'Art and science' – producing high quality forage-based feed for intensive dairy production

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Abstract. *Dairy cows of today need a high performance ration to meet the rigours of high production, reproduction and health. High quality pasture is finding a different role to what was traditionally seen, with changes required persistently to fit a fine balance of meeting the cow's nutrient requirements effectively, economically and in an environmentally sustainable way.*

Introduction

'Emmie-R Farms' is a 300 cow dairy operation producing around three million litres of milk per annum. The farm consists of 134 ha of land area purchased in December 2004. The property at that time was used as a mixed farming operation with no pasture improvement and minimal fertiliser inputs.

The farm has been transformed into a high-input/high-output dairy operation where home-grown forages drive the profitability and production output of this system. High quality pastures form the base to the ration for a high production dairy herd. This grass-base is balanced by corn silage, cereal grains, protein meals, pasture silage and straw.

Background

Jamie was born and bred on the family farm. Jamie studied at the University of New England where he completed a Bachelor of Science degree, majoring in Chemistry and Bio-Chemistry. He also completed a post-graduate year in Animal Nutrition and Agriculture and Resource Economics. In 1996, Jamie returned to the family farm where he purchased cattle, leased a neighbouring farm and formed a partnership with his parents. Over nine years, herd numbers and farm area were expanded to milk 180 cows on 105 ha.

This farm on the North Coast, near Taree, was on the lower Manning floodplain with an average annual rainfall of around 1,000 mm. This rainfall was traditionally summer-dominant but during the late 1990s to the time of moving farms, the rainfall pattern tended towards drier summers and wet autumn/winter periods along with rainfall becoming far more sporadic. With increases in stocking rate, production and variability of feed due to rainfall variability, a move was made towards more supplementation along with continued use of high quality ryegrass/clover pastures. This system was developed extensively during the period of Jamie's involvement with the operation at Taree.

The move

Jamie's father was ready to retire, so in 2005, a sheep and irrigation property was purchased at Tamworth for conversion to a dairy. Consequently, the family farm at Taree was sold and Jamie and Michelle Drury started a new adventure on the other side of the ranges.

The dairy facilities consist of a double 15 Boumatic Grandprix Rapid Exit Parallel Parlour and a 300 cow feed-pad with self-locking head locks. The existing shearing shed has been converted for calf rearing facilities.

The irrigation is made up of two Valley centre pivots covering 66 ha plus side roll and hand shift irrigation. A two-pond effluent system treats waste from the dairy facility with treated effluent being injected into pivots along with 'fertigation'.

Currently the feed mixing/conservation areas are being developed with the mixing area. Four 1500 tonne silage pits are being completed together with new hay sheds and commodities storage are being constructed over the next 12 to 18 months.

Cow production

The rolling herd average of 10,500 L of milk at 4.0% fat and 3.3% protein compares favourably to a district average of 7,500 L at 3.7% fat and 3.2% protein. This level of production is achieved by feeding a partial mixed ration of soda wheat, barley malt combings, corn silage, barley straw and ryegrass/legume silage. This partial mixed ration is balanced to complement the availability and quality of ryegrass/clover pastures. By balancing this ration correctly, we can increase pasture intake by cows along with overall dry matter (DM) intake to drive production higher.

Pastures and cropping

Pastures are sown from the last week in February starting on the irrigation area so that it can be watered if needed. We aim to complete sowing by mid-April at the latest. Unfortunately, with the lack of rainfall in autumn this year, we have only recently completed our sowing on the dry-land areas.

The pasture mix consists of a tetraploid ryegrass (Feast II, Winter Star II) at 30 kg/ha and annual clovers (Arrowleaf clover, Sardi and Turbo Persian clover, Alexandria burseem clover) at 4 kg/ha. The varieties used in each area are chosen on seeding date, ie. the short rotation varieties are sown in areas that will be cropped in summer with longer rotation varieties sown on the balance of the area.

A pre-plant fertiliser application consists of 300 kg/ha of sulphate of ammonia, 2.5 t/ha lime (every second year) and 50 kg/ha of Granulock 15 at sowing. The pasture is topdressed with urea and effluent-water as needed. Effluent-water is preferred for a number of reasons. Firstly, it is a readily available resource that is a by-product of our farming system. It offers a good balance of nitrogen (N), phosphorus and potassium to our pastures along with improving microbial functions in the soil, and lastly (and most importantly) it is significantly cheaper than any other fertiliser.

We aim to provide between 40 and 50 kg of N/ha between every grazing to achieve maximum yields.

Rotation length varies from 24–28 days in autumn to 40–45 days in winter, and shortens to 14 days in spring.

The short rotation varieties are sprayed out around the last week in September to allow for ground preparation for a corn crop to be planted during the first week in October. The timing of this will vary with soil temperature needing to be at 16°C to sow, but we aim to have the corn sown within 10 days of spraying out the ryegrass. A pre-plant fertiliser application of 300 kg/ha of urea and 300 kg/ha of potash is used along with 125 kg/ha of Granulock 122 at sowing. A further 80 to 100 kg/ha of N is applied during the growing season through the pivots. Sowing in early October allows for a target harvest date of around the end of January. This then allows for approximately three weeks until ryegrass is sown again, giving a total fallow/lay 'off-time' of less than four weeks for the year for the irrigation area.

The dry-land areas are sown to a longer rotation cultivar of tetraploid ryegrass (Feast 2). This year, the late spring/early summer rainfall meant that these pastures continued to grow well into early 2008. Heat and weed infestation reduced the productivity of the pastures with the dry-land area sprayed in January and left fallow ready for direct-drilling in autumn. The same pre-plant fertiliser is used as for the irrigation area with follow up N application dependent upon moisture, but the aim is to be as close to the irrigated area as we can.

Weed control

In our initial year, we had a significant weed burden. In that year we sowed grass-only pastures to give us cheap and effective weed control. The following years have resulted in minimal spray requirements for winter weeds.

When we are grazing, there is a considerable juggling act between fertiliser, irrigation, grazing and weed control. We have found that if we do the first three things very well, then there is little need for sprays to be used for weed control. Most weeds will be grazed and when sufficient nutrients are used to push the pasture along, then the weeds are generally killed out.

The use of summer-cropping has significantly reduced all weeds. Our ryegrass/clover pastures, grown after a corn crop have no weeds to be controlled – this comes about due to the management practice of cutting silage prior to a corn crop early in the season. Any weeds that survive through the winter grazing/fertiliser program are harvested for a silage cut in spring before any seed-set. Paddocks are then sprayed with 'Roundup' and cultivated for corn. A pre-emergent spray of Dual and Atrizine are used for grass and broadleaf weed control in the corn crop. These young weeds have a significant detrimental effect on young corn taking nutrient and water, and consequently affecting the overall yield and quality of our corn silage.

Our principal of weed control is based around the fact that weeds will only grow when there is a lack of competition; hence, we work very hard to make sure they do. This in turn gives us a larger proportion of home-grown feed which drives our profitability.

Pasture and crop production

The greater the amount of pasture DM produced on-farm and the higher the quality of this feed, the greater the profitability we can achieve. This principal is born about by the fact that the higher the quality (in terms of palatability, digestibility, acid and neutral detergent fibres, starch, protein profiles, sugars, fats and amino acids) of our forages all have a significant effect, not only on production but on the other inputs required to balance these forages for the required production level. Purchased feeds are more expensive and less predictable in some cases, and thus reduce the potential profitability. Having said that, we still require certain amounts of grain and commodities to balance the ration for high production levels and cow health and reproduction.

We aim for pasture DM yields, at present, of greater than 35 t DM/ha on our irrigation area with this target increasing to above 40 t DM/ha by the end of 2009. Currently, this is achieved by corn yields of 23–25 t DM/ha and ryegrass yields up around 15 t DM/ha. The increases in overall yield will be achieved by ongoing improvements to soil health and nutrition and increased efficiencies in harvest for our ryegrass.

Currently all ryegrass is grazed by the milking herd. We have found over the last two years that we are starting to have significant compromises between what is agronomically correct for ryegrass defoliation and what cows can physically harvest. We are finding that we need to graze at the two-leaf stage rather than the preferred three-leaf stage for maximum ryegrass yields. We are currently investigating the economics of alternatives such as 'cut-and-carry' for some of this production during winter. Excess feed in spring is conserved as silage, to be fed out in the total mixed ration through summer, and also to balance rations through autumn and winter during any wet periods if we cannot graze.

Repeatability

The pasture component of this system has been repeated at two other farms where our heifers are contract reared. In both these operations, a proportion of the irrigation area has been sown to a semi-permanent pasture mix of Feast II ryegrass, red and white clovers (USA Red red clover, Haifa white clover), chicory and lucerne (WL 925HQ lucerne). The balance of the irrigation areas are sown to a tetraploid ryegrass and annual clovers. Dry-land areas are sown to a similar mix with early paddocks (early March sown) having 10 kg/ha oats included. Excess spring growth is purchased as silage with some hay being made to supplement the heifers in feed-gaps.

One of these properties, 'Wingara', where our in-calf heifers are run, has been contracting our heifers for approximately 18 months. The farm consists of 80 ha – 35 ha irrigation, 35 ha dry-land and the 10 ha balance of laneways and lay-off areas. Last year, the average number of heifers run on this block was between 90–100 550 kg heifers with a peak of 140 in spring. We also cut the entire irrigation area for silage once in spring, and a second cut of hay and silage was taken off the irrigation area in November. A 7 ha block of lucerne is used for hay production only, except for one grazing during winter. This represents a significant increase in the previous enterprise of fattening 30–40 steers on oat-crops!

These systems are based on maximising the inputs available. The climate in Tamworth allows for production of both summer and winter crops. Ryegrass/clover based pastures are selected for winter cropping as they are high production, high quality feed for grazing livestock. We are currently considering/trialling some winter cereals for use on our dry-land area for cutting for silage.

Annual ryegrasses are selected in preference to perennials due to their higher production and hence better water- and nutrient-use efficiency. The cost of re-sowing each year is far out-weighed by the significant increase in production. The other consideration is the low water-use efficiency of ryegrass over the summer period.

Corn has proven to be one of the most water-use efficient crops we can grow. Corn grows a large amount of DM over the summer period and is also a complementary feed for ryegrass pasture or silage.

Ryegrass typically has good energy, with low starch, high protein and high digestibility (and can be low in fibre). Corn silage complements this by being low in protein, good effective fibre with high energy and high starch levels to complement the ryegrass. Both feeds also have similar digestion times which gives an efficiency of nutrient use and hence an increase in production. These two feeds are then balanced by adding some straw (for effective fibre) and cereal grains and protein meals (to increase ration density and balance the nutrient profile) to achieve a balanced ration for high production.

Conclusions

Many farmers do a good job in certain areas of their operation. At 'Emmie-R Farms' we try to extend the boundaries of what can be achieved. We do this by looking at what we do well and trying to do better, along with bringing in expertise to balance what we do so as to achieve the best out of the inputs available to us. The nice thing is that we all have this option available to us.