PasturePlan™ : On-farm pasture growth and quality data for sheep and beef farms throughout New Zealand

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Abstract

Farmers throughout New Zealand are interested in pasture growth and quality but often this information is hard to obtain for their particular farm environment. The Meat and Wool New Zealand (M&WNZ) PasturePlan™ programme enabled participating farmers to measure growth on their farms and generated a large database across New Zealand. Information from pasture probes, rising plate meters and herbage samples submitted by farmers at regular intervals over a 4-year period was used to build the PasturePlan™ database. Pasture probe and plate data were calibrated by region and season against actual yields. The Q-graze programme was used to estimate pasture quality. There was considerable variation in pasture growth rates and quality between seasons and years within a location and between locations. Farmers easily measured pasture growth and quality on their properties. Other farmers in similar environments can use the PasturePlan™ data to help make feed planning decisions.

Keywords: pasture growth rates, pasture quality, PasturePlan™

Introduction

Increasing intensification by New Zealand sheep and beef farmers will continue to increase the need for accurate feed planning which requires accurate pasture growth rate (PGR) and pasture quality information. To date, farmers and consultants have relied on historical pasture growth rate information from around New Zealand (e.g. Radciffe 1974; Radcliffe & Cossens 1974) which may no longer be relevant to current management systems (e.g. new fertiliser regimes or new pasture species). Research organisations and seed companies are now including pasture growth rates of various new cultivars or different farm management practices as part of promotions to sheep and beef farmers. Many of these trials have been carried out in research centres or areas far removed from actual farm environments. These sources contain little data on the within farm variation in PGR due to management (e.g. pasture renewal) or spatial differences (e.g. east vs. west slopes). For farmers to be able to use information on pasture growth rates, they need to be able to access data relevant to their own property.

Farmers and consultants currently determine pasture mass and calculate pasture growth rates through visual estimates, pasture probes, rising plate meters or sward sticks. The accuracy of all methods relies on appropriate calibration, and with the pasture probes and plate meters calibration equations for each season are required. The collection of actual PGR and pasture composition information provides the opportunity to improve calibration equations for more robust equations for use on sheep and beef pastures.

The objective of the PasturePlan™ project was to develop calibration curves developed from accurate pasture growth rate data measured with soil moisture and temperatures on farms throughout New Zealand under different management and environmental conditions. In this paper, we describe PasturePlan™ and demonstrate the breadth of the pasture production data from the PasturePlan™ database using results from two farms in contrasting climate zones.

Method

Pasture data were collected by individual sheep and beef farmers from May 2002 to November 2006 on a total of 80 farms. The farms were selected from within each of eight geographical regions to cover the full range of farm classes and environments – Southland, Otago, Canterbury, North Canterbury-Nelson-Marlborough, Southern North Island, North Island East Coast, Central – Northern North Island, and Chatham Islands (2006 only).

Farmers selected at least two contrasting sites on their own property. These sites were selected to provide useful information to assist on-farm management decisions. The comparisons between sites differed on every farm and included spatial comparison (e.g. north vs. south) through to management impacts for example old pasture (greater than 5 years old) versus new (up to 3 years old), irrigated versus dry, different seed mixes. A full paddock description and history was collated prior to commencement of measurements, which included soil type, soil fertility, paddock contour, rainfall, altitude, stock mix, species sown, aspect, pasture age, and irrigation.

Pasture growth rates were determined twice monthly over the pasture growing seasons from May 2002 to October 2005, then monthly from November 2005 to November 2006. During periods of very slow growth

(less than 10 kg/ha/day due to winter or moisture stress) growth rates were determined at longer intervals. Two pairs of two cages (exclusion areas) were used in each paddock. The pasture within their confines was trimmed to typical grazing height (approximately 30 mm), one cage pair at the start of the month, the second pair in the middle of the month (only one pair per month from November 2005 onwards). Cages were harvested after one month's growth and then a new area was trimmed back to grazing height. The area sampled was a rotary mower width (recorded for each property) by approximately 2 m (actual length recorded each time). Herbage harvested was weighed immediately (wet weight) and a sub-sample of approximately 100 g was couriered in a sealed plastic bag to AgResearch for determination of dry matter (oven dried at 80°C for 24 h). Pasture composition (percentage of dry matter of legume, green leaf, green stem, dead, and weeds) was determined from a single sub-sample collected from within the cage area (with hand shears cut to mower height). Prior to and after mowing, each sampling area was measured with a pasture probe and/or the pasture rising plate meter. The data were sent to AgResearch to develop the calibration equations. Pasture growth (kg DM/ha/d) was calculated from the amount of 'regrowth' in this monthly period. Pasture energy contents (mega joules of metabolisable energy per kilogram of dry matter; MJ ME/kg DM) were estimated from composition data using 'Q Graze' (Woodward *et al.* 2000). Soil temperatures were recorded at the time of each sampling on most properties, while soil temperature data loggers (at 10 cm depth) were used to monitor soil temperatures on selected properties from December 2003 to November 2006.

A monthly PasturePlan™ report on pasture growth rates and pasture quality was sent to all participating farmers and distributed more widely through M&WNZ. Seasonal pasture production reports were compiled and sent out quarterly.

Results and Discussion

The PasturePlan™ monthly report provided participating farmers with a monthly summary for each paddock and for other properties in their region of:

1. PGR (kgDM/ha/day)
2. Pasture composition and estimated ME (MJ ME/kg DM) which showed the changes in quality over time.
3. Monthly rainfall and fertiliser application.

The probe calibrations developed for different regions and soil moisture were:

South Island West Coast

$G=0.538 \times A - 297$ ($R^2 = 0.74$)

South Island East Coast

$G=0.333 \times A + 55$ ($R^2 = 0.39$)

North Island West Coast

$G=0.410 \times A - 44$ ($R^2 = 0.55$)

North Island East Coast

$G=0.362 \times A + 40$ ($R^2 = 0.45$)

where: G is the actual growth mass (kg DM/ha)

A is the estimated probe growth mass (kg DM/ha). **A** is the difference between the start and end probe readings

The plate calibration equation was:

$G=129 \times B + 294$

where: G is the actual growth mass (kg DM/ha)

B is the change in plate height (cm), i.e. B is the difference between the start and end plate height readings

Important: The calibration equations have been derived for specific makes of probe and plate. They are the TruTest GrassMaster II probe and the FarmTracker Electronic Plate (which measures height in 0.5 cm units).

The wider farming community received this information via M&WNZ Regional Managers and their website (www.meatandwoolnz.com). The project objective was to provide PGR information to farmers that highlighted variability between the areas selected for comparison on each farm.

The type of results collated for individual farmers and the wider community are presented for a North Island (Dannevirke) sheep and beef property and a South Island (South Canterbury) sheep breeding and finishing property (Table 1). On each of these farms, the contrasting sites were new vs. old pasture species. Table 1 shows a 'pasture quality' report sent to each farmer (summarised to 3-monthly intervals). These reports demonstrated to farmers' variation between new and old pastures and over time within a paddock.

In addition to the monthly reports, annual pasture production reports were supplied in July each year (Figs. 1 & 2). Each graph summarised the annual data for each contrasting site on each farm and demonstrated clearly for the farmer the variation within and between years and due to management options for each paddock.

PasturePlan™ proved to be a reliable way of getting on-farm information about pastures but it was time consuming for farmers. The mowing and pasture collection component of the sampling was the most labour intensive, taking most farmers 15-45 minutes per cage to complete. The pasture mass measuring tools, either a pasture probe (GrassMaster II: Tru Test NZ) or a rising plate meter (Jenquip NZ; Farmworks NZ), were much faster to use. However, it was not always possible to get a good relationship between probe-measured growth and actual harvested growth (see R^2 values above). Possible reasons for this are being investigated as the R^2 values from AgResearch field trials are typically higher. Farmers need to be aware of potential differences in estimates between individual users because of

Table 1 Pasture composition (percentage of dry matter) and estimated energy content (MJ ME/kg DM) for a new pasture and old pasture on South Canterbury or Dannevirke farms.

Date	Green leaf %	Green Stem %	Dead %	Clover %	Weeds %	Estimated ME MJ ME/kg DM
South Canterbury – New Pasture						
Oct-03	58	26	5	11	0	10.7
Jan-04	38	19	14	29	0	9.6
Apr-04	48	6	5	41	0	11.0
Jul-04	76	5	8	9	2	11.1
Oct-04	53	1	0	46	0	11.6
Jan-05	61	12	0	19	8	10.8
Apr-05	79	0	11	10	0	10.6
Jun-05	77	0	1	21	1	11.6
South Canterbury – Old Pasture						
Sep-03	85	0	2	11	2	11.4
Jan-04	72	11	7	6	4	10.0
Apr-04	89	0	3	5	3	10.9
Jul-04	92	2	4	0	2	11.3
Oct-04	87	0	3	3	7	11.2
Jan-05	82	9	1	8	0	10.6
Apr-05	62	0	5	33	0	11.2
Jun-05	98	0	0	2	0	11.6
Dannevirke – New Pasture						
Aug-03	95	1	3	1	0	11.3
Oct-03	92	0	1	7	0	11.2
Jan-04	38	11	0	51	0	10.8
Apr-04	74	0	1	25	0	11.2
Jul-04	93	1	6	0	0	11.1
Oct-04	88	0	1	11	0	11.4
Jan-05	65	14	0	19	2	10.7
Apr-05	89	0	0	11	0	10.8
Jun-05	96	0	0	4	0	11.5
Dannevirke – Old Pasture						
Aug-03	92	2	5	1	0	11.3
Oct-03	83	0	3	14	0	11.2
Jan-04	71	9	2	18	0	10.3
Apr-04	86	0	2	12	0	11.0
Jul-04	95	2	3	0	0	11.1
Oct-04	79	5	0	16	0	11.2
Jan-05	61	17	0	22	0	10.6
Apr-05	92	0	0	8	0	10.6
Jun-05	99	0	0	1	0	11.3

differences in the amount of pressure and the angle of placement exerted on the rising plate meter. The probe results can also differ between operators over the same strip of pasture, leading to differences in estimates of PGR between operators. Extremes in herbage moisture conditions can also cause challenges with the pasture probe. For this project all farmers were sent a protocol for use of the pasture probe. This included having the probe set at a slow walking pace for more accurate readings and the importance of placing the probe and plate into the pasture at a 90 degree angle.

Herbage dissection samples sent from throughout the country arrived at the AgResearch lab in excellent condition. To achieve this, farmers extracted all the air out of the sample in the plastic bag and sealed it. Even samples taking a week to arrive from the Chatham Islands were received in good condition.

The duration of this project has produced a solid set of data enabling farmers to develop a clear understanding of how PGR and quality change with time, location and management input. For example, some participating farmers collected pasture data from two paddocks over the whole 4 years of the project, resulting in a good understanding of long-term paddock performance. The data collected showed farmers the variation in pasture growth within and over the different seasons and provided an opportunity to make early decisions on feed shortages or excesses.

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Figure 1 Pasture growth rate (kg DM/ha) measured bi-monthly from June 2003 to June 2004 for old (annual 8580 kgDM/ha) and new (annual 8760 kgDM/ha) pasture on a South Canterbury farm.

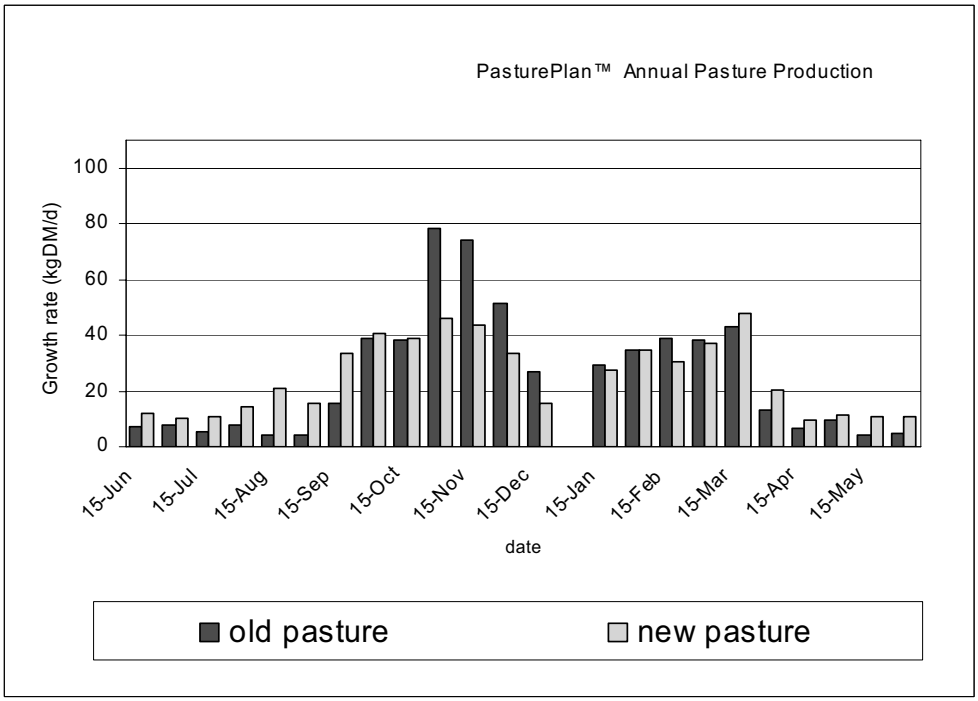
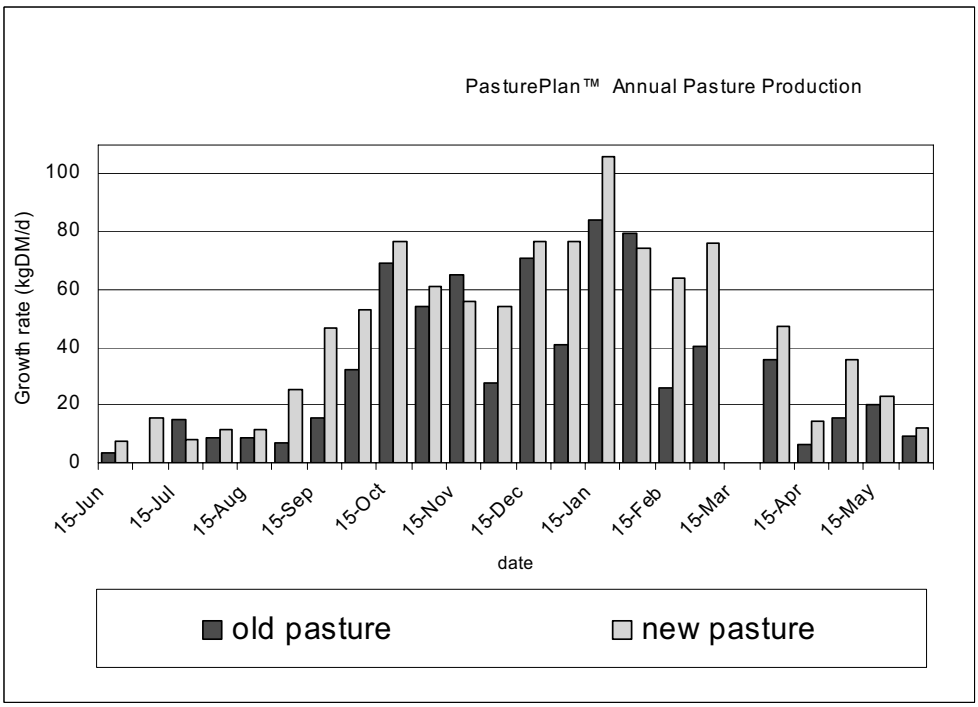


Figure 2 Pasture growth rate (kg DM/ha) measured bi-monthly from June 2004 to June 2005 for old (annual 11 277 kg DM/ha) and new (annual 16 165 kg DM/ha) pasture on a South Canterbury farm.



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