The Northfield Dairy Research Centre

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The Northfield Research Centre is carrying out valuable research for the farming community. Although most of the centre is devoted to dairying, other field work also takes place.
This bulletin describes the development of the centre and the range of experiments in progress.

History

The Northfield Research Centre was started in 1963 when the then South Australian Department of Agriculture took possession of approximately 250 hectares of land previously used as a farm by the Northfield Mental Hospital. The farm supplied milk to the hospital and provided light manual work for the patients.

Development

Plans were immediately made for the development of the farm for research. Revised weed control and cropping programmes were implemented and new boundary fencing constructed.

Fodder conservation research is important at Northfield. Various additives are being tested in silage making. They are pumped onto the herbage from drums on the rear of the forage harvester.

The farm has a variety of soil types, including red-brown earths and black earths. Previously, most of the area was cropped, but about 80 hectares have now been sown to pasture. To make best use of the 400 mm rainfall which falls predominantly in winter, Sirocco and Australian phalaris, Clare and Yarloop subterranean clovers, and Jemalong and Paragosa Gama medics were selected for the pasture mixtures. As the stands have become established, new sub-divisional fencing has been built. In the main dairy area bounded by Fosters Road, Folland Avenue, Hampstead Road and Redward Avenue, a series of 14 paddocks, each of four hectares, has been developed. The heavy, black clay soil of the adjacent laneways has been stabilized with lime to prevent pugging in winter.

Fodder conservation

Because dairying in South Australia is dependent on hay and silage for much of the year, new fodder conservation facilities have been developed. Up to 25,000 bales of hay have been cut from the property in one year, and up to 1500 tonnes of silage have been conserved in bunkers in other seasons.

Some feed grain is also grown, but much of it is brought in from other departmental research centres and from Roseworthy Agricultural College.

Stock

The dairy herd, which was of mixed Friesian x Ayrshire breeding in the final days of hospital operation, has been changed to a grade Friesian herd by artificial breeding to selected sires held by the Artificial Breeding Board of South Australia and more recently the Victorian Artificial Breeder's Co-operative. (The Artificial Breeding Centre is on the north-west side of the Northfield Research Centre.)

About 80 cows are maintained in milk at any given time, calvings being spread throughout the year to provide cows in all stages of lactation for experimental work.

Dairy replacement heifers are reared from the Research Centre's own calves, but stock purchased from country markets are used extensively for calf rearing and dairy beef trials. Up to 300 head of cattle are held at the centre at any one time.

A small flock of sheep is maintained because sheep are easier to manage than cows in nutrition studies requiring housing in individual pens.

An experimental piggery for 30 sows has also been established. This unit is described in Extension Bulletin 33.74 entitled "The Northfield Pig Research Unit".

Improving hay quality to increase feeding efficiency is also important.

Facilities

The two-storey Northfield Research Laboratories were opened in 1965. Activities in the laboratories are described in a Special Bulletin entitled "Research Laboratories, Northfield – notes for visitors". The laboratories are headquarters for the dairy research staff and for agronomy, soils and horticultural research officers who conduct experimental work throughout South Australia. Many of these officers are also involved with research carried out at the centre.

Dairy research was originally carried out using the milking facilities taken over from the hospital. The Pine Drive Dairy, designed many years ago as an eight-stand walk-through type for hand milking by patients, has been reconstructed as a modern four-stand doubled-up pipeline dairy with refrigerated bulk milk storage.

A second milking unit has been provided in the Folland Avenue Dairy which comprises a four-stand doubled-up walk-through milk shed, a large milk room with facilities for experimental butter and cheese manufacture, modern research laboratories and offices. A spacious feedshed, to hold 42 cows in individual stalls or 64 cows in feeding bails, has been built adjacent to the new dairy. The feedshed is equipped with automatically self-closing gang-opening bails to allow easy handling of stock. A cool room, meat preparation laboratory, cattle yards and cattle weighing facilities have also been constructed.

The need to bring animals to the Research Centre has led to the establishment of a quarantine area with separate feed mixing and stock handling facilities. Emphasis has been placed on the development of equipment for calf rearing research. Individual pen housing has been constructed for up to 40 sheep or calves for digestibility, nitrogen balance or feeding trials. A small laboratory is used in conjunction with these facilities.

The Research Centre has a well-equipped servicing workshop for maintaining the farm's agricultural implements and constructing special experimental machinery.

Dairy research

Dairy research is carried out by a staff of 11 scientists, assisted by a technical staff who also carry out the day-to-day operations of the farm. Staff are supported by the South Australian Government, the Commonwealth Government and the Dairying Research Committee.

Ideas for research are obtained by discussing problems with individual farmers, advisers, processors and representatives of farmers' organizations. Other ideas are obtained from scientific developments overseas. Over 100 separate dairy research projects have been initiated at Northfield since 1965. Some have been completed in a few weeks – others have taken four to five years before conclusive results were obtained. As useful results are obtained they are incorporated in departmental publications, news bulletins, radio talks, television presentations and farmer meetings.

Research is carried out in three main areas – dairy husbandry, dairy technology and milk chemistry. Some of the principal areas of work are described below:

Feed quality analyses

Digestibility

Pasture, hay and silage quality are measured at Northfield using an *in vitro* digestibility analysis that is similar chemically to a cow's digestive

The Folland Avenue Dairy includes well equipped research laboratories.

Intake of experimentally prepared silages is measured in a special feedshed.

system. Many samples from experiments have been tested. Other samples have been examined for groups of farmers and the significance of the results discussed at local meetings. A fee-paying service is provided for use by industry.

Other analyses

Chemical analyses are also carried out for soluble carbohydrates, crude protein, various organic acids, and gross energy values of feeds as an aid to better understanding of dairy cattle nutrition.

Fodder conservation

Haymaking

Plot and field trials in dairying areas have shown that up to 50 per cent of the digestible dry matter of hay crops can be lost if cutting is delayed at maturity. Subsequent trials at Northfield showed that Wimmera annual ryegrass lost digestibility after flowering at about three times the rate of nine other species tested. This suggests that where a number of paddocks are ready for haycutting together, those containing the most ryegrass should be cut first.

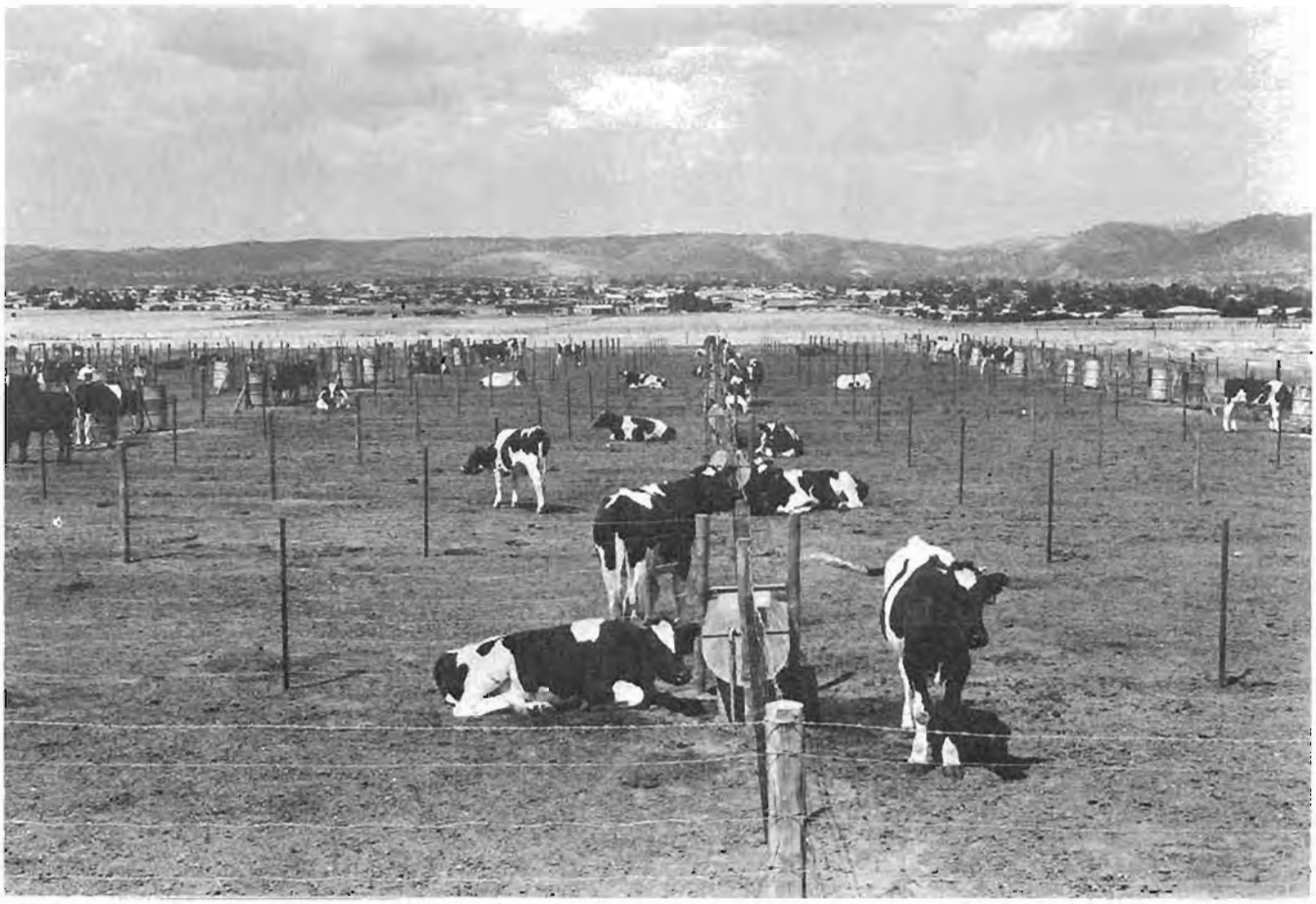
Comparisons carried out in 1970 with phalaris – ryegrass – clover hay cut early or cut 19 days later from the same pasture showed that cows given free access to early cut hay produced 13 per cent more milk and 16 per cent more butterfat than cows offered the late cut hay.

A series of plot experiments was carried out in 1973 to examine the changes in dry matter digestibility and crude protein content of cereal varieties used for hay production in South Australia. As a result of this experiment it was found that Halberd wheat, harvested at the milk stage, and Avon and Kent oats, harvested at the flowering stage, were the best cereal crops from which to make hay and silage.

Although there is a greater risk of rain and consequent mould damage of hay cut early in the season, an experiment has shown that early cut mouldy cereal hay is at least as good as late cut cereal hay for feeding dairy cows.

Hay storage

An experiment to examine various methods of drying rain-affected hay in 1971 showed no advantage in turning the bales compared to leaving them



A wide variety of different feeding programmes is being tested for rearing calves after weaning.

alone. If bales were turned, mould developed on both sides of the bale rather than on one. Sometimes more rain is expected before bales are sufficiently dry for stacking: it was found that stooking in pairs increased rainfall runoff and reduced the risk of further damage.

Research work to compare the digestible dry matter and crude protein losses from round bales, square bales and fodder rolls stored in the open, showed fodder rolls had no advantage over the other types of bales when storage extended over the winter period.

A three year experiment to investigate feed quality losses in cereal, lucerne and pasture hay in long term storage is in progress.

Silage additives

The silage intake and milk production of dairy cows can be increased if either formalin or formic acid is added to pasture when cut for silage. Further production increases can be obtained if mixtures of these chemicals are used. An experiment is in progress to compare the milk production of dairy cows fed hay to that of dairy cows fed wilted silage or formaldehyde-treated silage.

Comprehensive feed storage and mixing facilities allow many experimental rations to be prepared.

Calf rearing and dairy beef

Calf rearing has been investigated for the most efficient methods of feeding, the use of milk replacers, the labour required for feeding, the incidence of scouring, the age of weaning and the breed of calves.

Milk replacers

Early experiments compared milk and milk substitutes for calf feeding. One commercial product was withdrawn from sale following these experiments. A subsequent trial showed that it was not profitable to feed milk replacers at high rates to produce calves for sale as veal at three months of age.

An experiment to examine the effect of milk replacer temperature on the growth of calves found that when the temperature of the milk replacer was below 20°C, calves reduced their feed intakes and liveweight gains.

Once-daily feeding

Labour costs can be reduced by feeding calves once-daily. When milk was used, calves fed milk at the lowest fat percentage had the highest weight gains. Milk between three and five per cent butterfat is satisfactory. Costs in the Adelaide whole milk zone can be further reduced if milk replacers are used instead of milk, but experimental results have suggested that a 15 per cent mixture of powder in water rather than the usual 10 per cent mixture should be used.

Experiments have shown no growth advantages in feeding calves through teats rather than buckets. The labour required to teach purchased calves to drink from either teats or buckets was similar, but 20 per cent more labour was required for feeding with teats because of the extra preparation and washing up time required.

Early weaning

Calf feeding can be made easier by combining once-daily feeding with early weaning. Calves weaned abruptly at four weeks onto a pelleted high protein ration showed a check in growth compared to calves fed a milk replacer to 12 weeks of age, but no set back was observed in calves weaned at six weeks. Early weaning does not necessarily reduce feeding costs because the milk substitute is replaced by a pelleted ration which must also be purchased.

A recent experiment has shown no difference in liveweight gains of calves fed urea and meatmeal as alternative protein sources at weaning. Research at Northfield has shown that up to 45 per cent good quality hammermilled hay can be included in the diet of early weaned calves without affecting liveweight gains. This gives considerable savings to the dairy farmer in purchases of grain concentrates.

Scouring

It has been found that high rates of feeding combined with prolonged use of fixed housing can result in increased deaths from scouring. It is thought that scouring is usually induced by a nutritional upset rather than by infection. Starvation for 24 hours has been found the easiest treatment. If feeding is continued, calves can continue to scour. In an experiment to test the use of prepared salt solutions, it was found that calves not only continued to scour, but rapidly lost weight.

Crossbred calves

Comparisons were made of one Hereford, one Friesian and two Charolais sires on Friesian and Jersey dams to produce crossbred calves for artificial rearing as dairy beef. Of the crosses made with Jersey cows the growth rates of calves sired by one Charolais and the Friesian bull were greater than for the other sires. No differences existed in growth rates of the crossbred calves from the Friesian cows. Charolais cross calves proved more difficult to rear artificially and more deaths were recorded.

Calf dehorning

Investigations into methods of calf dehorning have shown that use of an electric dehorning iron is a satisfactory technique.

Feedlot finishing and compensatory growth

Following increased awareness of the value of the dairy herd for meat production, an experiment was designed to compare the growth rate, feed intake and carcass composition of Friesian steers fed hammermilled high grain rations which contained different ratios of barley grain and oaten hay. When the ration contained 20 per cent oaten hay, feed intakes were higher but digestible energy intakes, liveweight gains and carcass composition were similar to steers fed a 10 per cent oaten hay ration. Seventeen month old Friesian steers were satisfactorily finished for the local meat trade by feeding for 90 days in the feedlot.

An experiment is in progress to examine the effect of a period of low nutrition on the subsequent performance and body composition of Friesian steers.

Dairy management

Experiments are being conducted over a wide range of activities to improve management

techniques, increase dairy efficiency and reduce the workload of dairymen.

Cattle identification

Correct identification is essential to any dairy breeding programme. Experiments have shown that freeze branding and ear tattooing with green ink using hollow pointed needles are effective methods of identification.

A recent experiment has shown that flexible ear tags are not readily dislodged from the animal's ear and are easily read at a distance of 10 metres.

Milking omission

An experiment to investigate the consequences of missing an occasional milking was carried out for 12 months in 1969-70. It was found that missing one milking each week reduced the total lactational milk yield by 3.5 per cent, the total butterfat yield by two per cent and the total protein yield by 1.3 per cent. If two consecutive milkings were missed each week, the yields of milk and butterfat were reduced by 14 per cent, and some factory processing problems were to be expected. Neither treatment resulted in an increase in mastitis. It was concluded that single milkings can be omitted without ill effect, though the technique should be avoided if most of the herd is still within the first ten weeks of lactation.

Milk meters

Ten commercial milk meters have been tested in the Northfield dairy, and two of these were subsequently evaluated in a field trial by departmental officers in the Ambleside Dairy Cattle Improvement Association. Following these experiments, the "Trutest" meter was selected for herd recording in South Australia.

Automatic teat cup removal

A trial to investigate the use of an automatic teat cup remover showed that total milk production of a herd could be reduced by up to four per cent if these units were used. This is thought to be owing to the premature removal of cups from those cows showing the characteristic of double milk let-down.

Polyunsaturated milk

An experiment to evaluate the use of a formaldehyde-treated sunflower seed supplement fed to dairy cows grazing green oats showed that although milk of increased unsaturated fat content could be produced, it was readily oxidized and required different manufacturing techniques for the production of cheese and skim milk powder.

Composition of diet and milk protein production

Because consideration is being given to the payment for milk on a fat and protein basis, the effect of diet composition on milk protein production is being investigated.

Cows grazing green oats and fed a barley concentrate produced more milk protein and solids-not-fat than cows fed an unsupplemented diet or a hay supplemented diet. Composition of the diet did not affect the relative proportions of different milk proteins or the manufacturing properties of the milk.

The effect on milk production and composition of supplementing cows fed pasture hay with different levels of a barley concentrate is also being investigated.

Calving synchronization

Seasonal calving of dairy cows allows the farmer some relief from the daily job of milking cows. An experiment carried out at Northfield to investigate the possibility of synchronizing calving showed that cows injected with 'Opticortenol' calved on average 24 days prematurely, with no significant increase in calving problems. But premature calves were lighter at birth and this difference was still evident at 12 weeks of age.

Herd recording

Investigations have been carried out on less frequent and cheaper methods of herd recording. Alternate a.m.–p.m. sampling was found to be more accurate than bimonthly sampling and more suitable than the current method of sampling twice daily once a month.

Mastitis

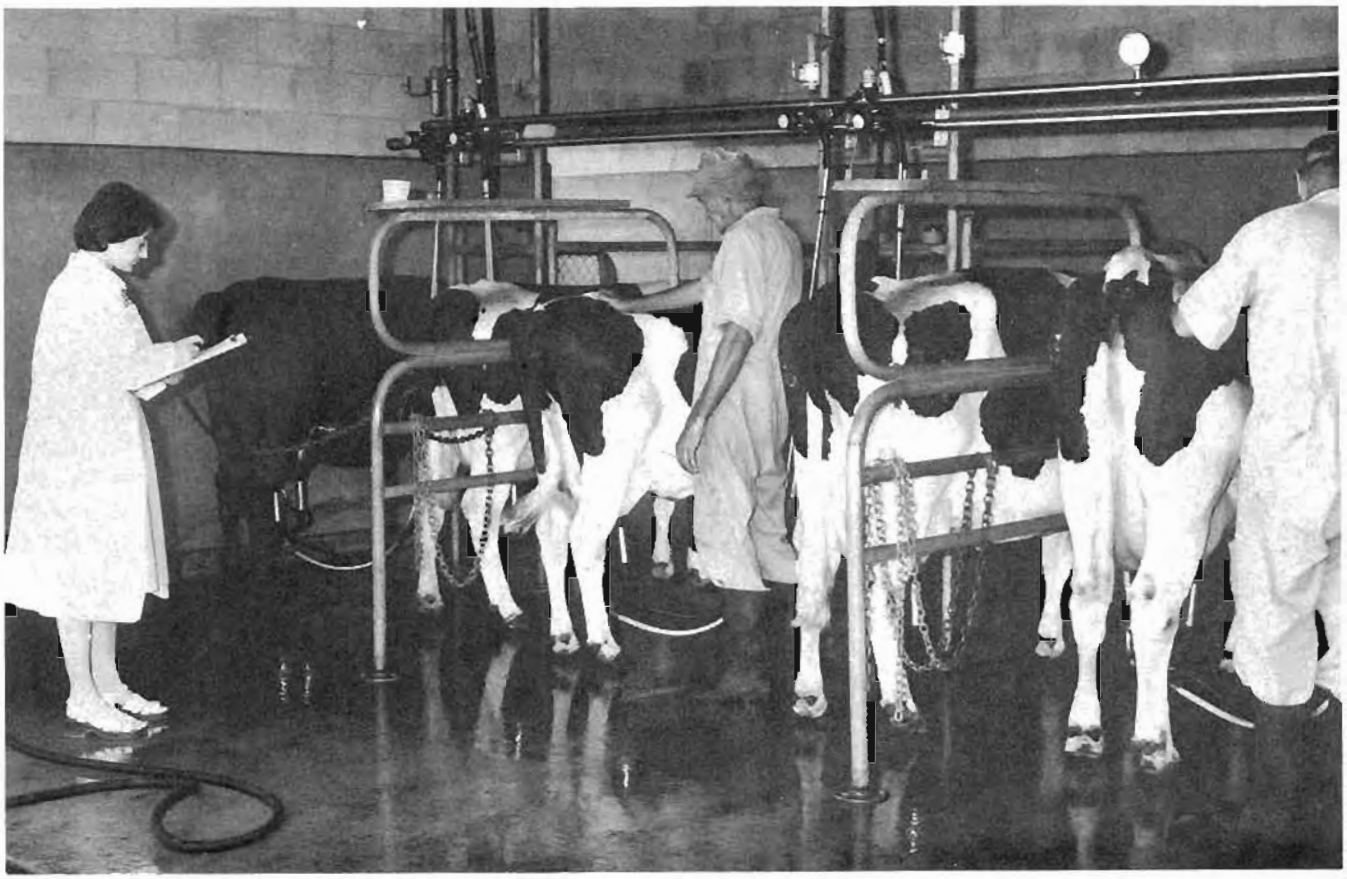
Mastitis reduces milk yields from cows and can seriously affect the processing properties of the milk. A number of techniques for reducing mastitis are being investigated.

Teat dipping

Iodine post-milking teat dips were found to be of some value in reducing the number of new udder infections in heifers, but did not reduce the level of mastitis in cows already affected.

Teat squirting

New Zealand research recently suggested that mastitis could be reduced by taking one squirt of milk from each teat before washing the udder for milking. In a three month trial at Northfield no advantage could be found from using the technique.



Many records are taken from individual cows in the Folland Avenue Dairy during each experiment.

Antibiotic therapy

Antibiotic therapy using "cloxacillin" on cows in the Northfield herd at drying off resulted in a 28.5 per cent increase in milk production in the following lactation from quarters that had been intermittently affected with mastitis. After testing the treatment in 16 commercial herds in the Adelaide Hills, it was concluded that "cloxacillin" is effective under a wide range of field conditions.

Treatment of infected quarters with "Masolin", a mixture of antibiotics and anti-inflammatory agents, was found to be no more effective than commercially acceptable penicillin.

Leucocyte count survey

This survey, assisted by the South Australian Dairymen's Association, has been designed to monitor leucocyte levels in bulk milk samples from 1,400 herds in the area under control by the Metropolitan Milk Board. A Cell Count Monitoring Service is being established to encourage more effective use of mastitis control methods.

Chlorine teat dip

Following concern over the increased iodine levels in milk for human consumption, the use of chlorine mixed with a lanolin emollient as a teat dip has been investigated. The teat dip reduced leucocyte counts, mastitis bacteria and the incidence of new infections, but caused a teat irritation lasting from two to eight weeks.

Dietary zinc

An experiment to investigate the use of dietary zinc in controlling mastitis found no relationship between the zinc content of the diet and the effectiveness of leucocytes in controlling bacterial infections in the udder.

Dairy breeding

Genetic type and milk quality

Genetic differences occur in the proteins of milk from different cows and these can be detected in the laboratory. Genetic typing of the proteins in the milk of cows in the Northfield herd and selected commercial herds has shown relationships between milk composition, processing properties and genetic types. Knowledge of such relationships will allow desirable changes to be made in milk composition by breeding.

Genetic typing of bulls

In order to determine the milk protein transmitted by a bull to its offspring, hormones have been

Sophisticated biochemical methods are used to examine the different proteins in cows' milk.

injected into young bulls to induce them to produce a small amount of milk. By this means the bulls have been successfully typed.

Milk processing

Laboratory research using milk from the Northfield herd is aimed at improving milk processing techniques.

Milk fat/vegetable oil spread

Market surveys have shown that although people prefer the flavour of butter, they prefer the spreadability of vegetable oil-based spreads when taken directly from the refrigerator. The dairy technology group at Northfield in co-operation with other organizations has developed a spread ('dairy blend') containing 80 per cent butterfat and 20 per cent vegetable oils. The commercial development of 'dairy blend' is at present in the hands of industry.

Cheese quality 'starters'

A cheese starter service is available to industry. Single strain cultures of *Streptococcus* species are cultured in liquid milk and checked to ensure sufficient activity before distribution.

Cheese manufacture

Examinations are being made of the factors affecting the curd firmness properties of milk, an important attribute in cheesemaking. Curd firmness depends on the genetic make-up of the cow, its nutrition, and the freedom of the udder from diseases such as mastitis. Serious losses can occur in factories where inadequate cheese curd formation is obtained owing to deficiencies in the milk supplied by farmers.

Dried and condensed milk

Studies are being carried out on the stability of milk to heat, a property which is important in processing dried and condensed milk. The heat stability of milk can change dramatically with even small changes in pH and varies with the composition of the milk protein fraction. Hence factors that affect heat stability are mastitis, breeding and heat stress. It has been shown that difficulties in manufacturing heat-stable skim milk powder can be largely overcome by adjustment of the pH of the milk to that of the maximum heat stability.

Other experimental work

In addition to dairy research, other experimental work is being carried out at the Northfield Research Centre.

Horticulture

The horticultural staff operate a research unit which is used for introducing new virus-free plants and improved planting material to South Australia. Emphasis is placed on vines, potatoes and fruit trees. Research is also being carried out on post-harvest handling of horticultural produce.

Entomology

Entomologists have been carrying out insecticidal screening trials to find suitable replacements for DDT in the control of barley grubs.

Crops

Crop agronomists have been conducting trials to find better varieties of wheat and barley. The value of peas, oilseed rape and lupins as alternative crops to wheat is also being investigated.

Pastures

An important pasture development programme is in progress to select newly introduced lines of

annual medics and to breed new medic cultivars from these lines.

Bees

An apiary unit has been established at the Northfield Research Centre, and a beekeeping school is run each spring.

Visitors

Groups of farmers are welcome to inspect by appointment the research being carried out at the Northfield Research Centre and the adjacent Northfield Laboratories. Appointments can be obtained for visits during the morning of any weekday. Arrangements can be made through the Officer-in-Charge of the Northfield Research Centre or the Senior Officer of the Northfield Research Laboratories as appropriate. At least one month's notice is preferred for large groups.

Publications

As experimental work has been completed, results have been incorporated into departmental publications. Detailed descriptions of individual experiments are contained in papers submitted to scientific journals. Over 100 journal articles, bulletins and scientific papers have been written by the Northfield dairy research staff since 1965. A complete list of these is available from the Principal Dairy Research Officer, Box 1671, G.P.O., Adelaide, telephone 261 3288. Reprints are available of most articles.

Although the Northfield Research Centre has been in operation only since 1963, its research already has contributed significantly to the improvement of farming in South Australia. Northfield and Research Centres like it help the farmer to keep his place in the continually changing world of agriculture.

Experimental results are incorporated into departmental bulletins and scientific papers.

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