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Intensive sheep and beef production from pasture — A New Zealand perspective of concerns, opportunities and challenges

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ABSTRACT

This paper details current production trends for sheep and beef cattle production in New Zealand and gives some insight into the opportunities for improvement based on New Zealand research at Massey University. Further it outlines some of the challenges the industries face in the near future. The New Zealand climate favours pasture growth and this is the key to sheep and beef cattle production with over 95% of the diet being grazed pasture or crop. Exports are the focus of the industry with 95% of sheep meat and wool, and 80% of beef exported. There have been considerable gains in production over the last 20 years but there still remains a huge opportunity for further intensification through breeding sheep at an earlier age, increasing the weight of lambs weaned per ewe per year and improving beef production systems. These improvements need to occur within a framework of minimal environmental footprint and produce products that are in demand in the high end international markets.

1. Introduction

Pastures are the mainstay of the New Zealand economy with around 55% of the total annual export earnings generated by the livestock industries in the year ending 30 September 2013 (Beef & Lamb New Zealand, 2014). The New Zealand climate favours pasture growth and hence grazed pasture and forage crops supply in excess of 95% of the livestock diet on New Zealand farms (Hodgson et al., 2005). It is this efficient, sustainable and relatively low cost system that allows New Zealand to compete globally as a major exporter of food and fibre. Today sheep and beef cattle production are the dominant land uses in terms of land area, utilising 66% or 9.7 million ha of New Zealand's agriculture and forestry land (Ministry for Primary Industries, 2012) and forms the basis of the traditional visual and social landscape of New Zealand.

The sheep and beef sectors have a strong export focus with 80% of beef, 95% of sheep meat, and 90% of wool exported (Morris, 2013). In the year ending 30 September 2013 New Zealand produced an estimated 628,000 tonnes of beef, 488,000 tonnes of sheep meat and 191,000 tonnes of wool (Beef & Lamb New Zealand, 2014). New Zealand is the largest exporter of lamb meat accounting for approximately 47% of the world's trade in lamb (Morris, 2009). The major market for lamb is the European Union taking around 40% of exports by volume in the year ending 30 September 2013. New Zealand has a tariff-free quota of 227,854 tonne carcass weight equivalent for sheep and goat meat imports to the European Union. This quota has been underfilled in recent years as there has been a concerted effort to diversify exports to many countries. Presently the North Asia region (China, Japan, South Korea and Taiwan) accounts for around 32% of export volume up from 24% the previous year (Beef & Lamb NZ, 2014). New Zealand is the third largest producer of wool in the world producing 12% of world production on a "clean" basis. Most of the wool produced (88%) is described as strong crossbred wool (greater than 31 μm) and China is the major market with the proportion of wool exports going to China increasing from 27 to 53% over the last five years. Fine wool (less than 25 μm) accounts for around 10% of production. Thirteen percent of the wool clip originates as slipe wool (that which is removed from pelts after processing of sheep at meat plants).

North America is the dominant export market for beef accounting for 52% of beef exports by volume whilst North Asia (principally China) accounts for 31% of exports (Beef & Lamb NZ, 2014). The dairy cattle industry contributes significantly to beef production with an estimated 35% of the calves entering the beef industry each year being born on dairy farms. It is also estimated that approximately 700,000 dairy cows are the major contributor to the 900,000 adult cows processed for beef each year.

Sheep and beef cattle are usually farmed together in New Zealand and increasingly tend to be located in the steeper hill country often of lower fertility and in many cases in summer dry regions. From a management viewpoint sheep and beef cattle farms are relatively complex with the same pastures having to meet several different feed requirements, including feeding ewes and beef cows, finishing lambs and

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growing cattle for slaughter. Sheep generally graze pasture to a shorter residual height than cattle and hence grazing policies are not consistent throughout the year but rather vary between seasons. For example the same paddock may be set stocked (continuously grazed) during spring, then rotationally or shuffle grazed at other times of the year (Stewart, Kerr, Lissaman, & Rowarth, 2014). Many pastures are permanent especially those in less cultivatable hill country, which is a significant proportion of the total area farmed, as it is presently uneconomic to renew pasture. Of the total area farmed with sheep and beef cattle the annual rate of pasture renewal has been reported to be just 2.3% compared with 8% on dairy cattle farms which are generally on flatter more fertile land (Stewart et al., 2014).

2. Level of performance on New Zealand intensive sheep and beef farms

Agriculture contributed strongly to productivity in the New Zealand economy during the period 1978 to 2011 where labour productivity increased 3.4% per annum and capital productivity (ratio of output to capital input) increased by 2.2% per annum (Statistics New Zealand, 2013). For multi-factorial productivity (the ratio of output to total inputs, reflecting growth that cannot be attributed to capital and labour, such as technological change or improved knowledge, methods and processes) agriculture increased 2.8% annually (Statistics New Zealand, 2013). Examples of change in practices on New Zealand sheep and beef farms that has helped lead to these gains include implementation of pregnancy scanning, body condition scoring, improved lamb survival, and the feeding of triplet-bearing ewes pre-lambing to enhance survival, use of terminal sires, use of crossbreeding and composites in sheep and beef cow herds, selection for improved growth rate in sheep and beef cattle, improved reproductive performance of sheep flocks, breeding at younger ages, introduction of whole herd/flock health plans, once bred heifers(heifers that have calved and are then processed for beef) and bull beef production. Unlike many countries the New Zealand sheep and beef industries have not utilised the reproductive technologies such as AI and ET due to the extensive nature of sheep and beef cattle farming in New Zealand and the cost of these technologies. Changes have occurred also in the genetic makeup of the flocks and herds through importation of new breeds (sheep and cattle) to meet industry demand (improved growth and meat production in cattle and sheep and improved reproduction in sheep). These imported sheep and cattle breeds have then been crossed with the established breeds to obtain the desired traits and animals that are productive in the New Zealand environment. Many composite breeds have been developed and stabilised (i.e. Landcorp Supreme).

The total production of the sheep meat and wool industries have been maintained despite a dramatic decline in livestock numbers (Table 1) due to an impressive increase in per animal production. Mackay, Rhodes, Power, and Wedderburn (2011) note there has been little change in animal stocking rates in the last 20 years but a dramatic lift in livestock performance with an increase in sheep meat production of 72% on hard hill country farms since 1989/90. There has been a 23% increase in lambing percentage from 98% in 1987 to 121% in 2013 and average carcass weights for lambs have increased from 14 kg to 18 kg. Bray (2004) estimates that this increase in carcass weight equates to a 50 g a day improvement in lamb growth rate without changes in stocking rate and little change in the slaughter pattern. Presently lambing percentages range from 92% (lambs tailed/100 ewes mated) on high country to 130% on intensive finishing country (Table 2). The potential under more intense management on improved land could be vastly greater as many farmers are already achieving lambing percentages greater than 150%.

Table 1
Total livestock numbers in New Zealand 1985, 1995, 2005 and 2013.

	1985	1995	2005	2013
Sheep	67,854	48,816	44,002	30,943
Dairy cattle	3308	4090	4494	6441
Beef cattle	4613	5183	4787	3686
Deer	320	1179	1800	1090
Goats	427	256	175	160

Source: (Beef & Lamb NZ, 2014).

2.1. What is the potential in the future

The New Zealand Government has a "Growth Agenda" to improve the income and wealth for New Zealanders. This is to be achieved by increasing the ratio of exports to GDP from the current 30% to 40% by 2025 (New Zealand Government, 2012). For the agricultural sector economic growth is linked to export markets. A significant proportion of export growth in last decade has been from Agriculture and it is likely to be the key to enhanced growth (New Zealand Government, 2012). Research indicates considerably higher levels of animal production are possible. For example farmlet experiments at Massey University indicate that over 720 kg lamb carcass weight per ha/year is possible on plantain, red and white clover mixed pastures compared to 400 kg/ha on the traditional ryegrass/white clover mix pasture (Kemp, Kenyon, & Morris, 2010). Earlier research indicated 1000 kg beef carcass weight per hectare is possible with Friesian bulls (Cosgrove, Clark, & Lambert, 2003) although McRae (2003) suggests 500–600 kg beef/ha is the likely average performance level. Three potential areas that livestock performance could be increased dramatically that have been researched by our group at Massey University and others in New Zealand are outlined below in Sections 3, 4 and 5.

3. Breeding ewe lambs successfully

Advantages from breeding ewe lambs (8 to 9 months of age at breeding) include: improved utilisation of additional herbage in spring through extra demand, an increase in total number of lambs born per farm per year, a selection tool for ewe replacements, increased selection pressure for replacements as more lambs are born and a reduction in greenhouse gas emissions per unit of product produced. In addition breeding ewe lambs can increase profitability (Young, Thompson, & Kennedy, 2010) and lifetime reproductive performance (Kenyon, van der Linden, West, & Morris, 2011). Traditionally only 25 to 30% of ewe lambs are bred on New Zealand farms with the remainder bred for the first time at 17 to 19 months of age. The potential advantages of ewe lamb breeding have driven many farmers to consider a change to this management system. Whilst the lambing percentage of ewe lambs is often only half of that achieved by the mature ewe flock, considerable variation exists indicating ewe lambs are capable of achieving weaning percentages greater than 100% on a flock basis (Kenyon, Pinchback, Perkins, Morris, & West, 2004; Kenyon, Thompson, & Morris, 2014; Mulvaney et al., 2013). An additional issue with ewe lamb breeding is that the weight of lambs weaned and lamb survival can be lower in lambs born to ewe lambs compared to mature ewes (Corner et al., 2013; Kenyon, Thompson, & Morris, 2014). To achieve high performance levels with ewe lamb breeding an integrated management approach is needed and involves appropriate management from when the ewe lamb herself is weaned until she is re-bred at 18 to 19 months of age (Kenyon, 2012; Kenyon, Thompson, & Morris, 2014). If ewe lambs are not managed appropriately not only will their performance be disappointing in that year it will be poor the following year and lifetime performance can be negatively affected (Kenyon, Thompson, & Morris, 2014). However, if managed well, lifetime performance can be increased (Dyrmundsson, 1973; Kenyon, van der Linden, West, & Morris, 2011).

Our group has developed management guidelines for New Zealand farmers to enable them to achieve high performance levels with their ewe lambs. Prior to breeding ewe lambs should be exposed to vasectomised rams for 17 days (Cave, Kenyon, & Morris, 2012;