Priorities for forages for the subtropical Dairy Industry

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Abstract

Climatic limitations to developing high quality and high yielding pastures for dairying in the subtropics are discussed. Priorities identified by farmers were canvassed by the Dairy Research and Development Corporation, responsible for allocating R&D funding, and objectives and priorities of the regional program for the tropics and subtropics are listed. Priorities include: improved yield, quality and grazing persistence of tropical grasses and legumes; and improved persistence of temperate grasses and legumes. Overall goals are to reduce cost of milk production and improve farm gross margins by 20% by the year 2000. This is to be achieved, inter alia, by developing improved winter and summer forages as well as improved livestock and pasture management.

Introduction

On the average dairy farm in the subtropical regions of Australia, production from pastures is low compared with that from other regions. For example, a comprehensive survey covering south-east Queensland in 1986–87 showed that, of a total milk production of 2800 L/cow, only 1900 L/cow came from pastures (Anon. 1988). A subsequent survey in 1990–91 found a substantial increase in production to 3197 L/cow. Available evidence suggests most of this improvement had come from bought-in feed, and at an average stocking rate of less than 1 cow/ha, the forage utilised per ha is relatively low (Anon. 1993). In northern NSW, the situation is similar, with utilised pasture dry matter production of less than 3 t/ha on the average dairy farm (W.J. Fulkerson, unpublished data).

The reasons for the relatively low production are many, including:

- unreliable rainfall, with floods and droughts common;
- lack of water for irrigation, with the source often being unreliable;
- lack of conserved fodder, partly due to the poor quality of the normally seasonal surplus forage (tropical grasses in summer). Over recent years, there has been a substantial increase in silage made from summer crops — lablab, maize, sorghum, soybeans and cowpeas;
- poor persistence of perennial temperate pastures, necessitating yearly sowings of annual ryegrass, which may fail in excessively wet or dry (without irrigation) autumns;
- the marked seasonal growth and relatively low quality of tropical grasses — kikuyu grass (*Pennisetum clandestinum*), setaria (*Setaria sphacelata*), paspalum (*Paspalum dilatatum*) and pangola grass (*Digitaria eriantha*); and
- abundance of pathogens, particularly nematodes, fungi, viruses etc. targeting all crops and pastures.

Notwithstanding, under good management, very high yields of temperate and tropical pastures can be achieved. These can exceed 16 t/ha DM for ryegrass and 15 t/ha DM for kikuyu grass of acceptable quality.

Thus, the northern dairy region of Australia has high pasture production potential, but there are many challenges to overcome.

In 1995, the Dairy Research and Development Corporation (DRDC) divided Australia into 4 dairy regions (Mason 1993) with approximately equal milk production from each region, for the purpose of providing funds for regional research.
and development. These regions were based on climatic and feedbase similarities.

The 4 regions are:
- Subtropical-coastal (northern dairy region) (Queensland and NSW coast to Kempsey);
- Inland irrigation (Goulburn Valley and MIA);
- Temperate high rainfall (Gippsland, western district and Tasmania); and
- Low summer rainfall (WA, SA and the drier parts of the western district)

Solving the problems of the northern dairy region

The Northern Dairy Group (NDG) was set up in 1989 with the objective of attracting more funds for research to solve some of the problems facing the northern dairy region. The region was initially north from Taree on the NSW north coast, but with the recent development of a strategic plan for the NSW Dairy Industry (the Hayes Report, commissioned by the DRDC), the southern border was moved north to Kempsey.

The ‘subtropical-coastal’ region is characterised by a subtropical climate and, as a consequence, C₄ summer grasses grow prolifically, whereas temperate pastures, particularly rye-grass, lack persistence.

In 1989 and 1990, the farmer organisations in both Queensland and NSW canvassed dairy farmers for research priorities. The areas identified were those where knowledge was not available. The research priorities, as they relate to forage improvement, are listed below:

<table>
<thead>
<tr>
<th>NSW</th>
<th>Queensland</th>
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<tr>
<td>Developing subtropical pastures</td>
<td>Year-round pasture production</td>
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<td>Nitrogen-fixing grasses</td>
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<td>Nutritional factors affecting (cattle) fertility</td>
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<td>Adapting temperate perennials to the subtropics</td>
<td>Prevention of bloat</td>
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<tr>
<td>Control of parramatta grass (<em>Sporobolus africanus</em>)</td>
<td>Pasture-based feeding systems</td>
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Problems which were amenable to immediate research effort (in terms of definable research hypothesis and available resources) were developed and scientists encouraged to submit proposals.

At this stage, the role of the NDG was to conduct surveys to identify farmers’ needs in research and extension, develop these ‘needs’ into achievable research objectives and encourage scientists to submit proposals in these areas. These proposals were then submitted to the DRDC without any effort being made to rank or reject proposals.

In 1993, the NDG, under the auspices of the DRDC, organised a very successful workshop on feed management, with participation from key farmers, processors, scientists and extension workers, again to try to define research and extension priorities specifically related to the feedbase for dairy cattle in the subtropics (Ternouth 1993). The priority areas relating to ‘forage improvement’ identified at the workshop were:

A. _Summer crops and pasture production_

- Select improved pasture and crop legumes for quality and seasonal growth characteristics, these to include grazing-tolerant pasture legumes (including lucerne), annual legume crops, suitable legumes for dryland farms, shrub legumes and suitable legumes for irrigation.
- Improve the management of pastures and crops for optimum yield and quality (including the efficiency of fertiliser use, grazing management and improved water use in terms of both irrigation and stored moisture).
- Select and breed grasses for improved digestibility and disease resistance (including the control of the kikuyu yellows disease).
- Increase the utilisation of quality summer forages through grazing management, conservation and strategic use of supplements to balance nutrients.
- Develop summer feeding systems to increase milk protein.
- Optimise production of summer forage and summer-grown crops, including legumes, for feeding back in the winter and spring as conserved fodder.
- Manipulate the utilisation of high fibre diets by the use of rumen additives.
B. Winter crops and pasture production

- Select and breed a wider range of more suitable species for the (subtropical) environment. The characteristics sought in ryegrass and winter legumes (clovers, lucerne) include: persistence; deep rooting; more efficient water use; disease resistance; heat tolerance; reduced night respiration; high soluble carbohydrate; and lower rumen-degradable protein levels. A wider range of dryland forages was considered desirable, including: more productive species; more legumes to replace N fertilisers (lupin, field pea, vetch, Shaftal clover); and chicory and brassicas.
- Work on water harvesting and the efficient use of irrigation through better irrigation systems and management. This work should include the effects (of irrigation) on salination, leaching, drainage, compaction, pugging, acidification and the possible use of brackish water for irrigating salt-tolerant species.
- Assess the economics and applicability of present fertiliser, water and grazing management for the existing winter forages.
- Develop an understanding of the behaviour of temperate species in the subtropics, particularly white clover, as an aid to further selection and improved management.
- Determine how to use concentrates, grazing management and conservation to make maximum, efficient use of winter pastures, taking into account substitution effects and the influence of increased stocking rates.
- Undertake research to find new forages and new management techniques to fill the autumn and early spring feed gaps.
- Undertake research to determine sustainability of farming practices, for example, legume-based farming vs. heavy use of N fertiliser; zero tillage; and agroforestry.

In 1995, the NDG, in consultation with the DRDC, commenced plans to develop a regional RD and E program based on the Meat Research Council’s key program concept. In effect, the NDG became the DRDC’s managing agent for the northern dairy region’s regional program.

Although the boundaries of responsibility between the NDG and DRDC are still being defined, the approach is new and exciting and has the potential to deliver much to farmers in the north.

Program objectives and priorities

The NDG regional program is very much driven by farmer needs for solutions to problems of regional interest. This program is based on research and extension priorities set by farmers through state-wide surveys in NSW and Queensland, the Feedbase 2001 Workshop and, more recently, a reference group project conducted in all 7 subregions of the northern dairy region. The goals for the overall program and the goals and priority areas for the ‘Forage Improvement’ subprogram, were developed from this and are outlined below.

Overall program goals

- To increase the competitiveness of the northern Dairy Industry by reducing the average cost of milk production in cents per litre by 20% by the year 2000.
- To achieve an average margin over variable costs for all farms of at least $1000 per cow by the year 2000.
- To improve farm gross margin by 20% by the year 2000.
- To ensure the sustainability of dairy farms by the collation, dissemination and implementation of resource management guidelines and practices to all farmers by the year 2000.
- To improve milk quality in line with industry needs.

Goals for the Forage Improvement subprogram

- To achieve, within 5 years, mean milk production under commercial dairy farm conditions in excess of 10 000 L/ha/yr from annual pastures and crops.
- To improve the persistence of temperate perennial pasture species to achieve an average milk production of 8000 L/ha/yr over a 4-year life-span of the sward.
- To achieve, within 5 years, summer forage options capable of producing an average milk production for all farms in excess of 10 L/cow/d.

Priority areas for the Forage Improvement subprogram

To improve persistence of temperate pasture. This includes improving the persistence of peren-
nial ryegrass or evaluating the potential of alternative species of temperate grasses. Ryegrass has the advantage of an enormous amount of past research into its growth and physiology and also an extensive breeding and selection network around the world. However, ryegrass is a temperate pasture species, and research and selection to adapt plants to the subtropical environment has been very limited.

An additional thrust is to improve the persistence of white clover or introduce alternative legumes like Lotus pedunculatus. Although considerable research work has been undertaken to develop the most appropriate management for white clover, between-season fluctuations in yield are marked, and this is believed to be partly or wholly due to the ebb and flow of pathogens, in particular root knot nematodes, and perhaps fungal infections such as those caused by Rhizoctonia spp., Fusarium spp. etc.

To improve summer pastures. Improving the forage quality of summer grasses such as kikuyu, setaria and pangola grass, as low quality is believed to be a key limitation to their use in the Dairy Industry.

There is a need for persistent legumes such as Pinto peanut (Arachis pintoi) and perhaps species like Vigna parkeri, which are showing some ability to withstand the intense grazing pressure common on dairy farms, while also being productive.

To improve quality and adaptation of fodder. There appear to be only sporadic data available on the best species/varieties of fodder crops for the many diverse microclimates in the northern dairy region. Farmers appear to be seeking more comprehensive data for the whole region.

Goals of other subprograms in the NDG regional program

Feed systems management — To increase milk production per hectare on the milking area by 25% by the optimal use of feed resources by the year 2000.

Resource management — To increase the use of sustainable farming practices by 50% on subtropical dairy farms by the year 2000.

Whole-farm management — To develop decision support tools and management guidelines which allow dairy farmers to examine and adjust their factors of production and improve their management decisions on 50% of all farms by the year 2000.

Human resource management — Firstly, to involve more than 25% of northern dairy farmers in activities designed to increase their self-help capacity in identifying problems and assessing solutions through new information and technology by the year 2000. Secondly, to increase the personal vision, planning and development skills of dairy farmers commensurate with competency-based training over the next 5 years.

Funding

Having agreed on the subprogram goals and priority areas, the DRDC has given a notional grant of $2M over a period of 3 years for the program, with the ‘split’ between subprograms being decided on project merit as determined by the Program Advisory Committee (the 5 technical co-ordinators and the program co-ordinator) and the convenors of the 7 subregional groups within the region (see under management).

The funding arrangements are shown below.

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TAX PAYER $ FOR $  

LEVY 1.8 c/kg milk fat  
(collected by processor)

DRDC $13M/yr

Regional programs  
National programs  
Manu.  
Economics/Marketing  
Human resources

Subtropical Dairy Program $2M over 3 yr  
7 subregions - Kempsey to Malanda
Within the regional program, a small proportion of funds is also available for farmer-initiated projects of local (subregional) interest. Projects of national interest are still funded directly by DRDC.

**Management**

The management structure is shown below.

The Program co-ordinator is Mr Ralph Shannon, who has had substantial experience with the key program concept of the Meat Research Corporation (MRC).

**Eliciting interest from research, development and extension providers (RDEP)**

The technical co-ordinators of each subprogram (in consultation with their expert panel) are responsible for developing expressions of interest from RDEP. In the final analysis, projects are prioritised by a combined group including the Program Advisory Group and the subregional team convenors (dairy farmers).

The prioritising is based on:

• scientific merit;
• industry relevance, in particular the extent to which a project with a successful outcome will achieve the subprogram and program goals;
• chances of success;
• expected rate of adoption of the results;
• collaboration between institutions; and
• track record of the applicants.

DRDC has the final say on project approval and seeks input from scientific referees. The NDG is responsible for ensuring milestones are met.

**Benefits**

The response to calls for expressions of interest has been excellent, with over 30 applications coming from a broad cross-section of possible RDEP in 1996.

The benefits of this approach are:

• The research is pro-active with priorities and direction of research driven by the industry (farmers), but still with a major input from scientists.
• The focus is regional and should create a greater sense of ownership by farmers.
• The expressions of interest cast a very wide net, thus bringing together a far greater number of participants of diverse disciplines with potential for more innovative ways of tackling various problems.
• The approach should encourage multi-disciplinary/multi-institutional proposals.

The down side, if there is one, is that innovative, speculative and basic research may be stifled in the quest for problem-solving applied research.

**Conclusions**

As with other industries, the Dairy Industry wants value for money in its investment in RD and E and this can be achieved only if the end
result (of RD and E) is an industry which has improved profitability and sustainability (economically and environmentally) and a better lifestyle at the farm level. As an industry, it must remain internationally competitive; this means either lowering its cost of production or increasing production throughput, or both.

The key issues appear to be:

- Selecting and breeding pastures and crops, not for improved yields, but for resistance to pathogens, such as nematodes, root-feeding fungi, rust, and insects; coping with seasonal extremes of the subtropics (e.g. heat tolerance) more appropriate forage quality (e.g. incorporation of the brown midrib gene in maize and pearl millet and possibly kikuyu grass); and more persistent perennials.
- Matching crop types/varieties with sub-regional climatic zones to improve reliability of yield.
- Improving efficiency of use of irrigation water by pastures and crops by selecting the most appropriate crops and pasture species (e.g. by selecting for improved root systems).
- Finding persistent perennial legumes as companions for temperate and tropical grasses in order to reduce N fertiliser use and to improve overall pasture quality.

References


