3 year report on the UCD Lyons Systems Herd

Development of a Profitable High-Output Grass-Based Spring Milk Production System

It is widely recognised that grass-based systems will predominate in Ireland post quota abolition. However, grazing systems that have been developed to utilise large quantities of grazed grass have in the main been based on low-output per cow. In this scenario, high levels of profitability are possible through avid cost control and comparatively high stocking rates for grazing systems. There are now reasons to consider the development of grazing systems that are based on high-output per cow. These reasons include (i) concerns about increasing dairy cow numbers and environmental emissions, (ii) facilitating farm expansion post EU-milk quota removal for land limited and fragmented farms, (iii) lack of available skilled labour on farms to deal with expanding animal numbers.

Given the significant costs associated with expansion and the fact that many farmers are operating on a land-bank that is limiting the expansion of their business, a higher input – higher output spring calving grazing system may offer an opportunity to grow the dairy business. Such a system might facilitate the successful expansion of the farm business without the need to buy or rent extra land, to buy stock, to acquire extra labour or to provide extra cow facilities. The focus in such a system is on maximising milk/milk solids output from the existing land holding which involves high output from individual cows. This will occur most efficiently through maximising the use of grazed grass/home grown forage in the system and the strategic use of supplementation thereafter**.**

In this project, the animal and grassland performance for a grazing system based on high-output per cow will be reported. The experiment has been on-going for 3 years (2016-2018) at UCD Lyons Research Farm and will continue until 2021. The targets of this system are presented in Table 1. Each year 60 high EBI Holstein-Friesian spring calving cows were used in the study. The average genetic merit of the herd and the herds genetic merit national ranking is presented in Table 2 for the 3 years of the study.

Table 1. Targets for the system

Parameter	Target
Stocking rate on milking platform	3.4 LU/ha
Stocking rate whole farm	2.4 LU/ha
Milk yield kg/cow	7,500-8,000
Milk solids kg/cow	625
6-Week in calf rate	75%
Concentrate (kg/cow/year)	1,500
% diet as grazed grass	>51
% diet as grazed grass and grass silage	>75

Table 2. Average genetic merit of the herd (based on the January evaluations each year) and the herds genetic merit ranking (top %) in 2016, 2017 and 2018.

	EBI	Milk	Fert	Calv	Milk kg	Fat kg	Prot kg	Fat%	Prot%
2016	208	72	101	35.2	195	14.2	11.3	0.1	0.1
Rank	1%	1%	10%	1%	20%	1%	5%	10%	10%
2017	154	58	58	37.5	150	12.5	8.8	0.1	0.1
Rank	1%	1%	10%	1%	10%	1%	1%	10%	10%
2018	161	56	61	42.1	78	10.5	6.9	0.1	0.1
Rank	1%	5%	10%	1%	40%	5%	10%	10%	5%

Cow management and feeding

Mean calving dates were the 17th, 20th and 15th of February for 2016, 2017 and 2018 respectively. Depending on calving date, once calved, cows were turned out to grass (by day at first until weather conditions are adequate). Cows were offered concentrates, grass and silage based on their days in milk (DIM), according to predefined feed budget (Table 3) over the 3 years. In 2018, during the drought, cows were supplemented with a maize-silage based partial TMR for 5 weeks.

Table 3. Feed budget targets for 2016, 2017 and 2018

	Days in milk	0-20	20-60	60-120	120-180	180-240	240-270	270-305	306-365*	Total annual DMI
2016	Milk yield	31	34	32	27	22	19	15	-	7500 kg
	Silage DMI	12	0	0	0	0	6	10	8	1.25 t DM
	Grass DMI	0	15	16	15	13	6	0	-	3.6 t DM
	Concentrate	8	8	7	3.5	2.5	2.5	6	-	1.3 t DM
2017	Milk yield	31	34	32	27	22	19	15	-	7500 kg
	Silage DMI	12	0	0	0	0	5.5	10	8	1.25 t DM
	Grass DMI	0	13.5	14.5	14.5	14	5.5	0	-	3.2 t DM
	Concentrate	8	8	6	3.5	2.5	4	6	-	1.3 t DM
2018	Milk yield	31	34	32	27	22	19	15	-	7500 kg
	Silage DMI	12	0	0	0	0	5.5	10	8	1.25 t DM
	Grass DMI	0	13.5	14.5	14.5	14	5.5	0	-	3.2 t DM
	Concentrate	8	8	6	3.5	4	4	3	-	1.3 t DM

*2 kg rolled barley/cow/day is fed for two weeks before calving

Dry cow management and feeding

Cows were dried off to give them a minimum 60-day dry period or if their yield dropped below 9 kg/cow/day. Cows were not restricted in feed prior to drying off. In 2016 and 2017, all cows are given teat sealant and selective dry cow therapy was practised across the herd. Only problematic high SCC cows (SCC>100,000 in past 3 months or cows treated for mastitis over the lactation) were treated. In 2018, it was decided (after seeking veterinary advice) that all cows receive antibiotics at drying off due to increasing SCC in the herd. Dry cows were housed and fed approximately 8 kg DM silage and 150 g of dry cow minerals. Dry cows remained on this diet for the first six weeks of their dry period while housed on cubicles. For the last two weeks of the dry period, cows were housed on straw bedding and fed 8.5 kg silage DM, 2 kg Barley, 150 g dry cow minerals, 750 g SoyChlor. Allowances from the dry cow mineral were as follows: Magnesium 26 g, Phosphorous 0 g, Calcium 0 g, Sodium 10 g, Copper 300 mg (1/3 of this in highly available form), 30 mg Iodine, 1.5 mg Selenium (as highly available Selenium), 415 mg Manganese, 750 mg of Zinc (1/3 of this in highly available form), 10 mg of Cobalt, 75,000 IU Vitamin A, 25,000 IU vitamin D3, 1,200 IU vitamin E, 20 mg Biotin.

Milk production and composition

Herd milk production and milk composition for 2016, 2017 and 2018 are presented in Table 4. Cows were milk recorded twice monthly by Progressive Genetics (305 day yield, Table 4). Milk production was also recorded through the milking parlour (actual milk yield, Table 4). Actual milk yield and solids produced by the herd was approximately 5% below target, producing 588 and 595 kg MS/cow and 7407 and 7466 kg/cow in 2016 and 2017 respectively. In 2018, actual milk yield and solids produced was approximately 13% below the target, producing 544 kg MS/cow and 6790 kg/cow.

Table 4. Herd milk performance in 2016, 2017 and 2018 compared to the targets

Parameter	Target	2016	2017	2018
Cow numbers	60	58	60	59
Milking Platform ha	17.64	17.58	17.65	17.65
Silage ha	9	9	7	7
Whole farm ha	26.6	26	24.65	24.65
SR on MP	3.4	3.3	3.4	3.34
SR whole farm	2.25	2.18	2.4	2.4
% heifers in herd	22	22.4	23.3	28
Average lactation days	305	301	305	305
Average fat %	4.50	4.60	4.49	4.45
Average protein %	3.60	3.56	3.66	3.62
Average lactose %	4.50	4.51	4.48	4.54
Average SCC	<120,000	111,000	91,500	154,000
Yield/cow (305d)	7750	7441	7548	6680
Milk solids/cow (305d)	625	592	602	558
Yield/cow (actual)	7750	7407	7466	6790
Milk solids/cow (actual)	625	588	595	544
Milk solids/ha MP	2125	1953	2023	1850
Milk solids/ha whole farm	1521	1291	1428	1306

Body condition score

Body condition score (BCS) was assessed fortnightly. Average annual BCS was 2.89, 2.99 and 3.02 in 2016, 2017 and 2018 respectively. Average monthly BCS are presented in Figure 1.

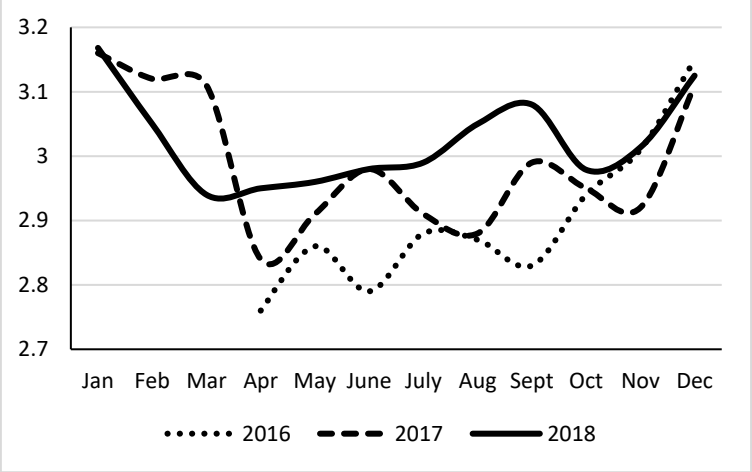

Figure 1. The average monthly BCS for the herd for 2016, 2017 and 2018.

Breeding management

The breeding season started on the 26th, 24th and 29th of April in 2016, 2017 and 2018 respectively and lasted for 12 weeks in 2016 and 2018 and 13 weeks in 2017. A pre-breeding scan was conducted prior to the breeding season to eliminate cows with fertility problems. All breeding was done using AI and was performed by a trained and licensed technician. AI was conducted once daily in 2016 and 2017 and twice daily in 2018. Heat detection was carried out using Moomonitors and visual heat detection in 2016 and 2017. In 2018, Moomonitors, scratch card and crayons were used. Bulls used for AI were selected based on high milk production and components while maintaining high fertility. Fertility performance of the herd is presented in Table 6.

Bulls used were as follows; 2016: YKZ, OZG, DBW, CSW, RNO, YGM, ZOL, AGH, SEW, FAD, HZB and YRY. 2017: FR2226, FR4020, FR2298, SEW, FR4019, FR4118, FR2426, FR2032, FR2339, FR2237, FR4021, YKZ and FR2040. 2018: HZB, LWR, FR2031, FR2236, FR2297, FR2298, FR2314, FR2371, FR2460, FR4020, FR4244.

Table 6. Fertility performance of the herd in 2016, 2017 and 2018.

	2016	**2017**	**2018**
Number of cows bred	58 (of 58)	59 (of 60)	55 (of 60)
Submission rate %	91	90	96
First service conception rate %	43	49	69
6-week pregnancy rate %	59	54	83
Empty rate of total cows %	9	15	13

Grassland management

Cows rotationally grazed the milking platform (17.58 ha in 2016, 17.65 ha in 2017 and 2018) at a stocking rate of 3.4 LU/ha or 2.4 LU/ha (whole farm stocking rate; 7 ha for silage production). Target pre-grazing herbage mass was 1400-1500 kg DM/ha (>4 cm) and target post grazing sward height was 4 cm throughout the year. Daily allocations of grass varied according to the feed budget and break fences were used to allow a fresh allocation of pasture to be offered after each morning and evening milking during the first and last rotation and on a 36 hour basis during the main grazing season. Grass supply was measured weekly using a platemeter and recorded on Agrinet in 2016 and PastureBase Ireland in 2017 and 2018. Three main tools are used to help manage grass on the farm; the spring rotation planner, the summer wedge and the autumn rotation planner.

Phosphorus (P) and potassium (K) were applied according to soil tests taken annually. Grassland performance data for 2016, 2017 and 2018 is presented in Table 7. Total grass production per paddock in 2016 ranged from 9.2-15.5 t/ha, in 2017 from 12.4-16.6 t/ha and in 2018 from 9.5-14.1 t/ha.

Table 7. Grassland performance in 2016, 2017 and 2018

	2016	2017	2018
Closing cover (kg DM/ha)	435 (28th Oct)	476 (20th Nov)	510 (6th Nov)
Stocking rate on MP	3.30	3.40	3.34
Nitrogen (kg N/ha)	235	260	265
Phosphorus (kg P/ha)	9.3	8.6	8.9
Potassium (kg K/ha)	31.7	44.0	112.3
Turnout by day	15th Feb	6th Feb	19th Feb
Turnout full time	1st March	15th Feb	21st Feb
Housed by night	28th Oct	1st Nov	1st Nov
Full time housing	28th Oct	14th Nov	6th Nov
Days (d) housed during grazing season	6 d in April	5 d in Feb & Mar	17 d during snow, 38 d on sacrifice paddock
Total days at grass	250	276	258
Grass growth (t/ha)	13.1	14	11.7
Silage (bales) on MP (t/ha)	1.7	2.0	1.4
Herbage utilized t/ha	11.4	12.2	10.0
Grazed grass utilized t/ha	9.7	10.2	8.6
Grazed grass utilized t/cow	2.9	3.0	2.5
Milk from forage (kg)	4,400	4,400	3,548

Silage production

Silage was produced on a separate 7 ha block (9 ha in 2016) from a perennial ryegrass and red clover mixed pasture in a 3-cut system. First cut silage was harvested on 23rd, 10th and 24th of May in 2016, 2017 and 2018 respectively. Second cut silage was harvested on the 13th of July, 16th of June and 5th of July in 2016, 2017 and 2018 respectively. Third cut silage was harvested in late August-early September each year. After ensiling, pit samples were taken using a pit core and analysed in an external laboratory. Silage quality results are presented in Table 8.

Table 8. Silage quality results in 2016, 2017 and 2018.

	2016		2017			2018	
	1st cut	**2nd cut**	**1st cut**	**2nd cut**	**3rd cut**	**1st cut**	**2nd cut**
DM (%)	24.5	30.9	34.7	36.7	31.3	36.2	26.8
CP (% DM)	13.3	12.4	16.6	13.5	13.2	16.6	14.2
DMD (% DM)	77.0	72.0	81.0	71.0	67.0	72.5	72.5
ME (MJ/kg)	11.9	11.3	12.2	11.2	10.9	11.0	10.9
UFL	0.87	0.81	0.92	0.80	0.74	0.82	0.82
NDF (% DM)	42	40	36	46	45	44	51
FIM intake (g/kgW0.75)	100	106	115	109	101	95.1	88.4

Financial performance

A financial simulation was conducted comparing a very efficient low concentrate grass based system to the Lyons high input high output grass based system in 2017 and is presented in Table 9.

Table 9. System financial comparison in 2017

	Very efficient low concentrate system	UCD Lyons high-output grazing system
SR cows/ha on the milking platform	3.50	3.40
Overall SR (LU/ha)	2.50	2.40
Replacement rate	20%	30%
Milk solids (kg/cow)	450	595
Milk solids (kg/ha)	1,125	1,430
Concentrates (t DM/cow)	0.43	1.30
Grazed grass (t DM/cow)	4.10	3.20
Grass silage (t DM/cow)	1.10	1.50
Milk output (€/cow)	1,679	2,206
Milk output (€/ha)	4,193	5,302
Gross margin (€/cow)	1,042	1,159
Gross margin (€/ha)	2,591	2,786
Fixed costs (€/cow)	500	585
Fixed costs (€/ha)	1,243	1,406
Net margin (€/cow)	**542**	**574**
Net margin (€/ha)	**1,347**	**1,380**
Breakeven milk price (€/kg MS)	**3.05**	**3.24**
Breakeven milk price (€ cent/L)	**23.17**	**25.10**

*Comparison assumes a milk price of 30 c/l (incl. VAT) and concentrate price €310/t DM

E-profit monitors for the farm system were conducted for 2017 and 2018 (Table 10). The financial performance in 2018 is considerably lower than in 2017 due to a number of factors; 1) the extra concentrates, forages and associated contracting costs to feed the cows during the snow storm in February/March and the drought during the summer; 2) the lower milk production in 2018 compared to previous years due to a higher proportion of heifers in the herd (28% heifers), weather events and a lungworm problem that occurred in the summer.

Table 10. The e Profit Monitor for the herd in 2017 and 2018

2017			
	€ dairy/ha	**€/cow**	**c/litre**
Gross output	7,045	2,894	38.25
Total variable costs	2,570	1,056	13.96
(*of which feed costs*)	994	408	5.40
Total fixed costs	1,423	585	7.73
Total costs	3,994	1,641	21.68
Net margin	**3,051**	**1,253**	**16.57**
2018			
	€ dairy/ha	**€/cow**	**c/litre**
Gross output	6,239	2,563	38.89
Total variable costs	3,623	1,489	22.58
(*of which feed costs*)	1,632	671	10.17
Total fixed costs	1,205	495	7.51
Total costs	4,829	1,984	30.10
Net margin	**1,410**	**579**	**8.79**

Key learnings

- High level of milk output possible in high EBI cows in grazing systems
- Good grassland management imperative to good grass utilisation
- Fertility targets are achievable
- High input systems can be profitable

2019-2021

- Continue focus on high EBI, high output herd for 2019-2021
- New genetics purchased (8 new animals: 6 heifers, 2 cows)
- Incorporate nutritional studies to improve the N efficiency of the herd.
- In 2019, the experiment will look at two differing crude protein levels in the concentrate; an 18% CP concentrate throughout lactation versus 18% CP concentrate for first and last rotations and a 14% CP concentrate for other rotations.