Extended Abstract
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Paper/Poster Title	The economic impacts of grassland reseeding in Northern Ireland

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Abstract	***200 words max***

Farmers are quit uncertain about the profitability of increasing the frequency of grassland reseeding. Grassland reseeding practice has been in a declining trend in Northern Ireland (NI). The lengthy production lifespan of grassland reseeding cycle and its high investment cost could increase the level of investment risk.

In this paper, a CBA was carried out to investigate the profitability of investment undertaking on grassland reseeding through a simulation of different scenarios on reseeding frequency levels. We applied the Net present Value (NPV) and the Annualised Net Present Value (ANPV) evaluation criterion to determine the possible returns from grassland reseeding on a dairy farm. The results financial analysis are further investigated using a fixed-effect causal regression model based on a panel data set. Results show that the effect of increasing the level of reseeding on a dairy farm will increase profit. The profit of grassland reseeding is sensitive to the substitution between concentrate feed and silage as well as on the depreciation rate of grass yield. Our sensitivity analysis on these variables indicates that the profit from the substitution of concentrates by grass-based feeds increases with increasing reseeding rates.

Keywords	Grassland reseeding management; Profitability of grassland reseeding; Cost Benefit Analysis (CBA); a fixed-effect regression model; and Difference in difference regression.
JEL Code	e.g. Energy: Demand and Supply Q41 see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	***100 – 250 words***

Grass biomass production is a crucial agricultural activity for dairy farms in NI. Permanent and temporary grasslands play a central role in sustaining livestock production systems and the effectiveness of grassland reseeding activity is essential in improving livestock farming.

In the last few years, grassland reseeding has been on a declining trend in the Republic of Ireland (RoI) (Creighton et al, 2011), an agri-food system structurally similar to NI. Shalloo et al., (2011) show that about 23% of dairy farmers had not been reseeding for 3 consecutive years in the ROI. Teagasc (2014) suggested that a decline in reseeding activity could be due to the associated high investment cost per ha, which is considered a burden.

Farm economic performance is generally reduced by the presence of old permanent pastures mainly because of reduced grass yields when compared to newly reseeded grasslands. Evidence

from a recent NI study (AFBI, 2017) suggests that the beef and dairy sectors could have the opportunity to increase grass production and utilisation by increasing the percentage of grassland reseeding.

The objective of this study is to evaluate the profitability of different rates of reseeding across intensively managed grasslands in Northern Ireland. This study provides estimates of the profitability of grassland reseeding for a dairy farm in NI. As it will be shown, the profit of reseeding is generally derived by substituting concentrate feed with silage and grazing as well as increasing grassland yield. A sensitivity analysis was carried out based on changing depreciation rate and grass yield. The sensitivity analysis indicates that in severely degraded areas high frequency of reseeding has less effect on profitability and the relationship between the starting grass yields and reseeding rates is linear.

Methodology

100 – 250 words

A CBA was applied to derive the profitability of reseeding at various frequencies on a dairy farm over 15 years. The NPV per ha can be calculated as follows:

$$NPV = \sum_{t=1}^{T} \frac{(B_t - C_t)}{(1+r)^t}$$

where NPV is the net present value of a farm per ha, B_t is the financial benefit of a farm at a given time t, C_t is the costs of reseeding, and r is the discount rate. A discount rate of 5% per annum is assumed.

The NPV from grass production depends on the depreciation of grass yield. A linear grass yield depreciation method is assumed to compute the subsequent years' grass yield over time. The starting grass yields could increase with the frequency of reseeding. A farmer's reseeding strategy is to renew the grass in places where the actual grass yield is lower than an expected amount.

The present annualised worth (ANPV) of a farm can be calculated using the formula:

$$ANPV = NPV\left(\frac{r(1+r)^n}{(1+r)^n - 1}\right)$$

This method provides an easy way to evaluate projects with different reseeding life cycles.

The effect of grassland reseeding on the NPV and ANPV were modelled using four scenarios at different reseeding life cycles (S0: no reseeding, S1: reseeding in every 10 years: S2:

reseeding in every 7 years and S3: reseeding in every 5 years. The baseline scenario is no reseeding.

A fixed-effect regression model on milk production was used to estimate the assumptions made about marginal substitution between grass-based feed and concentrates as well as the relationship between milk yield and reseeding rate.

Results	***100 – 250 words***

In grass production, increasing the frequency of reseeding rate from not reseeding to reseeding every ten years could increase the total NPV by £611 per ha whereas increasing the reseeding from no reseeding to reseeding every five years also increases NPV profit by £1,287 per ha over the project lifetime. The CBA results indicate that the effect of increasing the level of reseeding on grass production is profitable.

In dairy production, increasing the frequency of reseeding rate from no reseeding to reseeding every ten years could increase the total NPV per ha by £1,351 per ha whereas increasing the reseeding from no reseeding to reseeding every five years also increases profit by £2,651 per ha. Using reseeding, the grass production alone shows that an ANPV of around £154-£278 per ha while the profit from dairy production alone is £234-£489 per ha.

The major profit for dairy production depends on the substitution of concentrates with grazing and silage. Under S0 or no reseeding, the proportion of the value of feed costs comprised of 66%, 24% and 10% of concentrate, silage and grazed grass, respectively, compared to 64%, 25% and 11% in S3, where the reseeding rate is the highest, respectively.

A sensitivity analysis shows that poor grassland management is related to a higher depreciation rate. The simulation analysis also shows that the relationship between concentrate intake and DM forage intake is linear function. The marginal rate of substitution between concentrate intake and DM forage intake is -2.7.

Discussion and Conclusion	***100 – 250 words***

The economic analysis of different frequency of reseeding rates was evaluated based on NPV and ANPV per ha. The CBA results show that grassland reseeding has a positive effect on profit. However, the margin from DM grass alone is low compared to returns from other

agricultural activities in NI. This may be because the price of grass is relatively low as compared to many kinds of cereals and the investment cost of reseeding is very high (i.e. £609 per ha).

This study demonstrates that there is a possibility of increasing profit from grasslands by increasing the reseeding rates. Reseeding also increases grass yield and it can be considered as the second driver of change in profit.

The CBA above also shows that the effect of increasing the level of reseeding can increase profits on the dairy farm. The profit for dairy production depends on the substitution of concentrates with grazing and silage. Under ideal conditions of our model, higher frequency reseeding may be seen as more profitable at the time of reseeding since profits depend crucially on when the land was reseeded.

The sensitivity analysis and econometrics model also improve the results of the CBA; and shows that the breakeven point of the grassland depreciation rate varies linearly with the frequency of reseeding rate. The model also accurately estimated the substitution between concentrate and silage. The difference in difference and fixed effects econometric model results also show that consistent with the CBA indicating profit from reseeding increases with the frequency of reseeding.