Assessing components of a stubble and impact of grazing
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Introduction

This document summarises the observations from three years of recording the components of stubble and the corresponding livestock performance when the stubble was grazed. Ten trials and 42 observations covering a period three year period from 2004/2005 to 2006/2007 make up the data set. Three barley and seven wheat stubbles were used.

Two trials involved the testing of products claimed to increase stubble utilisation and livestock performance. The results of this work has been reported previously (SFS, 2006) and as there was no difference in stubble remaining after grazing or the livestock weights compared to no treatment, these observations have also been included in this analysis.

Measurements taken during the trials consisted of:

- Quantity for four stubble components (grain, green material, standing straw and loose trash)
- Feed quality of the four stubble components (metabolisable energy, digestibility, protein)
- Animal liveweight at regular intervals (generally one week or less).

Livestock were weighed within one hour of being mustered from the trial paddocks. The decision to cease grazing was made by the farmer involved. This usually occurred on the first weighing where livestock failed to gain weight.

Two trials involved long periods between weighing of livestock and were excluded from the livestock analysis but included in the stubble analysis. Three trials conducted in 2007 excluded measurement of the straw and trash components of the stubble and were excluded from analysis of changes in stubble mass. They were included in the analysis of the green and grain component of a stubble (table 1).

Table 1: Measurements taken at each trial (2005 – 2007)

Location	Year	Stubble type	L'weight	Stubble components			
				Straw	Trash	Green	Grain
St Leonards	2005	Barley	**X**	**X**	**X**	**X**	**X**
Mingay	2005	Wheat		**X**	**X**	**X**	**X**
Mingay	2005	Wheat		**X**	**X**	**X**	**X**
Werneth	2006	Barley	**X**	**X**	**X**	**X**	**X**
Werneth	2006	Barley	**X**	**X**	**X**	**X**	**X**
St Leonards	2007	Wheat	**X**	**X**	**X**	**X**	**X**
St Leonards	2007	Wheat	**X**	**X**	**X**	**X**	**X**
Inverleigh	2007	Wheat	**X**			**X**	**X**
Shelford	2007	Wheat	**X**			**X**	**X**
Warrambeen	2007	Wheat	**X**			**X**	**X**

The period of grazing, class of livestock and stocking rate is presented (table 2).

Table 2: Livestock and grazing details of stubble trials (2005 – 2007)

Location	Year	Class of livestock	Stubble type	Grazed area (ha)	No of stock in trial	Stocking rate (hd/ha)	Opening date	Closing date	Grazing days
St Leonards	2005	Mer ewes (off shears)	Barley	31	670	21.6	5-Mar	1-Apr	27
Werneth	2006	2nd X ewes	Barley	5.3	110	20.8	6-Feb	20-Mar	42
Werneth	2006	2nd X ewes	Barley	5.4	120	22.2	6-Feb	20-Mar	42
St Leonards	2007	Mer hoggets (off shears)	Wheat	10.3	109	10.6	11-Jan	25-Jan	14
St Leonards	2007	Mer hoggets (off shears)	Wheat	9.7	103	10.6	11-Jan	25-Jan	14
Inverleigh	2007	Mer wethers	Wheat	20	300	15.0	23-Jan	13-Feb	21
Shelford	2007	Mer ewe (off shears)	Wheat	14.6	76	5.2	24-Jan	14-Feb	21
Warrambeen	2007	Mer hoggets (off shears)	Wheat	31.5	155	4.9	9-Jan	12-Feb	34

Observations
A stubble commonly consists of four components. These are:

- Standing straw
- Loose trash (on the ground)
- Residual grain, either in heads or as individual grains
- Green material, either as volunteer weeds or as shot grain

The quantity of each component will vary from paddock to paddock for many reasons including the type of crop, canopy management, harvesting efficiency and weed control.

Quantity of stubble
The average stubble at the start of grazing was 5.0 t/ha (range2.1 t./ha to 8.7 t/ha). The standing straw and trash contributed to 98% of the total stubble load. Residual grain and green material accounted for only 2% of the total stubble in all but exceptional circumstances (significant shot grain that remained ungrazed for 30 days).

At the completion of grazing, the total stubble mass had declined by one third to 3.4t/ha (reduction of between 19% and 50%). As expected the green and grain components were the first consumed by the grazing animal. Grazing also altered the proportion of standing straw compared to stubble trash during the grazing period. While the total amount of stubble declined over time, there was a decrease in standing straw and an increase in trash or fallen straw (figure 1).

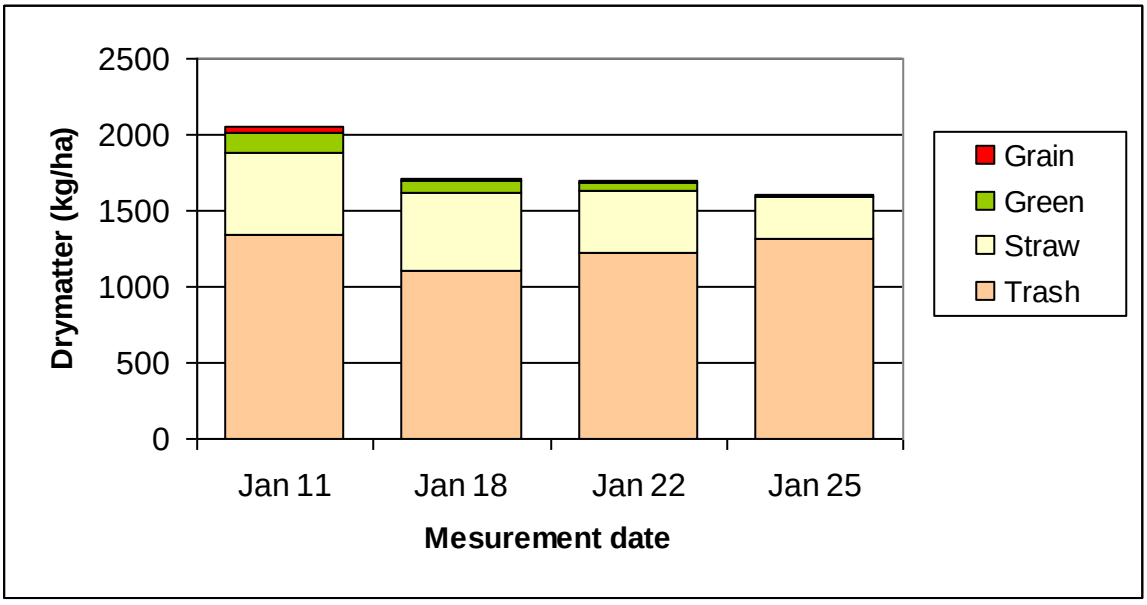

Figure 1: Decline in total stubble mass and change in stubble components (St Leonards, 2007)

Stubble reduction and grazing intensity
The reduction in stubble mass appears to be influenced by the stocking rate and duration of grazing. The total number of grazing days (stocking rate x duration) was compared to the percentage reduction in stubble load (figure 2).

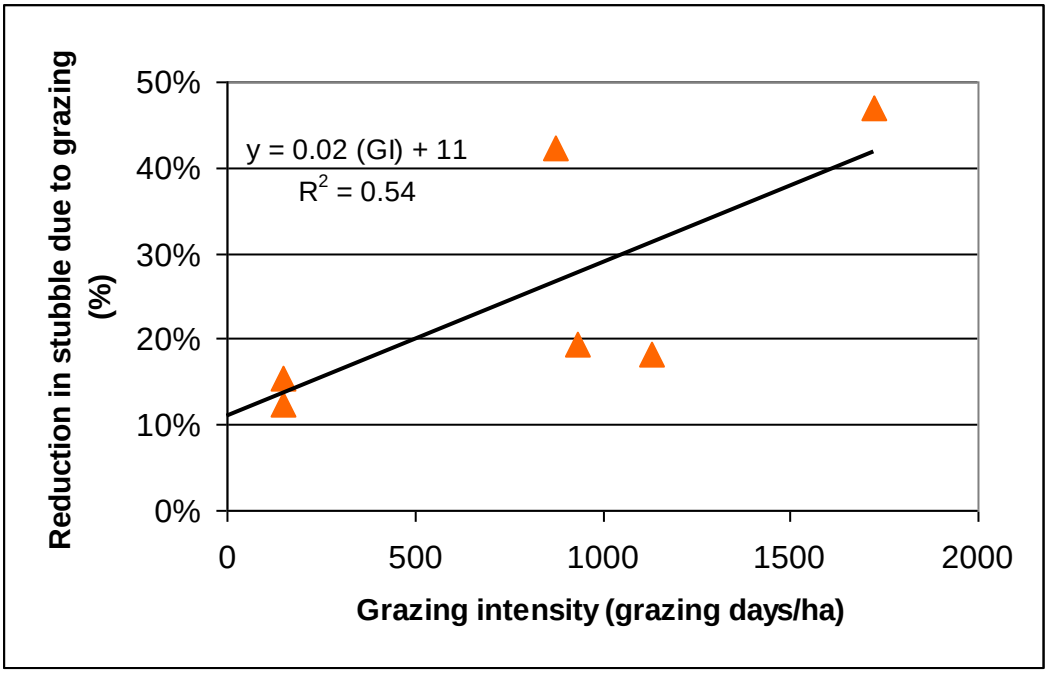

Figure 2: Reduction in total stubble mass compared to grazing days per hectare

As expected the increase in number of grazing days resulted in a reduction in the amount of stubble present. Continuation of grazing may have resulted in a further reduction in stubble present, but this would have resulted in liveweight loss (unless supplementary feeding was introduced).

Part of the decline in stubble mass can be attributed to grazing, either through direct consumption of the dry material or by trampling and crushing of the dry material. However part of the stubble decline may also be attributed to the natural breakdown of plant material, even without grazing. Figure 2 would also indicate a nature decline in stubble mass over a two month period of 11% (where the line intersects with the y axis).

Stubble quality

The four stubble components varied in quality. The grain provided the highest quality feed followed by the green materials (either weeds or shot grain). The standing straw and lose trash was of very low quality (table 3).

Table 3: Average digestibility, energy and protein of different stubble components during the grazing period

Quality parameter	Stubble component			
	Grain	Green	Standing straw	Lose trash
Digestibility (DMD %)	82.4	72.9	39.8	40.9
Metabolisable energy (MJ ME/kg)	12.7	11.0	5.3	5.2
Protein (%)	11.3	18.7	2.8	4.0

Livestock performance on grazed stubbles

The quality and quantity of the feed influence the amount of pasture an animal will eat. When there is sufficient **quantity** of pasture, an animal will eat to its maximum. However as the quantity of feed declines, an animal cannot 'harvest' enough to completely fill its stomach (as animals only graze for a maximum of 11to 12 hours in any 24 hour period).

The **quality** of the pasture is equally important in influencing animal intake. An animal will only continue eating if there is space in their stomach to store the extra feed. High quality feeds are digested more rapidly in the stomach of the animal than low quality feeds. This means the stomach is emptied more quickly allowing more feed to be eaten.

It is the ***combination*** of feed quantity and feed quality that **influence** intake and subsequently animal performance. Abundant high quality feed will maximise intake, whereas either limited amounts of high quality feed or large qualities of low quality feed will reduce intake.

Once the animal has feed in its stomach, it extracts energy (amongst other things). By definition high quality feeds have greater concentrations of energy per amount of feed consumed. Therefore an animal offered a large amount of high quality feed leads to high intake of a highly concentrated product. This 'multiplier effect' can mean dramatic differences in available energy (figure 3).

		Quantity of feed of offer	
		High	**Low**
Quality of feed on offer	**High**	**High intake** – can harvest a lot of feed and it passes through the stomach quickly allowing more to be eaten. The greater concentration of energy in the feed means the animal can extract more 'goodness'	**Restricted intake** – can't harvest enough feed, so the stomach is never full but the high quality of the feed may be sufficient for growth.
	Low	**Restricted intake** – can harvest a lot of feed but can't pass it through the stomach quickly, so the animal is prevented in eating more until the stomach begins to empty. At low quality, the 'goodness' in the feed is also less	**Low intake** – the animal cannot harvest very much feed and what it eats takes along time to pass out of the stomach. At low quality, the 'goodness' in the feed is also less

Figure 3: Interaction of feed quantity and quality on intake and performance

A stubble typically has large quantities of low quality feed (standing straw and trash) and reduced quantities of high quality feed (green and grain) (figure 4).

		Quantity of feed of offer	
		High	**Low**
Quality of feed on offer	**High**		
	Low		

Figure 4: Feed quantity and quality of a typical stubble
The high quality feed, although not abundant, can often provide enough quantity to enable growth (weight gain) to occur. However once the high quality component is reduced, weight loss occurs. It would appear there is only a very short period where animals maintain weight. They are either gaining weight or losing weight on a stubble (figure 5).

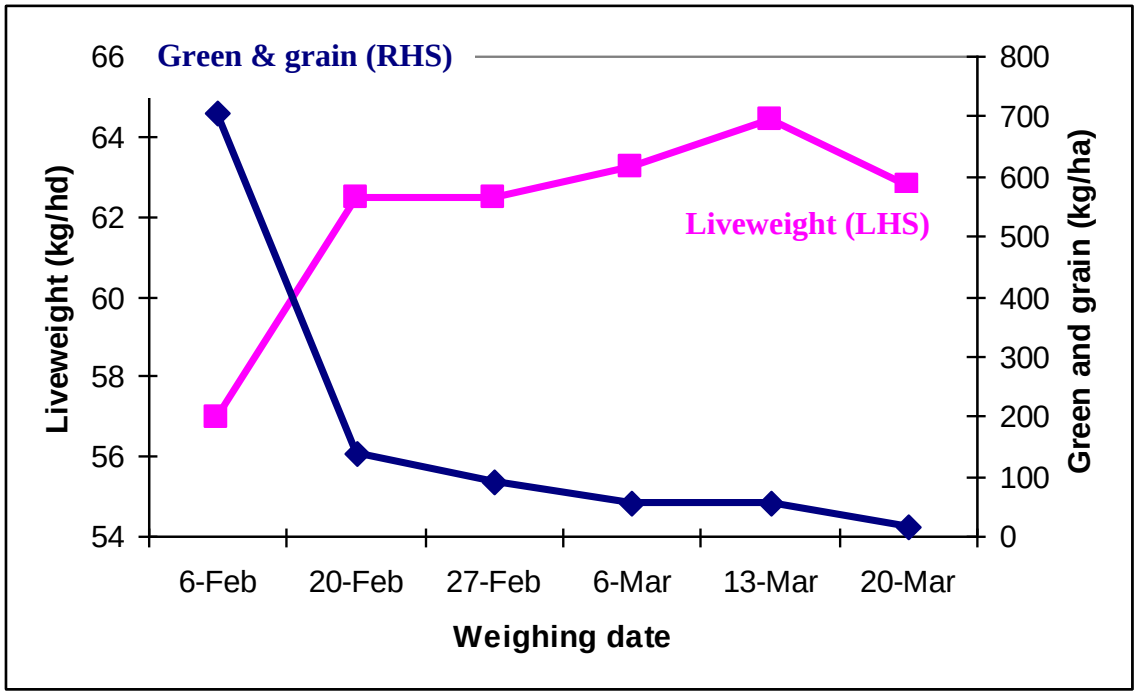

Figure 5: Liveweight change and quantity of high quality feed (Werneth 2006)

The Werneth results clearly show that even at small quantities of high quality feed, animals are able to consume enough to gain weight. However once a certain quantity is reached, liveweight declines.

The same correlation does not hold for the poorer quality components of standing straw and loose trash (figure 6).

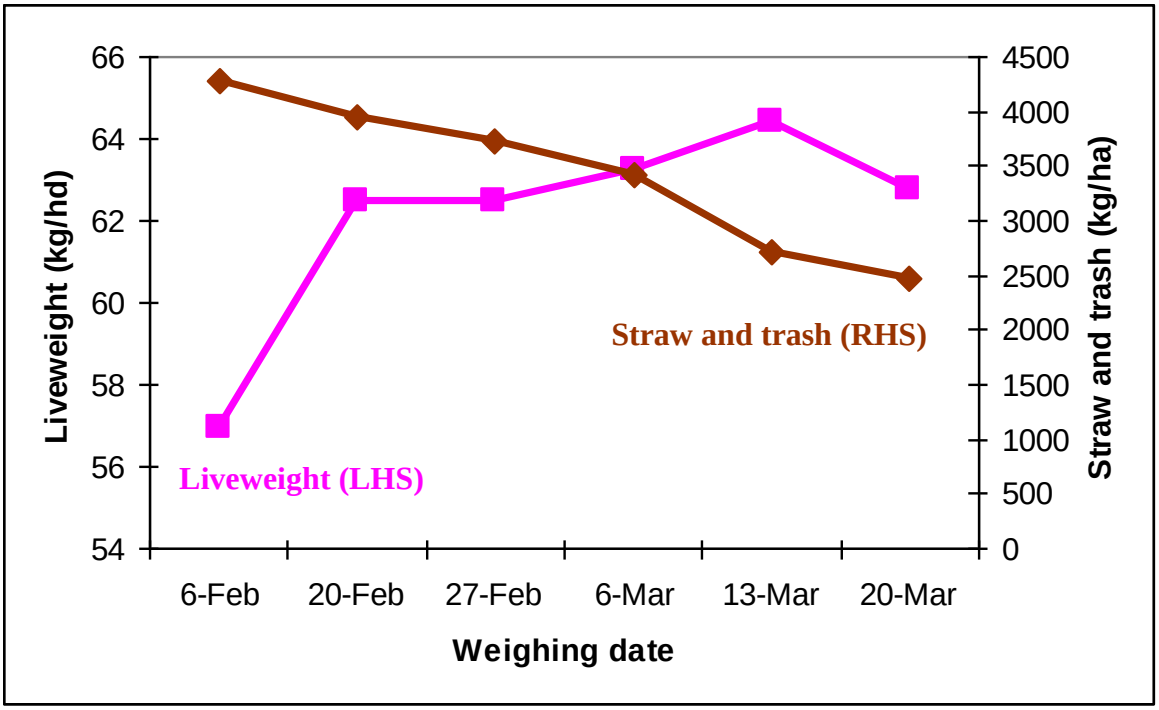

Figure 6: Liveweight change and quantity of low quality feed (Werneth 2006)

The value of grazing stubbles is clearly linked to the quantity of green plant material and remaining grain in the stubble. An assessment of all other trials revealed a similar trend, with rapid weight gain when high quantities of green material and/or grain is available and weight loss below a certain threshold.

This liveweight response can also be shown graphically, where the percent change in liveweight from one weighing period to the next is compared with the average quantity of green and grain available during the corresponding period (figure 7). Four weight brackets calculated as a percent of bodyweight were used to accommodate the different types of livestock used in the trials. A 0.15% daily change in liveweight represents a 75 gm change in liveweight for a 50 kg sheep.

It would appear a threshold exists at approximately 35 kg/ha of grain and 40 kg/ha of green material. When the quantity of **both** grain and green falls below these thresholds, animal lose weight. If one of these two components is exceeded, then animals will gain weight.

There are two results that defy this general statement. In each case the amount of green material is below the suggested threshold but the grain on offer is well above 40kg/ha. In both cases weight loss occurred at the measurement a week to 10 days following significant rain (30+ mm). Observation of the grazing animals in these trials indicated their preference to actively seek out the recently shot grain. It is surmised the change in diet from grain to 'green pick' has created some dietary upset or more likely the stock have actively sought out the green pick at the exclusion of other plant material (Andrew Moore, CSIRO pers comm.). Therefore the weight loss may be a function of insufficient intake of material and loss of gut fill. Once the green material was consumed, weight gain responded postively (figure 8).

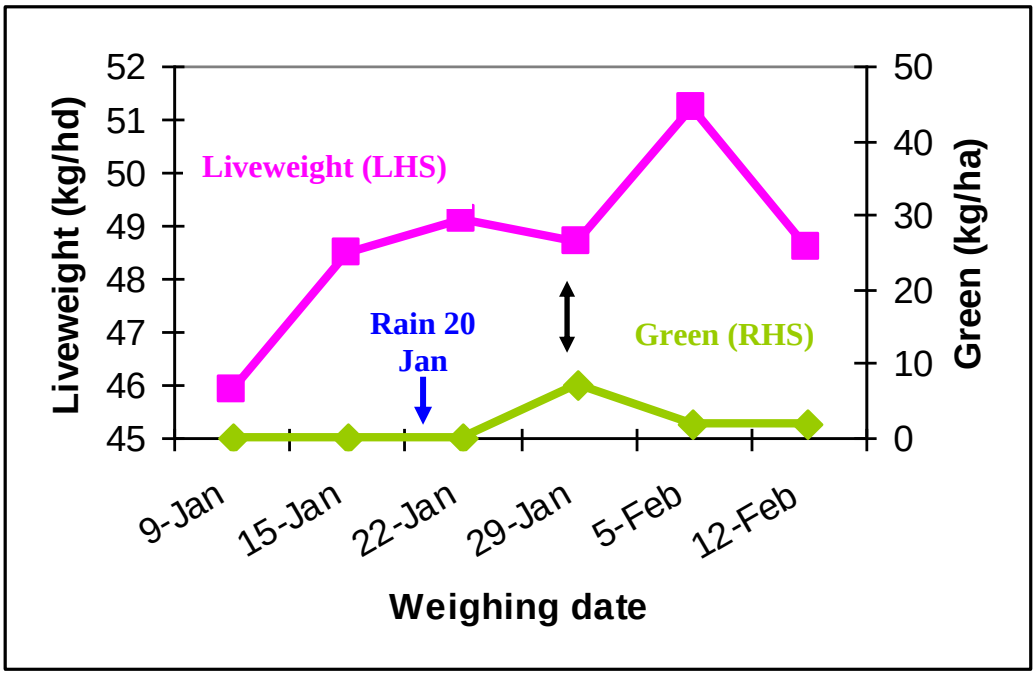

Figure 8: Liveweight change and corresponding availability of green feed (Warrambeen 2007)

References:

SFS 2006 Southern Farming Systems results book

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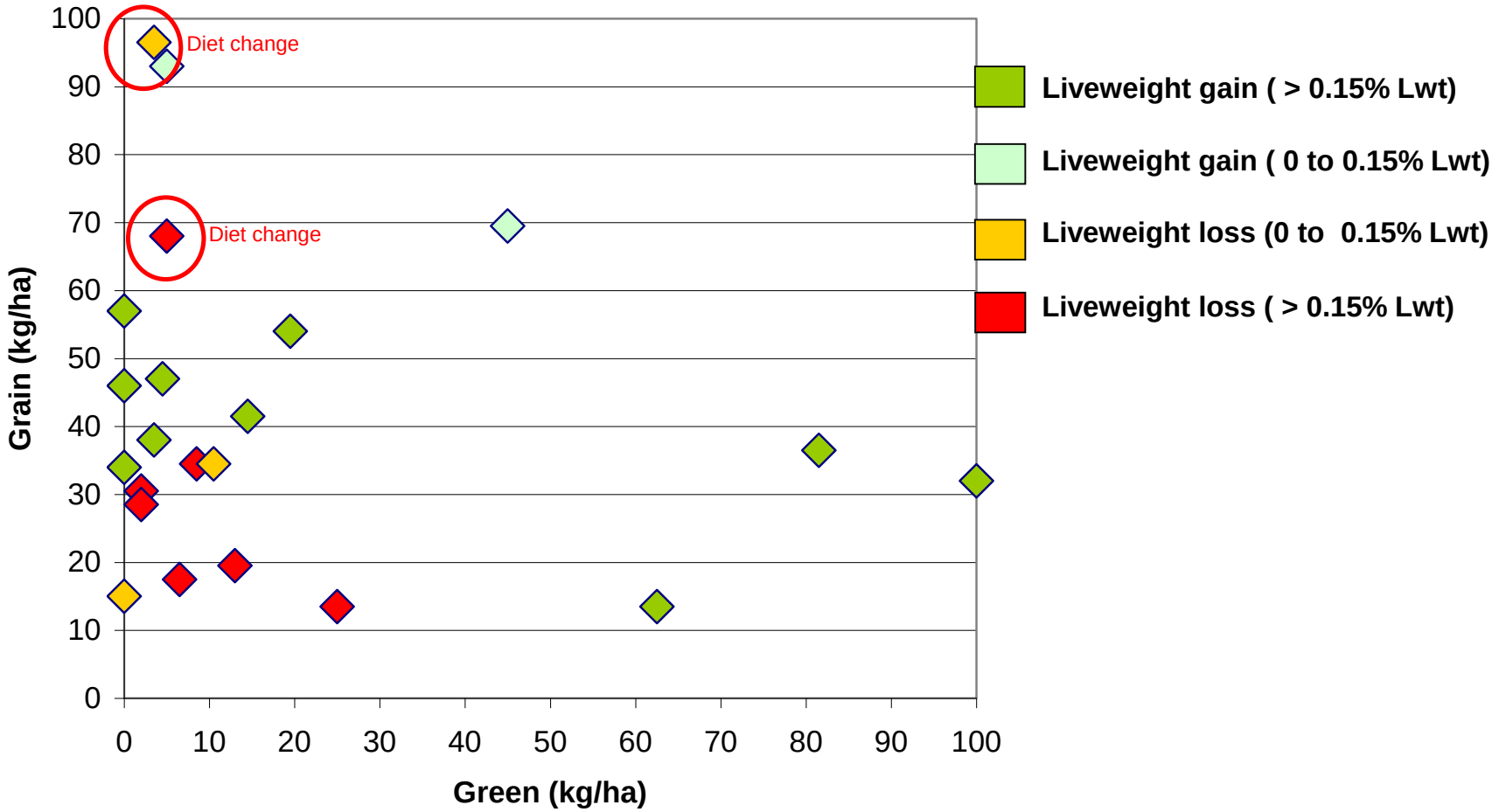

Figure 7: feed on offer (grain and green) and liveweight change (as a %)