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An Examination of the Volatile Nature of Grass Production in Ireland

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Abstact

Grass production provides Irish dairy farmers with a competitive advantage over many of their mainland European counterparts by providing a cheap feed source. The temperate climate in Ireland favours the production of grass, however production is highly seasonal with little growth over the winter period. This seasonal pattern of grass production in turn has resulted in predominantly spring calving dairy herds and has limited the development of the dairy product portfolio in Ireland which has created a reliance on dairy commodities. As Ireland exports approximately 80% of its dairy output, recent substantial increases in market price volatility has resulted in increased price volatility at farm level. The increased price volatility at market and farm level has been well documented; however the volatility of farm inputs has received little attention to date. In this paper the seasonal and volatile nature of grass production is presented and compared with other Irish crops. As Irish dairy and beef farmers expand production in the post quota environment the optimal use of grass as a feed source will be central to their competitive position. The volatile nature of this resource will require improved pasture management along with improved risk management tools. A number of possible tools are discussed in the latter part of this paper.

Keywords: Grass Production, Volatility, Risk Management, Risk Management Tools

1. Introduction

The climate in Ireland is influenced by the prevailing westerly winds and the proximity of the ocean, resulting in a temperate humid climate with maritime characteristics which are due to the influence of the North Atlantic Drift (Keane and Sheridan, 2004). This climate favours grass growth throughout most of the year and helps explain why grassland accounts for almost 60% of land cover in Ireland (Eurostat 2011). The grazing season in the south of Ireland is approximately 300 days in length, achieved through grass budgeting, early spring turnout and extension of the grazing season into late autumn. Grazed grass is the cheapest source of feed for beef and milk production in Ireland (Finneran et al, 2010; Dillon et al., 2005) with, for example, grass constituting approximately 80% of the diet of lactating dairy cows (Dillon et al., 2005). So by utilising grass as a feed source Irish farmers enjoy a competitive advantage over many of their of mainland European global counterparts. However a defining feature of this production system is its inherent seasonality. Hence, in an attempt to produce milk and meat at as low a cost as possible, most producers have adopted a strategy of adjusting the date of calving to maximise the use of grazed grass in the livestock's diet.

This strategy will be of increased importance if future targets for milk and meat production are to be achieved. In its vision for the Irish Agri-food and fisheries sectors the Irish Department of Agriculture, Fisheries and Food has set targets of 50% increase in milk production, and a 20% increase in the output value of the beef and sheep sectors by 2020 relative to a baseline of 2007 to 2009 averages (Department of Agriculture, Fisheries and Food, 2010). It is envisaged that this increase in production will lead to increased scale at farm level. A consequence of this increase in scale will be greater investment and specialisation. This in turn will translate into increased risk at farm level as the traditional risk management strategy of diversification both within and outside of the agriculture enterprise will be curtailed. The anticipated continuance of both input and output price volatility will compound these risks and require that alternative risk management strategies are explored and adopted if Irish farmers are to survive and compete in this new environment.

While the challenges associated with increased output price volatility at farm level and possible mitigation strategies have been presented (Keane and O'Connor, 2009; O'Connor et al., 2010), the challenges associated with volatile farm inputs has received less attention to date. Indeed the nature and management of these inputs are quite similar to those of the corresponding outputs. The volatility associated with energy, fertilizer and concentrate feed costs can be measured and managed in a similar manner to the farm gate prices for their end outputs. The stated importance of grass as an input in an Irish context requires that the volatility associated with this crop is addressed and managed. For comparative purposes the volatility in yield associated with the other major crops grown in Ireland is also presented.

The aim of the present analysis is twofold. First the variation in grass growth between years (inter-annual) and within years (seasonal) is presented along with a comparative analysis with alternative crops. Second a number of approaches to managing this variability are outlined and discussed. This paper continues by first describing the specific grass growth data considered in this study along with the methods used to quantify the level of volatility associated with this data. The results of this analysis are presented next. A discussion of these results is presented before some conclusions are drawn.

2. Data and Methodology

Grass growth data have been sourced at the Animal and Grassland Research and Innovation Centre, Teagasc, Moorepark, Fermoy, County Cork in the Republic of Ireland (latitude 50° 07' North, 8° 16' West). Grass growth rates (kg dry matter (DM)/ha (hectare)/week) were measured from 1982 to 2010 using plots that were harvested every four weeks[1]. Grass growth was measured using the methodology described by Corral and Fenlon (1978). This methodology estimates grass growth on a four week harvest interval. Four series of plots are harvested in rotation, spaced one week apart, and herbage mass is recorded at each harvest. A simple function (Equation 1) is used to calculate grass growth which is produced each week (kg DM/ha/week) of the growing season, on swards which are being harvested monthly.

$$GrowthRate_t = \frac{\frac{7}{16}Y_t + \frac{5}{16}Y_{t-1} + \frac{3}{16}Y_{t-2} + \frac{1}{16}Y_{t-3}}{4} \qquad \text{(Equation 1)}$$

where Y_t, Y_{t-1}, Y_{t-2} and Y_{t-3} are the harvested yields at the ends of weeks t, t-1, t-2 and t-3, respectively.

The perennial ryegrass cultivars used in the plots changed every 5 to 10 years; however the same management was continuously applied to the plots over this period.

The annual yields of a number of selected crops (wheat, oats, barley, beans & peas, oilseed rape and potatoes) grown in Ireland from 1985 to 2010 were sourced from the Central Statistics Office online

[1] Data for 1996 was not available.

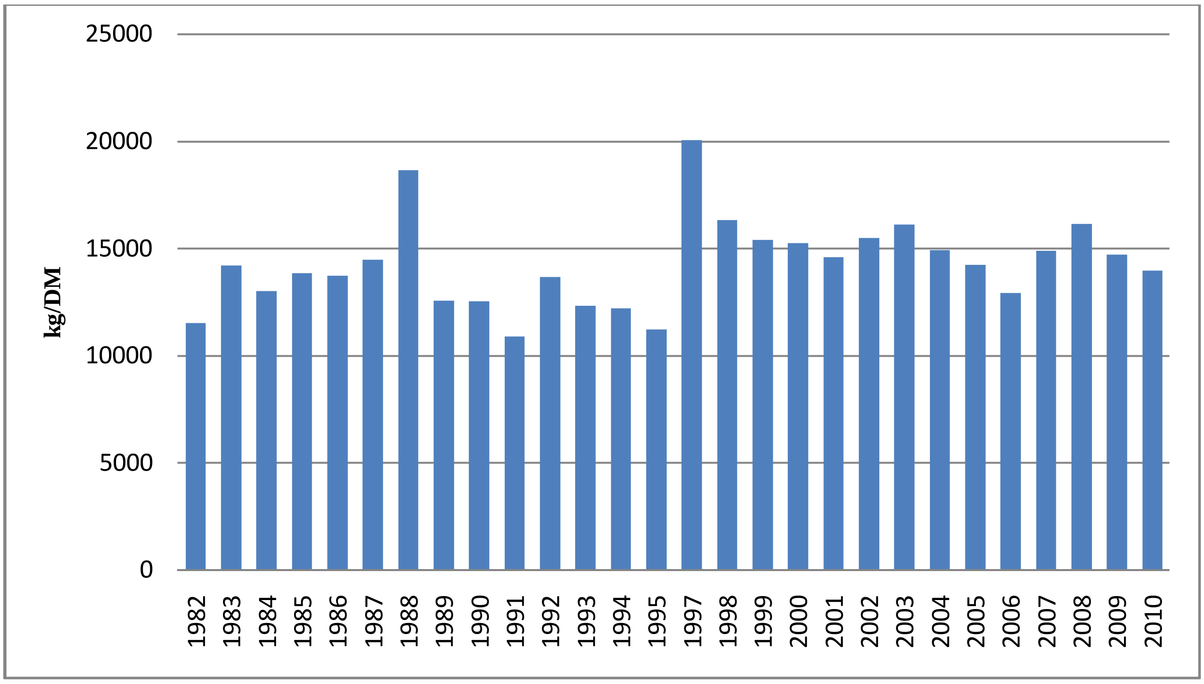
database[2]. All data is also split into two sub periods (1985-1997 and 1998-2010) in order to establish any trends in volatility.

Box plots display the weekly and monthly distribution of the growth rates. In order to capture the variability in the series coefficient of variation (CV) was calculated as the standard deviation divided by the mean and expressed as a percentage.

3. Results

The annual grass production from 1982 to 2010 is presented in Figure 1. The large inter-annual variation is best illustrated by comparing 1991 against 1997. Production in the former was approximately 11,000 kg/DM while for the later year approximately 20,000 kg/DM was recorded.

Figure 1: Annual Herbage Production



In Figure 2 the seasonal nature of grass growth is highlighted. This chart shows the grass growth for the two more extreme years along with the simple average over the entire sample period. This seasonal pattern bears close resemblance to the milk supply pattern in Figure 3.

[2] http://www.cso.ie/px/pxeirestat/statire/SelectTable/Omrade0.asp?Planguage=0

Figure 2: Grass Growth Average, 1991 & 1997

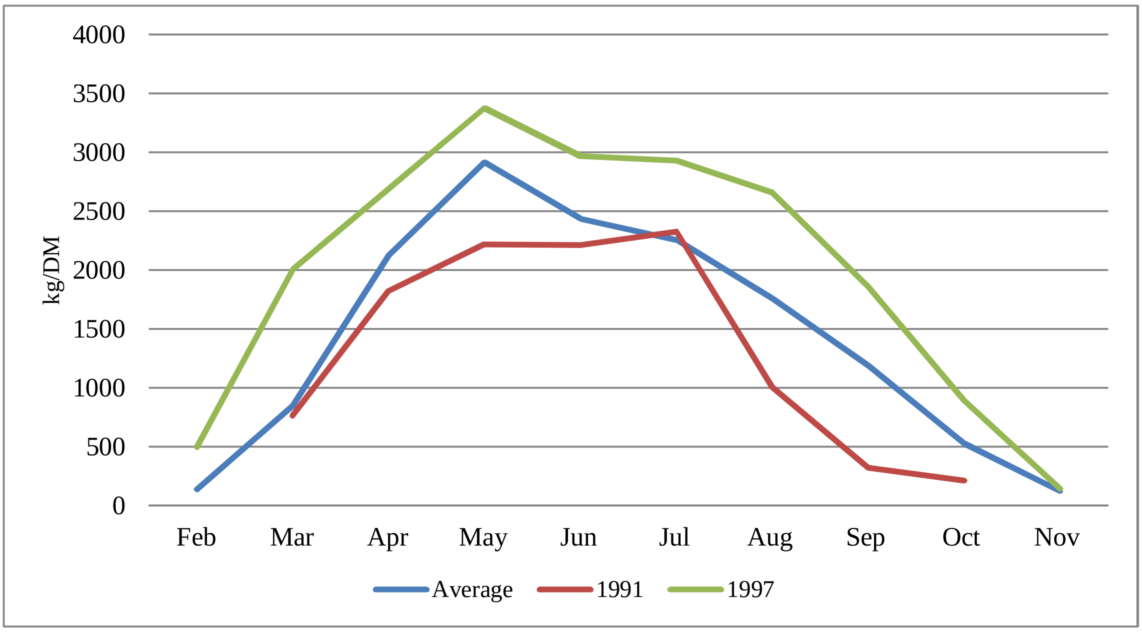
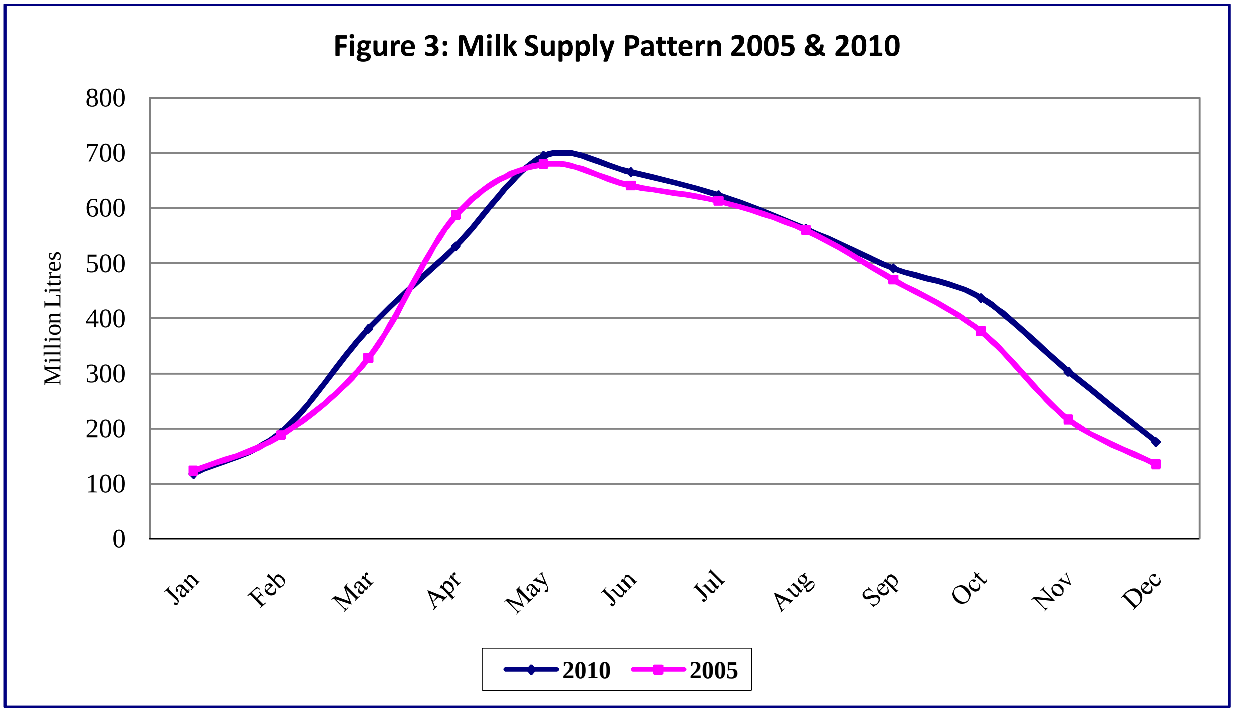


Figure 3: Milk Supply Pattern 2005 & 2010



Source: Central Statistics Office Dublin, Various Years

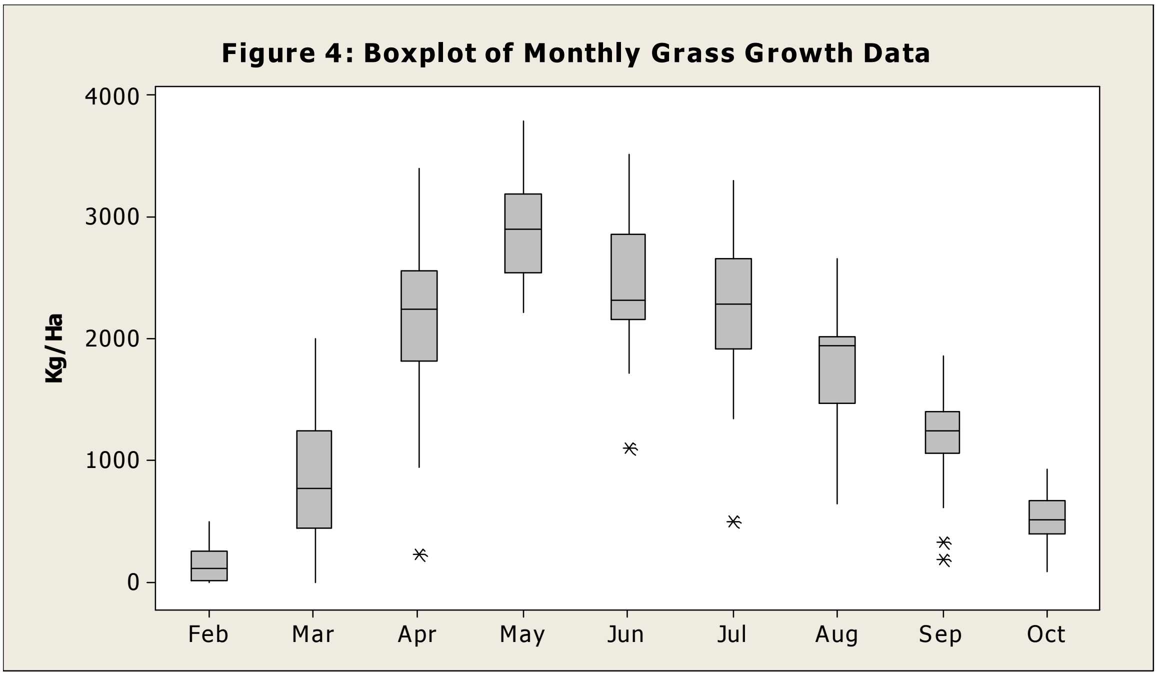
Table 1 allows comparison of the volatility of grass growth against a number of alternative crops grown in Ireland. If the entire sample period is considered then grass growth must be considered a relatively volatile crop with only oilseed rape and potatoes displaying greater volatility. This volatility was much greater prior to 1998 and during this earlier period grass was the most volatile crop. The latter sub period shows a sharp reversal with grass now the least volatile.

Table 1: The coefficient of variation (CV) of annual yields of selected crops in Ireland between 1985 and 2010.

	Winter wheat	Spring wheat	Winter oats	Spring oats	Winter barley	Spring barley	Beans and peas	Oilseed rape	Potatoes	Grass
1985-2010	13.11	10.58	7.48	12.46	13.29	11.42	8.77	15.23	17.42	14.48
1985-1997	13.48	9.24	6.78	10.16	13.65	8.52	8.38	13.77	12.92	20.17
1998-2010	7.41	6.88	5.77	7.43	8.94	8.76	7.65	16.14	11.15	6.39

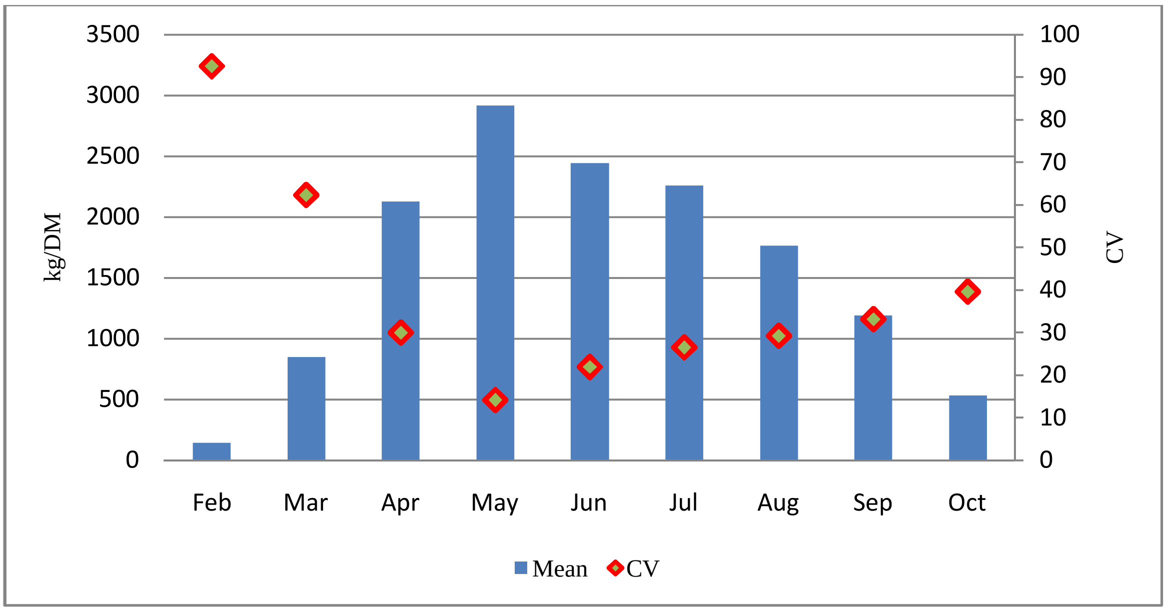
While the seasonal nature of grass growth is highlighted in Figure 2 it is only when the monthly and weekly boxplots of the data are examined that the full extent of the variability is better understood. In Figure 4, which considered the monthly growth, a number of outliers which correspond to relatively low values are clearly identified. In addition the boxes, representing the interquartile ranges, are large in the period from March to August inclusive. For example in May this range is 630 Kg/DM.

Figure 4: Boxplot of monthly growth data



However, when the relative variability, as measure by the coefficient of variation, is considered in Figure 5 it is clear that growth in May is actually quite stable with the spring and late autumn months the more volatile.

Figure 5: Monthly Mean and Coefficient of Variation (CV) of Grass Growth



When the weekly data is considered in Figures 6 & 7 similar patterns are reported. In Figure 6 it is clear that unfavourable conditions can lead to greatly reduced growth while in a few cases favourable conditions can enhance growth. Again in terms of volatility the early and late season display the greatest variability while the larger volume mid-season is relatively more stable.

Figure 6: Boxplot of weekly herbage production.

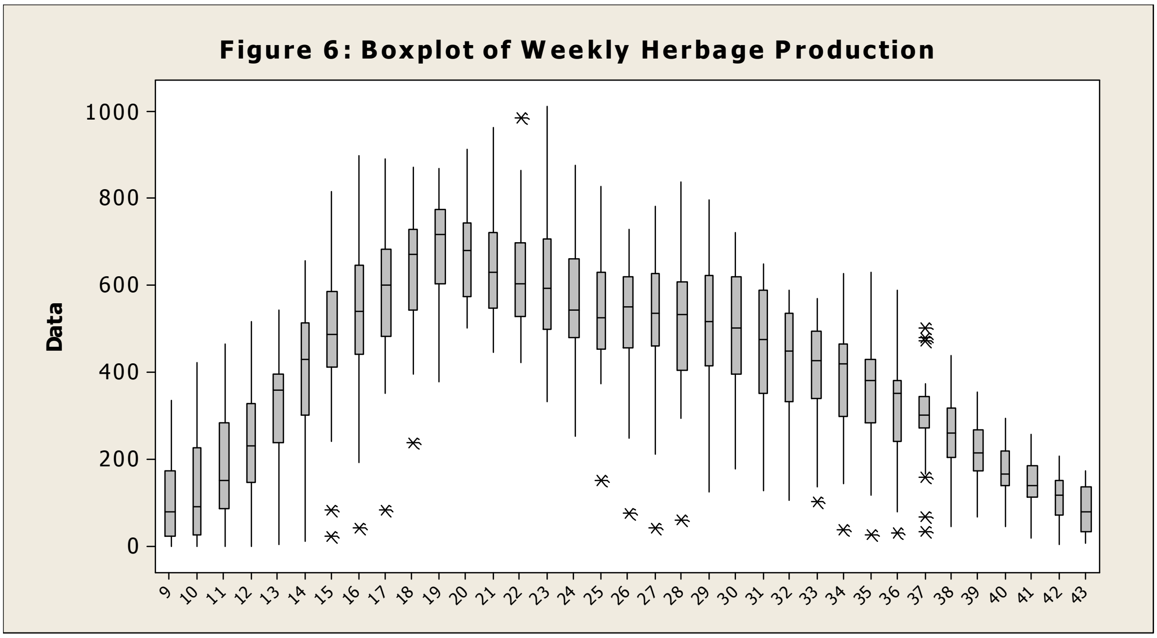
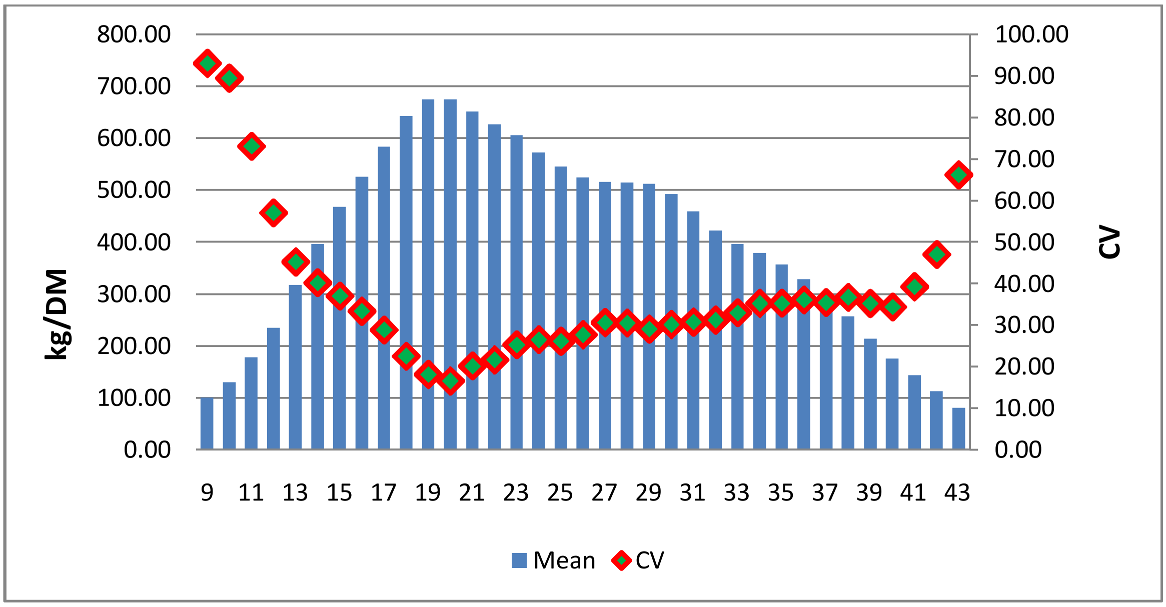


Figure 7: Weekly Mean and Coefficient of Variation (CV) of Grass Growth



4. Discussion and Conclusions.

Irish milk supply is somewhat unique in its reliance on outdoor grazing of grassland combined with spring calving which results in a highly seasonal milk supply pattern. Grass growth in Ireland is uneven both within seasons and between years. This implies that the notion of an average growth curve is misleading as growth varies considerably between years. This can in large part be attributed to the variation in climatic factors that influence grass growth both within and between years. When compared against alternative crops grass would be considered volatile over the long run but has been far less volatile in both absolute and relative terms in recent years.

This analysis also shows that in extreme cases growth can fall far below the long run average with significantly favourable outcomes far less frequent. In addition grass growth levels are low in early spring and late autumn when the relative variability is at its highest. While some crops can compensate for poor conditions at the start of their growing season, unfavourable conditions at this stage for grazing grass can have severe financial implications for Irish farmers as livestock need to be provided with alternative and more expensive feedstuff. This suggests that planning and managing the grazing season is particularly difficult at these times. This problem will be magnified if farmers are to achieve the expansion targets outlined earlier. The importance of scale is becoming more and more evident in the face of increasing exposure to world market volatility and the anticipated demise of the quota regime for dairy production. Larger farms will therefore be essential to the maintenance of a viable sector, and the capital and specialisation required will increase risk at farm level.

While part of this risk can be mitigated by better management practices including the adoption of new grass cultivars, grazing practices and grass budgeting, it is predicted that financial risk management solutions such as insurance will also be desirable. This need is acknowledged in recent CAP proposals who recognise a need a for " A risk management toolkit including support to mutual funds and a new income stabilization tool offers new possibilities to deal with the strong volatility in agricultural markets that is expected to continue in the medium term[3]".

Any proposed tools need to be cognisant of the central role of grass in Irish livestock production and tools developed for confined concentrate fed livestock may not be appropriate in an Irish context. The US can provide a useful case study in order to understand how a pasture based insurance product might operate. In recent year the risk management agency (RMA) at the USDA have, in a number of

[3] http://ec.europa.eu/agriculture/cap-post-2013/legal-proposals/com627/627_en.pdf

selected states and counties, piloted insurance policies designed to give forage and livestock producers the ability to buy insurance protection for losses of forage produced for grazing or harvested for hay. This pasture, rangeland and forage insurance is based on a Rainfall Index or a Vegetation Index. The Rainfall Index, using National Oceanic Atmospheric Administration (NOAA) Climate Prediction Centre data, bases insurance indemnities on the deviation from normal precipitation within the area for a specific time period selected by the producer. The Vegetation Index uses the Normalized Difference Vegetation Index (NDVI) data from USGS EROS. The NDVI is an alternative measure of vegetation greenness and correlates to vegetation conditions and productive capacity. Losses calculated using the Vegetation Index are also indemnified based on the deviation from normal

Further benefits may also accrue from New Zealand where in 2010 the New Zealand stock exchange NZX launched the New Zealand Pasture Growth Index. The index predicts potential grass growth in New Zealand's dairy regions, based on data provided by the national climate station network. The index is calculated with daily input from New Zealand-wide climate stations, and a biogeographic pasture growth model. While the index is not linked to any financial product, it is used as a planning aid for the New Zealand industry.

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