Teagasc Heavy Soils Dairy Programme Review

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Summary

- Farms in Clare, Limerick, Tipperary, Kerry and Cork are participating in a heavy soils programme.
- High rainfall is impacting negatively on grass grown and utilised on heavy farms. Grass growth, on these farms, in 2012 was over 2 tonnes DM/ha less than the five year average and 2.8 tonnes DM/ha lower than 2011.
- Concentrate feed costs increased from 3c/litre (2011) to 5.6 c/litre in 2012 based on increased concentrate cost and increased concentrate feed levels. In addition silage fed in the grazing season is valued at 1.9 c/l,
- The provision of adequate forage reserves including a feed buffer for years like 2012 is crucial on farms with heavy soils to ensure the system is sustainable in challenging conditions
- A targeted investment strategy in drainage and grazing infrastructure should be incorporated within the business plan for the farm

The year 2012 has been challenging on all farms but has been especially challenging for farmers on heavy soils. The ongoing and persistent rain from June onwards has made grazing, silage making and slurry spreading very problematic. Systems of milk production on heavier soil types must be robust enough to be able to cope with years like 2012, through having adequate infrastructure and ensuring that surplus feed is harvested in relatively good years which can be used as a buffer in poor weather years. What is clear is that there is a necessity to have good farm infrastructure, have a drainage plan in place and ensure soil fertility is not limiting production.

Rainfall

High rainfall is the single biggest factor impacting on grass growth and utilisation on heavy soils. Rainfall during the key summer months determines both the amount of grass grown, utilised through grazing and the quantity and quality of silage conserved. Figure 1 shows ten year data from the Teagasc research farm in Solohead showing the relationship between rainfall and herbage production (Humphreys, 2012).

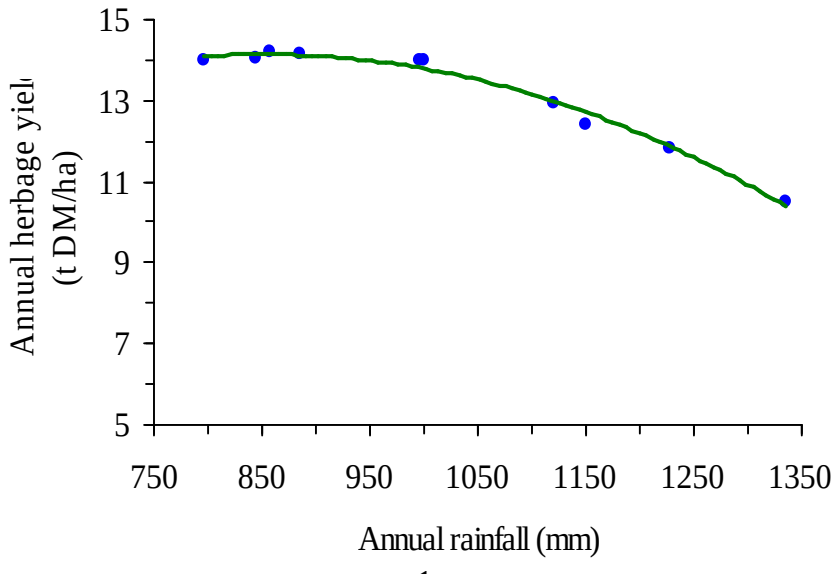
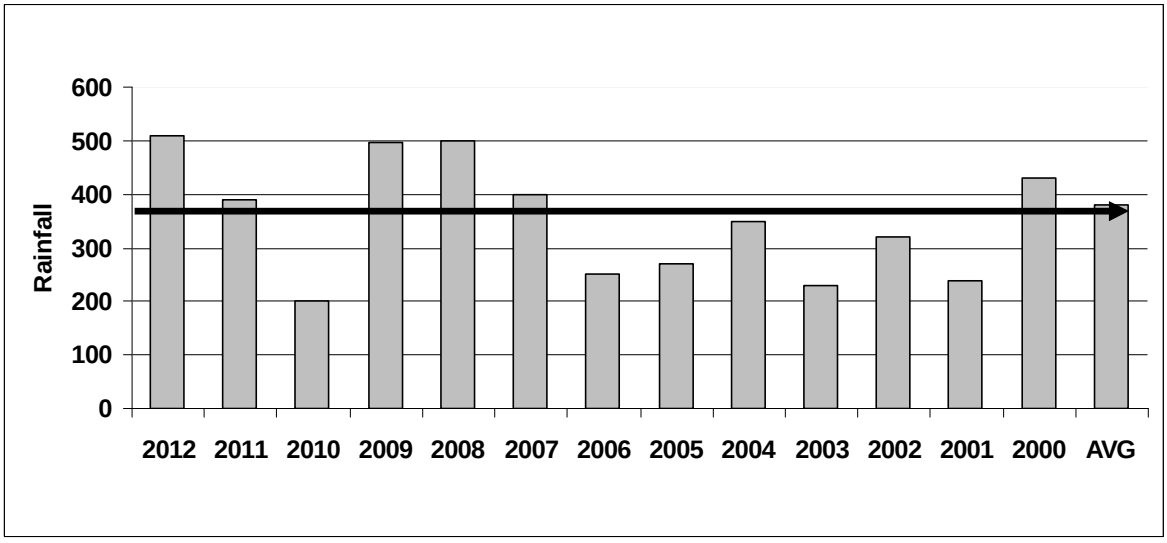


Figure 1 The impact of annual rainfall on annual herbage yields at Solohead between 2001 and 2010

Meteorological data (figure 2) from Castleisland, Co. Kerry shows that in 2012 total rainfall in the critical May – August period was 41% higher than the ten year average and was matched by equally wet summers in 2009 and 2008. Spring 2012 rainfall was at the ten year average and this autumn to date was 12% above average. Total rainfall measurements for January to October 2012 at different national locations showed that Castleisland recorded 1062mm compared to Moorepark 813mm and Kilkenny 653mm. The combined effect of increased total, and out of season, rainfall in combination with heavy soils has meant a reduction in grass growth and utilisation in the South West region.

Figure 2.Rainfall (mm) in Castleisland, Co Kerry over a twelve year period 2000 - 2012



Source: G Hurley, Teagasc

The incessant heavy rain impacted on grass growth but even more so on grass utilisation. Data from Kerry farms recording weekly grass growth (see table 1) shows that compared to the average of 2008 – 2011, grass growth for 2012 was 19% lower. Overall 2.1 tonnes DM/ha less was grown in 2012 compared to the 5 year average. Grass utilisation on much of the heavy land was averaging only 50%, with areas of many farms waterlogged and out of the grazing rotation for most of the main grazing season. The 4 year average grass growth was 11.3 tonnes/ha.
See Table 1 Teagasc Kerry-Grass Dry Matter grown (t/ha) 2008 – 2012

Table 1	2008	2009	2010	2011	2012	*Average
Total DM	11.2	10.8	11.7	11.6	9.2	11.3
Spring DM/Ha	1.5	1.9	1.2	2.0	1.5	1.7
Summer DM/Ha	7.6	6.6	7.8	7.1	6.2	7.3
Autumn DM/ha	2.1	2.2	2.7	2.5	1.6	2.4

(Source G Hurley)

*Average four year data (2008 -2011) - Kerry grass measurement group (n=20)

Compared to the previous four years data 2008 -2011

- Grass Grown in 2012 reduced by 19%
- Spring growth reduced by 13% (15 Feb – 30 April)
- Summer growth reduced by 16% (1 May – 31 Aug)
- Autumn growth reduced by 32% (1 Sept – 1 Nov)

Farm infrastructure

Farm infrastructure is even more important on heavy soils than on drier soils to ensure maximum grass utilisation. Ensuring maximum grass utilisation will require;

-Good farm roadways
-A well laid out paddock system
-Multiple water access points
-Wintering facilities – slurry storage

Farm roadways

Ground conditions are often marginal on farms with heavy soils. It is inevitable some damage will be done; therefore it is essential that when animals come off a damaged area, they do not go into that area again until the next rotation. This requires an adequate farm roadway system. It is essential to have good access to all paddocks for animals and machinery. Road layout must allow for good cow flow and have a suitable surface for cow walking speed and hoof welfare. Where a roadway is not necessary for heavy machinery, less expensive cow paths or spur roadways should be used.

Paddock System

A well laid out paddock system is important for maximising grass utilisation. If not already done, the farm should be mapped and a plan drawn up with the optimum number of paddocks appropriate to the farm. Paddocks should ideally be two day paddocks for the target herd size and have multiple access points. Ideally keep paddocks square or rectangular, if possible depth to width ratio should be 2:1, this will allow paddock to be divided easily for back fencing and on/off grazing. While ground was completely waterlogged on many farms and full time housing was required the principles of on –off grazing are still important in grazing seasons where ground is marginal but not as saturated as experienced this summer. The reality is that 90% of a cows grass requirement can be achieved over a three to four hour grazing bout after each milking. Many farms stood off cows until midday and still maintained reasonable grass intakes when conditions allowed. While poaching damage could not be avoided on farms with heavy soils some farms fared better than others in 2012.

Water

The importance of access to water can be overlooked when managing cows in difficult conditions. The fact the grass is very wet does not reduce the need for water for the animals, therefore access to water should not compromise grazing or incur extra poaching damage. The layout and placement of water troughs should be incorporated into the paddock plan and will in many cases require more than one trough per paddock.

Wintering Facilities

Dairy farming on heavy soils will require animals to be housed for longer periods. The aim where possible is to turn out cows to grass after calving but inevitably cows finish lactation indoors and in years similar to 2012 cows may have to be housed at various times during the grazing season. It is important that facilities are clean and suitable for milking cows. The emphasis on any dairy farm will be to maximise the amount of grazed grass in the diet. However, it must be acknowledged that in times of very poor ground conditions the best option may be to house cows for short periods and wait for suitable grazing conditions rather than irrevocably damaging paddocks.

The longer wintering period required for dairy farms on heavy soils means more slurry storage is required. Many farmers who farm on heavy soils have adequate slurry storage and housing for the existing herd. However with expansion, there will be increased demands for slurry storage and housing, all options should be examined and the relative costs of the various option analysed. The necessity to take advantage of ground conditions for slurry spreading has been highlighted in 2012, with a requirement that as much as possible of the slurry is spread in the Spring. The use of low ground pressure tyres for slurry tankers (and indeed for the full range of farm machinery) is essential in minimising soil compaction.

Summary of physical and financial data heavy soils project farms 2012.

The Teagasc heavy soils programme has seven monitor farms located across the Munster region. The farms have assembled physical and financial performance data for 2012 outlined in Table2, Table 3 and Table 4.
Average cow numbers milked remained static in 2012 at 87 cows on a milking block of an average of 41 ha (2.1 LU/Ha).Milk production (5040 litres/cow).
from the heavy soils farms fell by 5% compared to 2011 and was close to the annual production for 2010. Spring production had been better than previous years and less than 10 tonnes concentrate/farm or 115kgs/cow (11 % of annual total) had been fed on the heavy soils farms by March 31.

Table 2 Milk production (litres) from Heavy soils programme farms 2010 -2012

Location of farm	2012	2011	2010
Doonbeg	445,104	428,156	417,990
Listowel	390,744	453,810	404,784
West Limerick	410,080	402,199	378,900
Castleisland	524,706	534,978	532,760
North Cork	356,126	423,967	401,842
Macroom	488,817	510,198	489,992
Average	**435,930**	**458,945**	**437,711**

Supplementary feeding on Heavy soils programme farms

Table 3 Cow numbers in 2012 and levels of concentrate feeding in 2011 and 2012 for the Heavy soils programme farms.

Location	Cow number Avg. 2012	Conc. fed/cow (kg) 2012	Conc. fed/cow (kg) 2011
West Limerick	88	852	571
Castleisland	93	1688	771
North Cork	86	744	380
Listowel	81	775	775
Doonbeg	88	953	467
Macroom	84	1120	770
Average	**87**	**1022**	**622**

Meal feeding per cow increased dramatically from April onwards in 2012. On average 622 kgs/cow was fed in 2011 and this increased by 70% to over a tonne/cow fed in the full year of 2012. Within the group the variation was from 0.74 tonnes/cow up to 1.7 tonnes/cow.

Overall concentrate costs have increased to 5.6 c/litre on the heavy farms in 2012 from on average 3c/litre in 2011. In addition, the heavy farms fed 215 tonnes silage fresh or the equivalent of just under 3 bales of silage per cow (0.49 tonnes DM of silage/cow).This silage was fed during the grazing season period April – September and was additional to the winter feed requirements.

Table 4 Additional silage fed on the Heavy soils programme farms April –Sept 2012

Location	Silage fed (tonnes) April -Sept		Silage reserve (tonnes) in stock May 1 2012	
West Limerick	170	(1.9/cow)	94	
Castleisland	330	(3.5/cow)	0	
North Cork	280	(3.2/cow)	0	
Listowel	180	(2.2/cow)	150	
Doonbeg	250	(2.8/cow)	324	
Macroom	77	(1.0/cow)	600	
Average	**215**	**(2.5/cow)**	***195**	**(2.3/cow)**

*(=1 tonne DM/ha)

Milk production loss on the 6 farms was minimised by the input of very high levels of supplementation (concentrate + silage) costing an average of 7.5 c/litre. The farms had an average reserve of silage at the end of April 2012 of 195 tonnes or the equivalent of 2.3 tonnes/cow (0.46t DM/cow). One farm had a lot of silage in reserve but most farms had inadequate reserves to meet silage requirements. Silage surpluses made into bales in late May on some farms were also fed throughout the summer months The farms had to house cows by night on average 62 days in the period April –September and on average 20 days on a fulltime basis. The grazing season finished up quickly with cows housed by night from September 19th onwards and fulltime by October 16th. This was on average three weeks earlier than normal

fulltime housing. Despite an increase of 5% on already high fertiliser prices the cost of fertiliser remained the same as 2011 at 2.74c/litre. While additional P & K was applied early in the grazing season in response to soil analysis results, nitrogen had to be skipped on a number of occasions and overall N use (180kgs N/Ha) was considerably lower than last year.

Financial Outcomes for farms in heavy soils programme

A profit monitor report for 2012 (November and December estimated) has been produced by each of the farms participating in the heavy soils programme and a summary of the results is outlined in Table 5.Total costs of production increased by 17% to 24c/l compared to 2011 at 20.6 c/litre. This was largely due to an increase of 24% in variable costs. On top of this there is a deficit in silage on farms which could amount to 350kg DM /cow. This will impact on costs for 2013. Poorer quality silage, averaging 62 DMD and 9% protein will also need to be supplemented with additional concentrate (estimated @ 1.5kg/cow/day).

Table 5 Comparison 2012 projected v 2011 Profit Monitor data matched Heavy soils programme farms

	Gross Output c/litre	**Variable costs c/litre**	**Fixed costs c/litre**	**Total costs c/litre**	**Net Profit c/litre**	**MS/cow Kgs/Cow**
2012	32.1	14.5	9.5	24.0	8.1	372
2011	35.8	11.7	8.9	20.6	15.2	402
Difference	-3.7	2.8	0.6	3.4	7.1	-30.2
Change	**-10%**	**24%**	**7%**	**17%**	**-47%**	**-8%**

Milk price, milk solids production and Net Profit (estimate)

Milk price fell from 35c/litre to an average of 31.3c/litre (estimated) or an average drop of 3.7 c/litre (10.5%). Milk solids/cow fell by 8% to 372kgs/cow despite concentrate use increasing by 70% .The high inputs of silage negatively impacted on milk solids production and overall supplementary feeding did not replace the energy deficit created by the lack of grass in the diet.

Net profit/litre declined by 47% from 15.2 c/litre in 2011 to a projected 8.1c/litre in 2012 with a winter feed deficit that will add approximately 2c/l to next years costs of production and a requirement for additional concentrate due to silage quality issues.

Grass Production and Utilisation on the Farms in the Heavy Soils Programme

To capture the maximum benefits of grazed grass the most fundamental management practice must be to have the correct number of cows to match the grass production capability of the farm. Stocking rate traditionally expressed as cows per ha is widely recognised as the major factor governing productivity from grassland. It is therefore recommended that the overall stocking rate of the farm is closely aligned to the individual farms grass growth capability. Increasing stocking rate beyond the growth capability of the farm can be used as a short term strategy to increase animal numbers in advance of expansion but in the longer term, stocking

rates that exceed the growth capability of the farm result in significant increases in purchased feed and overall milk production costs.

On the basis that Irish farms have the potential to achieve annual pasture production of 15 – 16 tons of grass DM production/ha, the recommended best practice stocking rate for an enclosed production system is 2.9/3.0 cows/hectare (Horan et al., 2012).

This equates to a cow requirement of approximately 5 tons DM/annum. This provides a benchmark for dairy farmers to establish how many cows can be carried on their farm. Therefore every effort must be made by the farmer to establish what level of grass production is possible on the farm. This technology has been developed for many years through the weekly farm cover measurement (O'Donovan, 2000). Completing this weekly measurement over a number of years will establish the real potential of grass production on the farm.
A number of factors will influence the level of grass production on the farm. These include; Rainfall, soil type, altitude, aspect, grassland management, level of ryegrass content, and soil fertility.

In a comparison by Shalloo et al. (2004) the level of grass production was substantially lower on a heavy-clay soil with high rainfall (Kilmaley, Co. Clare) compared to low rainfall, free-draining soil (Moorepark, Co. Cork). This result occurred despite the fact that altitude, grassland management skill, soil fertility and level of ryegrass content were similar at both sites.

In recent years soil fertility has been overlooked on many dairy farms. Soil fertility (specifically P, K and lime status) is the foundation on which the grass production potential is achieved. Only about 30% of Irish soils are in the optimum Index of 3 for P & K (O'Donovan et al., 2012). The results of soil tests taken from the farms in the heavy soils programme indicate that a large proportion of the soils are at index 1 and 2 and are therefore sub optimal for herbage production (O'Loughlin et al., 2012).
Another consequence of poor soil fertility is the lower level of ryegrass survival. The level of ryegrass content was established on the farms of the heavy soils programme. The average ryegrass content of the pastures at the start of this programme was less than 30%. The poor soil fertility status of the farms is an obvious factor influencing ryegrass survival in conjunction with significant poaching during wet years.
Shalloo et al. (2010) demonstrated that increasing the level of reseeding on the farm has a positive effect on profitability through an increase in total and seasonal grass production and when accompanied by an increased stocking rate, increased pasture utilisation. All of the farms in the programme are making continued effort to address the poor soil fertility status and level of ryegrass content.

Table 6 The level of grass production and utilisation on the farms in the heavy soils programme for the years 2011 and 2012 (tonnes DM/ha)

	2011	**2012**
Grass Production (tonnes DM/ha)	10.6	7.8
Grass Utilisation (tonnes DM/ha)	8.1	5.4

Table 6 shows that grass production was 2.8 tonnes DM/ha lower in 2012 compared to 2011. There was a large difference in the level of grass utilised across the farms in 2012 with the average falling to 5.4 tonnes/ha. This difference was largely due to the level of rainfall rather than the soil type. Grass utilisation ranged from 50% to

80% of the grass produced. While achieving the utilisation efficiency of close to 80% is admirable, the ultimate consequence on grass production in the next season may be compromised due to soil damage this year.

Impact of lower grass production and utilisation

The financial impact of 2012 is outlined earlier in this paper. However as we have seen over the last few years, the incidence of high rainfall during the main grazing season has become more common. This results in lower grass production and utilisation. The system of milk production practised on farms with difficult soils must be able to cope both physically and financially with this challenge. A dairy cow requires 5 tonnes DM/annum to sustain herself and produce approximately 400kg MS/Yr. For example if cows receive an average 0.7 tonnes concentrate DM/cow. This leaves an annual deficit of about 4.3 tons DM/cow for the year.Forage production on the farm has to meet this deficit. The average stocking rate of these farms, on the milking platform, is 2.1 cows/ha. If we assume an average utilisation efficiency of 75% of the grass/forage produced, then the farm must produce 12 tons of DM/ha to meet both grazing and silage requirement.

4.3 tons DM/cow divided by 0.75 (utilisation efficiency)

= 5.73 tons to be grown/cow

Stocking rate: 2.1 cows/ha

2.1 X 5.73 = 12 tons grass DM grown/ha/yr

Of course, most dairy farms have out-farms and the farms in this programme are similar and in reality some of the forage for wintering originates from this source. The average stocking rate on the whole farm for these farms in the programme is close to 1.7 cows per hectare.

It is difficult to meet the silage requirements on farms with difficult soil types as outlined in studies carried out by Browne and Walsh (1966 –1968) especially at high stocking rates. The vast majority (70%) of the farms in the heavy soils programme have generated enough forage to meet their feed requirements this winter. However, it is important to realise that forage produced in the grass production year of 2011 was carried as surplus (1 tonne DM/ha) into 2012 and is main reason that enough winter feed exists on most of these farms (see Table 4). Two of the farms had no silage in stock as of the 1st May 2012. These farms face a significant feed challenge this winter. These farms had no fallback position in feed supply when difficult climatic conditions arose during the main grazing season of 2012. As a result some silage made in 2012 was consumed in the main grazing season of 2012. However, it is worth noting that these farms also have a higher stocking rate than most of the others.

Having a supply of high quality forage is also necessary in a difficult grazing year like 2012. The grazing season is shorter and the amount of time spent indoor is longer both during the grazing season and at the start and end of the season. Round bale silage technology provides the opportunity of taking small surpluses in grass production during the grazing season. This surplus can then be fed back to animals when they are housed and at the same time sustaining good levels of milk solids production (O'Donovan, personal communication) at a reasonable cost. Therefore every effort must be made by the farmer to generate this type of forage at every opportunity. The cost of purchasing additional feed/forage is generally much higher in a year like 2012. There is also risk associated with the quality of the forage

purchased. Further research is required to examine other ways of generating high quality forage on these types of farms.
It should not be discounted that these farms can produce higher quantities and quality of forage (grass or silage). As soil fertility and ryegrass content of pastures on these farms begin to improve, grass production and the quality of pasture should increase. In conclusion, it is essential that surplus forage is generated in years of good grass production to have a fallback in feed supply to overcome the deficit generated in years with difficult weather conditions.

Relative value of feeds

Farms with heavy soils are relatively more dependant on supplementation than farms on more free draining soil type (Shalloo et al, 2004). It is important that all supplementary feeds are fully costed on an energy basis which is the main limiting factor when grass intake is restricted due to poor weather conditions. See Table 7 on relative feed values:

Table 7. The Relative Cost of some Supplement Options

Example feeds	Cost € / t DM	Energy Content UFL / kg DM	Cost per € / 1000 UFL
Concentrates (€300/t)	340	1.10	375
Soya Hulls (€230/t)	260	1.01	264
70 DMD 1st cut silage-late May[1]	140	0.79	177
63 DMD 1st cut silage-mid-June[1]	130	0.70	185
74 DMD Surplus Baled silage[2]	84	0.84	100

[1]All costs incl land charge (€640/ha)
[2]Surplus excluding fertilizer charge & land charge and harvested at 2500-3000 kgs DM/ha @€15/bale

The relative value of feeds is constantly changing and different feeds represent good value for money and this needs to be constantly monitored. Surplus baled silage made during periods of rapid growth is always best value. It is a vital tool for good grassland management and is an alternative method of utilising home grown forage. In the above example concentrates are 3.75 times more expensive than home grown high quality surplus baled silage to supply the same amount of energy.

Conclusion

Data from the Heavy soils programme farms is highlighting the variation in grass output in years of high rainfall and its impact on farm profitability. Maintaining ryegrass swards and the building of silage reserves are key components of a sustainable dairy system on heavy soils.

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