairy sector to improve efficiencies and productivity. There is a particular need for a better appreciation of how farmers' grassland management practices are shaped. The Spring Rotation Planner (SRP) is a management tool that divides the area of a farm into weekly portions and takes the estimation out of planning the first grazing rotation. It offers a cost-saving alternative on many dairy farms, which could contribute to strengthening the competitiveness of the sector. Adoption rates of the SRP amongst farmers have been low despite extensive promotion of its advantages. This study therefore aims to use psychological constructs to analyse factors that affect the adoption of the SRP by commercial dairy farmers in Ireland. Dairy farmers (n = 256) were surveyed from different regions within the country. Principal Component Analysis was used to empirically confirm the hypothesised Theory of Planned Behaviour (TPB) beliefs. Cluster analysis was thereafter employed as classification criteria to cluster respondents into types. The TPB was subsequently applied to explain intention to implement the SRP. Two clusters of farmers were elicited; low and high adopters of the SRP. Low-Adopters of the SRP were characterised by their high sense of resource constraint. It is recommended that carefully planned communication, targeted at the different farmer types, can help encourage uptake of the SRP.

1. Introduction

Food production is forecasted to expand greatly in the coming decades due to a rising global population (Godfray et al., 2010). Action is therefore required throughout the food system to meet the challenges of increasing the provision of food while simultaneously lowering environmental impacts associated with production. As the impact of food production on the environment is often determined by agricultural practices it is therefore important that farmers adopt practices that increase productivity, which in turn can reduce environmental damage (Hyland et al., 2016a). Improved grassland management is an innovation that is expected to increase production and profits while reducing damage to the environment (Borges et al., 2014). Practices such as effective grassland management may consequently allow the dairy sector achieve the goal of sustainable intensification; i.e. increasing output without adverse environmental impacts and without the cultivation of more land (Garnett and Godfray, 2012; Smith, 2012).

In many regions of Western Europe grass is the primary dietary constituent for dairy production systems due to favourable temperate climatic conditions. Ireland presents characteristics that are applicable to many European dairy farmers of similar climatic conditions. The topography of the country varies considerably, encapsulating an array of challenges and environments faced by dairy farmers in temperate regions. Irish dairy cattle are fed predominantly on grazed grass with grass silage complimented with some concentrate fed during winter; sometimes high levels of concentrates are used in the finishing period (O'Mara, 2012). However, Ireland has a competitive advantage over many European countries as it has the potential to grow grass forage over a long growing season. Consequently, 54% of the lifetime weight gain of cattle is typically derived from grazed grass and 24% from grass silage (O'Donovan et al., 2011).

The dairy sector represents an important agricultural sector in Ireland (Hennessy et al., 2013). The removal of EU milk quotas has offered many Irish dairy farmers the freedom to expand which requires increased focus on grass growth and utilisation at farm level. Indeed, dairy is considered the most profitable Irish farming sector with average farming incomes of €51,809 with 23% of overall incomes derived from direct payments (Teagasc, 2018). The dairy sector is nevertheless

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expected to increase output as part of the most recent national agriculture and food strategy "Food Wise 2025" (DAFM, 2016). The strategy outlines key actions necessary to ensure the agri-food sector maximises its contribution to economic growth and exports in an environmentally sustainable manner over a ten year period. Increasing grass utilisation by 2t/ha is one of the key actions outlined for Food Wise 2025 which could assist the dairy industry increase its output (DAFM, 2016).

Taube et al. (2014) and Baumont et al. (2014) have suggested that general improvements in pasture production efficiency can be achieved by increasing pasture utilization and placing less importance on external supplementary feed and fertilizer inputs. In an Irish context it has been shown that significant cost reductions can be achieved by extending the grazing season (Läpple et al., 2012). The profitability of Irish dairy farming is consequently underpinned by levels of grass utilisation (O'Donovan et al., 2011). However, on-farm grass utilisation amongst Irish farmers is low, with significant potential for expansion and increased efficiency through adoption of grassland-management technologies (Creighton et al., 2011). To maintain competitive globally it is imperative that Ireland fully exploits its climatic advantages and maximizes the level of grass utilization on dairy farms.

The underlying psychological constructs which affect farmers' behaviour are often overlooked when evaluating the adoption of best management practices. When faced with technology that involves monetary, management, and social impacts, farmers may be uncertain about whether to adopt if these factors are in conflict (Kim et al., 2008). Whilst many studies have focused on farmer's adoption of new and novel innovations (Cavallo et al., 2015; Hennessy et al., 2016; Long et al., 2016), it is also important to understand the reasons why adoption rates of more established technologies have not been higher. The Spring Rotation Planner (SRP) is a management tool that offers a cost-saving alternative on many Irish dairy farms, which could contribute to strengthening the competitiveness of the Irish dairy sector. It is used to divide the farm up into weekly portions and can help take the guess work out of planning the first grazing rotation. It is a simple but effective tool that ensures that sufficient grass is grazed early and it is easy to implement. Despite extensive promotion of the advantages of implementing the SRP adoption rates amongst farmers have been low. This paper therefore aims to use psychological constructs to analyse factors that affect the adoption of the SRP by commercial dairy farmers in Ireland. The study aims to determine homogenous farmer groups based on their respective perceptions of the SRP and to evaluate how this affects behaviour. In doing so, the study contributes to the branch of the wider technology adoption literature. An improved understanding of how and why farmers make decisions can contribute to the design of effective advisory, promotion and policy interventions (Garforth, 2015).

1.1. The Spring Rotation Planner

The SRP is a grazing management tool that divides a farm into weekly grazing portions during spring. It is easy to implement and inexpensive; a strip wire is all that is required to allocate grazing. Milk production in Ireland is grass based, with calving date targeted to coincide with the start of grass growth. During the spring period grass growth is less than demand which transpires in a gradual decrease in overall farm cover. Therefore the SRP allocates the optimum quantity of pasture at these critical times in the grazing calendar when growth rates are typically lower than demand.

The SRP allocates a set area per day (or per week) from when the cows calve in early February to the 'magic date' in early April; the time when demand and supply are equivalent. Using a SRP to manage grass consequently allocates good quality grazed grass until the 'magic day'; when grass growth meets demand. The planner was initially developed in New Zealand but differs in an Irish context due to slower spring-growth rates. Therefore, seven to ten days are added to the predicted 'magic day' when using the planner in Ireland.

Together with weekly measurement of average farm cover the SRP enables sufficient grass until the end of the first rotation. The SRP ensures sufficient grass is grazed early enough to allow time for regrowth for the second rotation and that a sorted distribution of grass yields is created, providing a continuous grass supply during the second rotation (Teagasc, 2016).

The main objectives of the plan are (Teagasc, 2017):

- For cows to graze as soon as possible post-calving. This is because feed allowance increases progressively from calving until the breeding season.
- To graze 30% of the farm area during February to stimulate regrowth for the second rotation (between April 1st and 10th).
- To have 60% of the farm area grazed by mid-March, and to prolong the remaining 40% until early April (later if growth rates are below normal).

The use of the SRP therefore guarantees control of feed supply at a critical period by reducing the area offered to the herd which would negatively affect pasture growth (Macdonald et al., 2010). The SRP initially begins on a slow rotation where 40% of the farm is initially grazed. Thereafter, the remaining 60% of the farm is grazed later in the spring. The daily grazing area is related to the rotation length, e.g. 1/60 is a 60-day rotation. For instance, on a 30 ha milking platform the rotation is calculated by 30 ha/60 days, which equates to 0.5 ha/day.

Farms which complete the first grazing rotation in advance of early April produce substantially more grass than farms which finish the first rotation thereafter. O'Donovan et al. (2015) depicted a 20% increase (1320 kg DM/ha compared to 1030 kg DM/ha) in grass production by advancing the finish date of the first rotation. Financial benefits are also associated with including grazed grass in the diet of spring calving dairy cows in early lactation. Through higher animal performance and lower feed costs early grazing can increase profitability by €2.70/cow/day. Other Irish studies have shown that efficiency and production focused farmers are more likely to adopt the SRP (Kelly et al., 2015; McKillop et al., 2018). However, this study aims to assert the psychological reasons for the adoption and non-adoption of the technology.

1.2. Theoretical background: The Theory of Planned Behaviour

This study attempts to explain the rates of grassland management technologies adoption using the Theory of Planner Behaviour (TPB) (Ajzen, 1991) as its conceptual framework. The main construct of the theory is that human behaviour can be explained through intention to behave in a particular way. Intention in its turn is the outcome of individual attitudes and beliefs, which are divided into three categories: personal, normative and control. Personal beliefs relate to an individual's perception of the outcomes of a specific behaviour, normative belief are related to the perceived social pressure to perform a behaviour and control beliefs are associated with the individuals perception of how easy or difficult it is to perform the behaviour (Fig. 1). Therefore, adoption of a grassland management tool is directly related to a farmer's intention to adopt it, which in turn, is based on the farmers' beliefs about the grassland management tool.

The TPB has been used in agricultural research to explain the processes of farmers' decision making (de Lauwere et al., 2012; Mattison and Norris, 2007). Using the three central constructs it is possible to identify how farmers evaluate the use of the SRP (attitude),to explore the role of perceived social pressure upon farmers to use a SRP (subjective norm), and to identify the farmers' perceptions about their capacity to use this innovation (perceived behavioural control). The TPB is based on aggregating attitude (A), social norms (SN), and perceived behavioural control (PBC) beliefs and can be depicted in a model to explain behavioural intention (BI) in Eq. (1). In the TPB model, β represents the empirically determined weights that estimate each