

# CHARACTERISTICS, INTENTIONS AND EXPECTATIONS OF NEW ENTRANT DAIRY FARMERS ENTERING THE IRISH DAIRY INDUSTRY THROUGH THE NEW ENTRANT SCHEME

Roberta McDonald<sup>1,2</sup>, Karina Pierce<sup>2</sup>, Reamonn Fealy<sup>3</sup>, Brendan Horan<sup>1</sup>

<sup>1</sup>*Animal and Grassland Research and Innovation Centre, Teagasc Moorepark, Fermoy, Co. Cork,*

<sup>2</sup>*School of Agriculture and Food Science, University College Dublin, Belfield, Dublin 4,*

<sup>3</sup>*Spatial Analysis Unit (REDP), Teagasc Ashtown Research Centre, Dublin 15*

## Abstract

*As part of the gradual expansion and abolition of EU milk quotas, the Irish government has approved the allocation of milk quota to a small number of new entrants to dairy production. The objective of this study was to describe the characteristics of new entrant dairy farm businesses developing within the Irish dairy industry in terms of geographical distribution, planned production system characteristics and intended operational scale and expected profitability based on an analysis of successful applications and business plans to the Irish New Entrant Dairy Scheme over a 3 year period. A total of 230 applications and business plans of entrants who received up to 200,000 litres of milk quotas through the New Entrant Scheme from 2009-2011, were analysed for the effects of region, age, household income, previous dairy experience, and education on overall business plan expectations. The results show that a youthful, highly educated and highly resourced group of new farmers are using the New Entrant Scheme to enter the Irish dairy industry. Applicant age has a significant impact on available investment equity and expectations, as younger entrants have less owned resources, are increasingly reliant on additional borrowing and have significantly increased expectations for the productive capacity of their potential farm businesses when compared to older entrants. The results provide a further indication that quota abolition is likely to result in an increased regional polarisation of milk production within Ireland with increased intensity of production within traditional milk production areas in the south.*

*Keywords: new entrant dairy farmers, pasture-based, characteristics, expectations, Ireland*

## 1. Introduction

The introduction of milk quotas as part of the European Union (EU) Common Agricultural Policy (CAP) in 1984, constrained milk supply and provided stable and high milk prices for EU producers (Whetstone, 1999). Prior to the introduction of milk quotas, Irish milk production was growing by 7% per annum through increases in herd size and improved management to increase individual animal performance (CSO, 2011). The introduction of EU milk quotas curtailed this expansion and severely restricted industry development. While Irish milk production has remained stagnant since 1985, milk production in other countries such as New Zealand has increased by 62%, between 1983 and 2003 (Dillon et al., 2005). It is now generally accepted that while milk quotas protected and supported milk production in less competitive dairy regions, as a social policy, this was achieved at the expense of the expansion potential of more efficient producers. (IPTS, 2009). The policy restricted the entry of new younger dairy farmers while maintaining existing smaller scale producers (Dillon et al., 2005). Consequently, the CAP Health Check review in 2008 resulted in a decision to abolish milk quotas by 2015.

Acknowledgements: The authors wish to acknowledge the participating new entrant dairy farmers for their assistance and the financial support of AIB for this research. Thanks also to the Department of Agriculture, Food and the Marine for their support and co-operation.

The temperate climate of Ireland is conducive to high productivity grassland swards and provides Irish dairy farmers with a cheap high quality food source (Dillon et al., 1995, McCarthy et al., 2011). Consequently, comparatively lower costs of milk production have been reported in Ireland in comparison with other countries (Boyle, 2002, Dillon et al., 2006) and recent studies have concluded that EU milk quota removal will result in a proportionately larger expansion in milk production in Ireland (Lips and Rieder, 2005, DAFM, 2010). However, regional variation in profitability and competitiveness of milk production systems within Ireland may influence the geographical location of and potential for industry expansion within Ireland post-EU milk quotas. Brereton (1995) observed that the Irish grass-growing season ranged from 240 to 340 days per annum with a longer growing season occurring in the south of Ireland. Brereton (1995) suggested that regional variation in pasture growth (11-15 tonnes DM/ha/yr) is large enough to impact the technical and economic efficiency on Irish farms and should be considered in terms of the development of future low cost systems of production. Regional variation in milk expansion post quota abolition has been suggested by O'Donnell et al. (2010) who hypothesised that future expansion in milk production in Ireland would originate in the south where more favourable grass production characteristics allow lower milk production costs to be achieved.

The abolition of quotas will be preceded by a gradual increase in quota to member states (2% in 2008, and a further 1% per annum thereafter) to allow for a 'soft-landing' for dairy economies (IPTS, 2009). As part of this overall quota expansion, the Irish government also decided to offer one quarter of the 1% increase in total quota on a permanent basis to new entrants to the Irish dairy industry. As part of the application process, each successful new entrant applicant provided a detailed 5 year business plan incorporating physical and financial plans in addition to information on the location of their planned enterprises. As the first opportunity for new entrants to join the Irish dairy industry since the introduction of milk quotas, this group of new dairy producers represent the initial evolution of the dairy industry in Ireland post milk quotas and provide a unique opportunity to examine the characteristics of new dairy producers entering the industry.

The objective of this study is to describe the characteristics, intentions and expectations of new entrant dairy farm businesses developing within the Irish dairy industry, in terms of geographical distribution, planned production system characteristics and operational scale and expected profitability based on an analysis of successful applications to the Irish New Entrant Dairy Scheme over a 3 year period.

## **2. Materials and methods**

### **2.1. Data**

The applicants for the 2009, 2010 and 2011 milk quota allocations were obliged to submit an application form detailing relevant experience and educational qualifications with an accompanying 5-year business plan and a map of the proposed dairy holding to the Department of Agriculture Food and the Marine (DAFM). The 5-year business plan included an audit of existing resources, stock requirements, the source and nature of planned capital expenditure in addition to expected income and expenditure for each year of the plan (DAFM, Accessed October 2010). There are a total of 230 successful new entrants selected over the initial 3 years of the programme based on supplying adequate information. The information submitted by successful applicants was used to describe the expectations of new entrants to the dairy industry over the five initial years of these new businesses.

## 2.2. Data handling

A total of 50 key variables describing the characteristics of new entrants and their future dairy farm plans were generated from the application forms and business plans data including: 3 Regional Areas; 3 Age categories; 3 Other income categories; 4 categories of Dairy Experience; 3 categories of Educational Qualifications; 8 farm descriptors; 7 expected stock and productivity variables; 12 expected income variables; 11 planned expenditure variables and 5 expected efficiency variables.

## 2.3. Statistical analysis

Each continuous variable generated in this analysis was screened for normality using the Proc UNIVARIATE (SAS, 2006). The effect of region, age, other income, previous dairy experience and educational qualifications on the collated continuous data derived from the submitted business plans and application form (farm size, cow numbers, etc.) were analysed using a generalized linear model (SAS, 1999) according to the following model:

$$R_{ijklmn} = \text{mean} + R_i + A_j + H_k + D_l + E_m + RA_{ij} + RH_{ik} + RD_{il} + RE_{im} + RAHE_{ijklm} + e_{ijklmn}$$

Where  $R_{ijklmn}$  is the result for a farmer in the region  $i$ , within the age category  $j$ , with household income  $k$ , with previous dairy experience  $l$  and educational qualifications  $m$ ;  $R_i$  is the effect of the  $i$ th region of production ( $i = \text{SE, SW and BMW}$ );  $A_j$  is the age category ( $j = \text{under 30, 31-40, over 40}$ );  $H_k$  is the other income available ( $k = 1-3$ );  $D_l$  is the previous dairy experience ( $l = 1-4$ );  $E_m$  is the educational qualification ( $m = 1-3$ ) and  $e_{ijklmn}$  is the residual error term.

The effects of region, age category, other income, previous dairy experience and educational qualifications were tested for significance using the residual mean square as the error term. For binary variables, chi square analysis was performed using Proc FREQ (SAS, 2006).

## 2.4. GIS mapping

Each application provided ordinance survey maps and land ownership or land lease documentation which included the folio numbers and Land Parcel Identification Scheme (LPIS) numbers. The geographical distribution of the new entrant farms was conducted using ArcGIS v 9.3 (ESRI, Redlands, CA, USA). New dairy farm co-ordinates were mapped against the existing national distribution of specialist dairy farms within Ireland. A point density method was used to geographically map the farms. The Average Nearest Neighbour Distance tool was used to locate areas of farm clustering or if several new entrant farms are located in the one area.

## 3. Results

### 3.1. New entrant profile

The year of application (2009, 2010 or 2011) had no effect on the expectations of the new entrant farmers. The average new entrant applicant is 36 years of age (ranging from 21 to 62 years), while 97% are male. There was a large variation in knowledge and experience of dairy farming evident from the dataset. As the 180hour Agricultural Cert is a minimum prerequisite for Irish dairy farmers to establish land ownership and join the scheme, all applicants have obtained this minimal formal agricultural education. In addition to the minimum requirements, a further 72%

of applicants have completed a 2 year Advanced Agricultural Certificate in agriculture, while a further 21% have achieved a Bachelors degree level qualification. Fifty-eight percent of new dairy entrants are originating from previously beef enterprises, with 22% of all new entrants planning to become exclusively dairy farmers within 5 years. In terms of dairy experience, 44% of new entrants have a close relative in dairying (such as a parent, sibling or uncle) while a further 20% had no experience in dairy farming at the time of applying for milk quota under the New Entrants scheme, with the remainder having either worked as dairy farm labourers or as work experience students on a dairy farm at some point during their agricultural education.

The average new entrant has a substantial land block of 58.1ha (ranging from 20-199 hectares) and of which 60% is owned. The potential land base available to the new dairy farmers is extensive with an expected average stocking rate of 1.73 LU/ha, withstanding 71 cows. The predicted production expected by the new entrant businesses is 654kg MS/ha (fat plus protein kg) and an average milk yield of 4,954kg per cow. Almost 40% of new entrants have existing loan commitments while seventy-nine percent are hoping to secure loan finance as they develop their dairy farm, within a projected full set-up investment cost of €190,114 or €2,677/cow. The average new entrant farmer expects to produce an average of 352,360 litres of milk at an average production cost of 25 c/l and an average gross output of 30 c/l (including a 27 c/l milk price and a further 3c/l from sales of dairy stock). The expected profitability of a new entrant dairy farms is 5 c/l, equivalent to €428/ha and €248/cow.

### 3.2. GIS mapping and regional distribution

The majority of new dairy farms (80%) are located in the south of Ireland (Figure 1). Figure 1 demonstrates the density distribution of new entrant dairy businesses in comparison to the density of specialist dairy farms in Ireland by their respective county and region.

While region has no effect on the expected total level of capital investment required, the level of borrowings required to finance expansion was lowest in SW (€62,831) and highest in SE (€106,092) while BMW was intermediate (€91,854). Region had no significant effect on production (planned herd size, stocking rate or the level of milk production per cow) and financial (net profit per litre and per hectare) expectations.

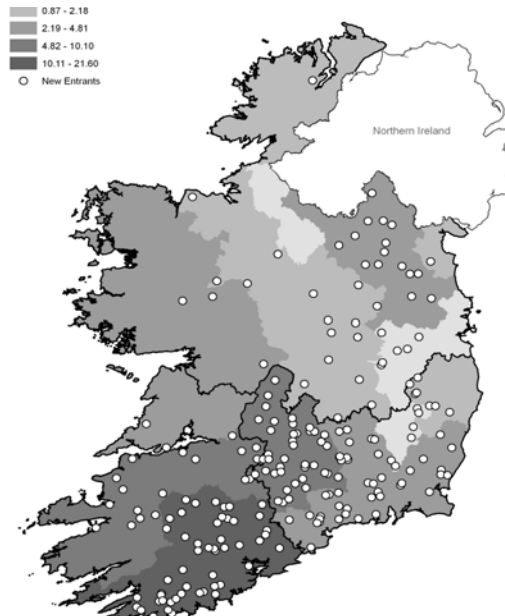
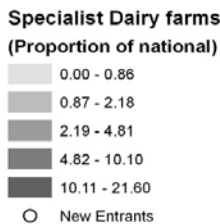


Figure 1. Regional distribution (South East, South West and Border Midlands and West) of new entrant farmers in contrast to the national proportion of specialist dairy farms in Ireland

### 3.3. The effect of age

The effect of new entrant age on existing resources and planned milk production characteristics and expectations are outlined in Table 1. The proportion of new entrants below 30 years of age (U-30), from 30-40 years of age (30-40) and greater than 40 years of age (O-40) was 26%, 45%, and 29%, respectively. While the total land area planned for dairying was unaffected by age, the area of owned land increased with increasing age (21, 35, and 47 ha for U-30, 30-40, and O-40 respectively). Age has a significant impact on the level of available equity for investment in dairy set-up. Only 63% of the U-30 group had an SFP income in comparison to 89% and 97% for 30-40 and O-40, respectively. Consequently, older new entrants have a significantly larger SFP (€18,874 and €24,925 for 30-40 and O-40, respectively) in comparison to U-30 (€10,246). New entrant age had no effect on either the level of required borrowing or the total level of capital investment planned. There was also no significant age effect on the planned herd size during the first 5 years, however stocking rate and milk solids output expectations were lower ( $P < 0.01$ ) for older applicants (30-40 and O-40). Age had no effect on the expected profitability from milk production in terms of either profit per litre or profit per hectare.

Table 1. The effect of applicant age on the characteristics and expectations of new entrants to the Irish dairy industry

	Under-30	30-40	Over-40	s.e	P-value
Proportion of new entrants (%)	25.8	45.4	28.8		***
Total land (ha)	51	60	61	3.3	
Land owned (ha)	21 <sup>a</sup>	35 <sup>b</sup>	47 <sup>c</sup>	3.1	***
Available equity (€'s)					
Single farm payment	10,246 <sup>a</sup>	18,874 <sup>b</sup>	24,925 <sup>c</sup>	1,920.6	***
Other grants	2,935 <sup>a</sup>	4,471 <sup>b</sup>	5,717 <sup>b</sup>	547.7	**
Production					
Herd size (No. cows)	71	70	70	2.8	
Stocking rate (livestock units/ha)	1.95 <sup>a</sup>	1.68 <sup>b</sup>	1.64 <sup>b</sup>	0.068	**
Milk yield (kg/cow)	4,943	4,920	5,015	55.8	
Milk fat plus protein yield (kg/ha)	756 <sup>a</sup>	645 <sup>b</sup>	587 <sup>b</sup>	30.3	**
Profitability					
Net profit per litre (c/l)	0.08	0.04	0.05	0.013	
Net profit per hectare (€/ha)	565	369	383	90.1	

a,b,c means with different superscripts are significantly different ( $P < 0.05$ )

### 3.4. The effect of other income and knowledge and experience

Sixty-six percent of new entrants have an other income source originating from either the continuation of alternative agricultural enterprises or an off-farm job, a further 12.2% have a working spouse, while only 21.8% of the new entrants intend to be full-time specialist dairy farmers with no other additional income. Farms planning to be specialist dairy production units expect to have higher ( $P < 0.05$ ) stocking rates (1.94 LU/ha) and milk output (5,094 kg milk/cow and 747kg MS/



ha) compared to either those with other income sources (4,932 kg milk/cow and 630 kg MS/ha) or a working spouse (4,838 kg milk/cow and 657 kg MS/ha). Full-time specialist dairy farmers also expect to achieve higher profits per litre (9 c/l) and per hectare (€733/ha) compared to either those with a working spouse (3 c/l and €231/ha, respectively) or those with an alternative income stream (5 c/l and €358/ha, respectively).

The majority of new entrants to dairying have gained dairy experience on their home family dairy farms (38%) or as dairy farm labourers (42%) while 20% have no previous experience of dairying. New entrant farm system productivity expectations were unaffected by educational qualifications or the level of previous dairy experience. Similarly, both the planned level of capital investment and the profitability expectations per litre and per hectare are similar for all new entrants irrespective of their level of dairy experience or educational qualification.

#### 4. Discussion

The development of a farm business plan is an essential process to help farmers to focus on the necessary factors for business success, by defining realistic goals to create a viable future enterprise (Johnson and Morehart, 2006). While the analysis of actual farm financial results of new entrants provide the ultimate measure of business success, an analysis of business plans of over 230 successful new entrant dairy farmers highlight the available resources, knowledge and experience and expectations of those entering the Irish dairy industry. The importance of personal attributes (knowledge and experience, education) and expectations in motivating farmers to make significant changes to their farming activities has been widely recognised (Lockheed et al., 1980; Sumner and Leiby, 1987; Kumbhakar et al., 1991; Gloy et al., 2002). The current evaluation of new entrants to the Irish dairy industry provides a unique opportunity to identify the characteristics and expectations of new dairy farmers in addition to the potential evolution of the industry post EU milk quota removal in 2015.

The BMW region of Ireland, while representing 47% of the national land mass, currently accounts for just 25% of national dairy production (CSO, 2010). Shalloo (2004) estimated that the profitability of milk production in the BMW region is reduced by 38 to 58% of that possible on drier southern soils based on a comparative analysis of milk production results. Consistent with these findings, O'Donnell et al. (2010) concluded, based on an attitudinal survey of existing milk suppliers, that future expansion in milk production would mostly occur in the south of Ireland. Similarly, the results of this study indicate that despite having a lower spatial density of specialist dairy farms, only a small minority (19%) of new dairy farms are to be located within the BMW region. As Figure 1 demonstrates, these results provide a further indication that quota abolition is likely to result in an increased intensity of milk production within the already heavily concentrated traditional milk production areas in the south and east of Ireland.

Previous studies indicate that farmer expectations are intrinsically linked to prevailing industry and wider economic conditions in addition to market sentiment (Kelly et al., 2012) however, there was no year of application effect on biological or financial expectations of new entrants in this study despite relatively large variation in actual milk prices during the study period (23.3 c/l in 2009, 30.8 c/l in 2010 and 35.5 c/l in 2011; CSO, 2011). The overall levels of farm performance expectations of new entrants (4,954 kg of milk per cow with an average production cost of 25 c/l) are consistent with existing dairy industry performance norms (5,075 kg milk per cow and with production costs of 23c/l; (Hennessy et al., 2011)) while an average expected milk price of 28 c/l is consistent with overall industry expectations (Binfield, 2008). The analysis of new

entrant farmer credentials indicates that a young and highly educated group of new farmers are using the New Entrant Scheme to enter the Irish dairy industry. With an average age of 36 years, this group of new dairy farmers are very young compared to either the existing demographic of dairy farmers (49 years) or the overall population of beef and mixed enterprise farmers (54 years) from which these new entrants originate (Hennessy et al., 2011). In contrast to the findings of Mishra et al. (2009) who reported lower levels of available equity and higher debt-to asset ratios amongst newly establishing farm business set-ups in the United States, the results of this study indicate that newly establishing dairy farmers in Ireland have considerable owned resources and equity from which to establish these new dairy units (with average decoupled EU payments of €22,992 in comparison to €19,488 for the average existing dairy farmer; (Hennessy et al., 2011)).

The impact of farmer age and experience on the expectations and likely performance of these new farm businesses is inconsistently reported in the literature. Although having less equity (savings, sales from previous enterprises, EU farm payments) and other assets (particularly owned land) and therefore requiring additional borrowings, younger new entrants (under-30 group) had significantly higher expectations for the productive capacity of their potential farm businesses. Mishra et al. (2009) similarly observed that younger farmers in the United States starting a new enterprise have fewer assets and concluded that, as younger farmers also have less experience at resource allocation, the financial performance of businesses run by younger farmers would be reduced. Summer and Leiby (1987) also found that older people tend to have fewer borrowings, and concluded that lower costs of borrowing result in larger farms and faster business growth. In contrast with these general findings, other studies have observed superior rates of technical development and adoption amongst younger farmers (Solano et al., 2003, Connolly and Woods, 2010) which may compensate for their inferior financial position. The results of the current study indicate that by initially setting-up with fewer financial assets, the overall profitability expectations of younger entrants are similar to older entrants due to superior farm productivity expectations.

In comparison with the average specialist dairy farmer who currently milks 57 cows on 50 hectares (Hennessy et al., 2011), the average new entrant is planning to milk 71 cows on 58 hectares. The positive expectations of highly educated new entrants are consistent with the findings of Lockheed et al. (1980) who observed that a farms productivity increases for every extra year spent in formal agricultural education. Similarly, other authors have observed that educational qualifications have a positive effect on the financial performance of the dairy farm (Mishra et al., 2009) resulting in increased technology adoption and improved on-farm technical efficiency (Kumbhakar et al., 1991). The increased incidence of other income among new dairy farm businesses (78%) within this study is indicative of the elevated educational status of this group (Mishra et al., 2009) while the reduced productivity and profitability expectations of farm businesses with a lesser reliance on dairy farm income is also consistent with previous findings (Foster, Rausser, 1991).

## 5. Conclusions

The analysed business plans and applications of over 230 successful new entrant dairy farmers highlight the existing resources, education, experience and expectations of those entering the Irish dairy industry in the lead up to EU milk quota abolition. The results show that a youthful and highly educated group of new farmers are using the New Entrant Scheme to enter the Irish dairy industry. Ninety-three percent of new dairy entrants have at least two years of formal 3<sup>rd</sup> level agricultural education and intend to develop larger scale and more efficient dairy farms post-EU milk quotas. Applicant age and other income has a significant impact on available equity and

expectations of entrants as younger and specialised dairy entrants have less owned resources and significantly greater expectations for the productive capacity of their potential farm businesses when compared to older entrants or those with alternative income sources. The results also indicate that, with 81% of new entrants to dairying located in the south of Ireland, quota abolition is likely to result in an increased regional polarisation of milk production within Ireland with increased concentration of production in traditional milk production areas in the south and east of Ireland.

## 6. References

- Boyle G.E., 2002. The Competitiveness of Irish Agriculture. *Report for the Department of Agriculture and Food*. Dublin: Irish Farmers Journal and the AIB group.
- Brereton A.J., 1995. Regional and year to year variation in production. In: D.W. Jeffery, M. B. J., J.H. Mcadam (ed.) *Irish Grasslands: Their Biology and Management*. Royal Irish Academy, Dublin, Ireland.
- Connolly R., Woods V., 2010. An examination of technology adoption & usage by farmers in Ireland. Dublin City University & Department of Agriculture, Fisheries and Food.
- CSO, 2010. Principal Statistics in relation to Agriculture.: Central Statistics Office, Skehard Rd., Cork, Ireland.
- CSO, 2011. Principal Statistics in relation to Agriculture. Central Statistics Office, Skehard Rd., Cork, Ireland.
- DAFM, 2010. Food Harvest 2020. Dublin, Ireland: Department of Agriculture, Fisheries, and Food.
- DAFM, Accessed October 2010. <http://www.agriculture.gov.ie/farmingsectors/dairy/newentrants-scheme/> [Online]. Dublin, Ireland.
- Dillon P., Crosse S., Stakelum G., Flynn F. 1995. The effect of calving date and stocking rate on the performance of spring-calving dairy cows. *Grass and Forage Science*, 50, (3) pp.286-299.
- Dillon P., Roche J.R., Shalloo L., Horan B., 2005. Optimising financial return from grazing in temperate pastures. In: MURPHY, J. J. (ed.) *Utilisation of Grazed Grass in Temporal Animal Systems. Wageningen Academic Publications*. Wageningen, The Netherlands.
- Dillon P., Hennessy T., Shalloo L., Thorne F., Horan B., 2006. Future outlook for the Irish dairy industry: a study of international competitiveness, influence of international trade reform and requirement for change. *International Journal of Dairy Technology*, 61, (1) pp.16-29.
- Foster W.E., Rausser G.C., 1991. Farmer behavior under risk of failure. *American Journal of Agricultural Economics*, 73, (2) pp.276-288.
- Gloy B.A., Hyde J., Ladue E.L., 2002. Dairy Farm Management and Long-Term Farm Financial Performance. *Agriculture and Resource Economics*, 31, (2) pp.233-247.
- Hennessy T., Moran B., Kinsella A., Quinlan G., 2011. National Farm Survey 2010 Teagasc Agricultural Economics & Farm Surveys Department.
- IPTS, 2009. Economic Impact of the Abolition of Milk quota Regime - Regional analysis of the milk production in the EU -. EuroCARE, GmbH, Bonn.
- Johnson J., Morehart M., 2006. Farm Business Management. *Agricultural Resources and Environmental indicators*. 2006/EIB 16.
- Kelly E., Shalloo L., Geary U., Kinsella A., Thorne F., Wallace M., 2012. The associations of management and demographic factors with technical, allocative and economic efficiency of Irish dairy farms. *Journal of Agricultural Science*, 150, (6) pp.738-754.
- Kumbhakar S.C., Ghosh S., McGuckin J.T., 1991. A Generalized Production Frontier Approach for Estimating Determinants of Inefficiency in U.S. Dairy Farms. *Journal of Business & Economic Statistics*, 9, (3) pp.279-286.
- Lips M., Rieder P., 2005. Abolition of Raw Milk Quota in the European Union: A CGE Analysis at the Member Country Level. *Journal of Agricultural Economics*, 56, (1) pp.1-17.
- Lockheed M.E., Jamison D.T., Lau L.J., 1980. Farmer Education and Farm Efficiency: A Survey. *Economic Development & Cultural Change*, 29, (1) pp.37-76.
- McCarthy B., Delaby L., Pierce K.M., Journot F., Horan B., 2011. Meta-analysis of the impact of stocking rate on the productivity of pasture-based milk production systems. *Animal*, 5, (5) pp.784-794.



- Mishra A., Wilson C., Williams R., 2009. Factors Affecting Financial Performance of New and Beginning Farmers. *Agricultural Finance Review*, 69, pp.160-179.
- O'Donnell S., Shalloo L., Horan B., 2010. A survey of the factors affecting the future intentions of Irish dairy farmers. *Journal of Agricultural Science*, 5, pp.647-654.
- SAS, 1999. User's Guide: Statistics, Version 8 Edition *SAS Institute, Inc.*, Carey, NC.
- Shalloo L., Dillon P., O'loughlin J., Rath M., Wallace M., 2004. Comparison of a pasture-based system of milk production on a high rainfall, heavy-clay soil with that on a lower rainfall, free-draining soil. *Grass & Forage Science*, 59, (c) pp.157-168.
- Solano C., León H., Pérez E., Herrero M., 2003. The role of personal information sources on the decision-making process of Costa Rican dairy farmers. *Agricultural Systems*, 76, (1) pp.3-18.
- Sumner D.A., Leiby J.D., 1987. An Econometric Analysis of the Effects of Human Capital on Size and Growth among Dairy Farms. *American Journal of Agricultural Economics*, 69, (2) pp.465-470.
- Whetstone L., 1999. The Perversity of Agricultural subsidies. . In: MORRIS. J., R., B.R. (ed.) *Fearing Food, Risk, Health and Environment*. London, UK: Butterworth Heinemann.