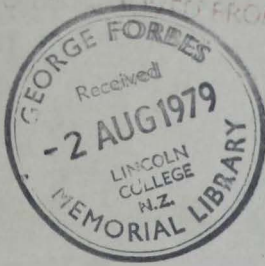


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# AGRICULTURAL ECONOMICS RESEARCH UNIT

**REVIEW: 1977-78**

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AGRICULTURAL ECONOMICS  
RESEARCH UNIT REVIEW  
1977-78

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## EDITORIAL NOTE

The need for greater interaction between agricultural policy makers and economics researchers expressed in the 1975/76 Review has become even more apparent over the past two years. This need has been partly answered by the Agricultural Economics Research Unit (AERU) in its policy of assisting by way of contract research those groups involved in producing, processing, distributing, and marketing farm outputs and inputs, as well as government departments and organisations associated with agriculture and policies affecting agriculture.

The principal objective of this second Review is to continue to present abstracts of agricultural economics and management research recently carried out at Lincoln College. It is hoped that the abstracts may be of value to decision makers associated with New Zealand agriculture by placing before them a reasonably comprehensive account of research completed or in progress.

This review has two major parts. The first part is made up of an article by Frank Ward, until 1978 Director of The New Zealand Meat and Wool Boards' Economic Service. The article reviews growth in the New Zealand meat and livestock industries over recent years. The second part presents abstracts of research studies which have been recently completed or which are in progress in the AERU and the two associated teaching Departments at Lincoln College. Personnel in other Departments involved in research with clear economic and management implications have also contributed abstracts; all these contributions are gratefully acknowledged.

P. D. Chudleigh  
J. B. Dent  
Editors

## **RESEARCH UNIT — BACKGROUND AND STAFFING 1977-78**

The Agricultural Economics Research Unit was established in 1962 at Lincoln College, University of Canterbury. Major sources of funding have been annual grants from the Department of Scientific and Industrial Research and the College. However, increasing involvement in contract research projects with government departments, producer boards and grower organisations, and with commercial and industrial groups has occurred in recent years.

The Unit is currently involved in research in the fields of agricultural economics and management, including production, marketing, policy, resource economics transportation and sociology. The results of these studies are published as Research Reports and Discussion Papers. The Unit also sponsors periodic conferences and seminars, often in conjunction with other organisations.

The AERU and the Department of Agricultural Economics and Marketing and the Department of Farm Management and Rural Valuation maintain a close working relationship in research and associated matters. The combined professional staff of the Unit and the two Departments is around 45. The policy of the Unit is set by a Policy Committee consisting of the Director, Deputy Director and appropriate Professors.

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Dr P. D. Chudleigh, B.Sc., Ph.D. (Deputy Director of Unit)

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J. V. BOYD	(from April 1977)

**GROWTH AND DEVELOPMENT  
IN THE NEW ZEALAND  
MEAT AND WOOL INDUSTRY**

by  
**F. L. Ward\***

\* Frank Ward was, until his retirement in September 1978, Director of the Meat and Wool Board's Economic Service. This invited paper, kindly prepared by Frank Ward in his retirement, reflects the views of the author and does not necessarily represent views and opinions of the A.E.R.U.

## INTRODUCTION

The farming industry has in the past clearly demonstrated its ability to grow and expand, but unfortunately a given volume of exports will today buy less than two-thirds of the volume of imports which it would buy five years ago.

New Zealand is committed to agriculture as a means of earning the major part of its export income. In the last ten years on average, the farming industry has been the source of 76 percent of export income. In addition, 31 percent of meat produced and 27 percent of milk and its products goes into domestic consumption.

For a country with a livestock economy, New Zealand has many advantages. It has a generally favourable climate, good pastures, high quality sheep and cattle and the excellent technical skills of its farmers and servicing organisations. There is also undoubted further production potential both in the land and the stock. The realisation of at least some of this potential is a matter of some urgency and importance if sound economic growth is to proceed in New Zealand.

The Prime Minister made it clear in his June 1978 Budget address, that agriculture was the key sector and that it was essential to maintain investment in farming if sound economic growth was to be achieved.

## Investment and Production

Production from meat and wool farming as in dairying is very dependent on preceding levels of 'on farm' spending. The main factor to influence the level of spending or 'investment' is that of farm income. Obviously in low income years money is not available and production is likely to decline in subsequent seasons. In high income years, the spending on farm inputs will increase with considerable beneficial effect on production in the following seasons.

The close association between the level of farm spending and subsequent farm output is often not appreciated in view of the inevitable time lag between the investment and production output. A good example of production lag is that of topdressing where fertiliser application results are likely to be apparent over a period of time.

## Production Potential

There is undoubted production potential in New Zealand land and livestock, but the question is whether it can be developed economically and soon enough to provide a basis for sound economic growth. Obviously opinion will differ as to what constitutes sound economic growth.

Livestock numbers have been the most common measure of progress in the farming industry and undoubtedly major increases have occurred in periods of farming prosperity with stagnation and decline in numbers in low price seasons.

Obviously there are physical and economic limitations to the number of livestock it is possible to carry on New Zealand farms, but on many properties there is still considerable scope as has been shown by the response to the recently introduced livestock incentive scheme. Many farms also with reasonably high stock numbers usually have some land capable of development.

Stock units are the commonly accepted measures of carrying capacity and the New Zealand total has remained fairly static in recent years at around 100 million stock units of which some 81.5 million are sheep and beef (Table 1).

Sheep and beef stock unit numbers could increase by around four percent per annum given a favourable economic and industrial climate, but there are other factors to be taken into account. It may well be that there is greater economic advantage in a lower rate of stock number increase and an improved individual

performance from animals. For example, an extra 0.5 kg per head of wool from 59.1 million sheep would at current prices, generate an additional \$65m and an extra five percent of lambs from 42 million ewes could yield another two million lambs worth over \$25m at farm gate.

Another reason why it could be wise economic policy to aim for increased production from individual animals is the cost factor. The cost of goods and services used on farms has increased by just on 100 percent in the last five years, in other words, it costs twice as much for the same volume of goods and services. To express it in yet another way—on the average all classes sheep and beef farm, a maintenance level of expenditure today is around \$13 per stock unit, which is three times greater than it was ten years ago.

**TABLE 1**  
**Stock Units Sheep and Beef and Ratio of Sheep to Beef Cattle 1967/68 to 1976/77 (also Total Stock Units Sheep, Beef and Dairy)**

	Total Stock Units (Sheep and Beef) (Million)	Percent		Total Stock Units (Sheep, Beef, Dairy) (Million)
		Sheep (Meat and Wool Farms)	Cattle	
1967/68	76.1	74	26	97.6
1968/69	77.9	73	27	99.9
1969/70	78.5	72	28	100.4
1970/71	79.7	71	29	100.6
1971/72	79.2	70	30	99.3
1972/73	82.4	70	30	102.5
1973/74	80.3	67	33	99.8
1974/75	81.1	65	35	99.8
1975/76	81.7	64	36	100.0
1976/77	81.5	66	34	99.6

Source: Ministry of Agriculture and Fisheries.

Given an adequate level of reinvestment, there could be both an increase in total sheep and cattle numbers and an improved individual performance by farm animals.

## Movement in Sheep and Beef Cattle Numbers

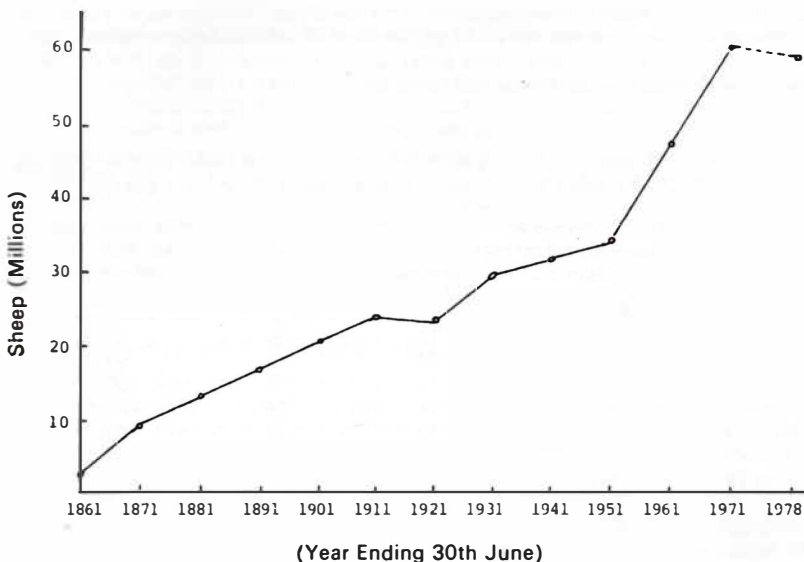
In a little over 150 years, sheep numbers have moved from zero to around 60 million (Figure 1). This movement in sheep numbers noted at 10 year intervals has been quite spectacular at times (see 1951–71). There were periods of decline, e.g. 1911–1921 (covering World War I period) and times of slow movement from 1931–1951 (which includes the depression years and World War II). More recently (1971–78) sheep numbers again declined when beef cattle made some rapid gains.

Beef cattle have long been associated particularly with hill sheep farming in New Zealand and in earlier days were mainly used to control second growth and improve pastures for sheep. Most farmers had established what they considered were desirable ratios of cattle to sheep.

In 1920 there were 1.8 million beef cattle and by 1940 there was little change at 1.9 million. It was not until 1960 and following some years of hill country development through aerial topdressing, that numbers reached three million. Thereafter the beef animal became very much a meat producer in its own right. Numbers increased rapidly and now total around six million.

Some 75 percent of the occupied farming land in New Zealand is used in sheep and beef farming and 10 percent in dairying. The balance is in mixed farming, cropping, forestry, etc.

**Figure 1**  
**Sheep Numbers in New Zealand, 1860 to 1978**



## Measures of Production in the Meat and Wool Industry

Production from the meat and wool industry is expressed in many ways. For example, when farmers, because of improved income and greater investment in farming, decide to increase livestock numbers, there is a fall in meat production. When farm incomes are falling, stock and herd numbers may be stabilised or decreased with a consequent increase in slaughterings. The so called production movement then appears to run counter to the economic situation in farming.

The production from flocks and herds does vary from season to season, for climatic and biological reasons. It is usually a matter of adequacy or otherwise of feed supplies at critical periods and weather at lambing or calving time.

The composition of the flock has a major impact on production. The proportion of breeding ewes in the flocks has increased from around 50 percent in the early 1950's to about 73 percent at the present time.

During the major flock expansion years of the 1950's and the 1960's, the proportion of ewes increased greatly and when flock numbers were stabilised in the 1970's the proportion of breeding ewes reached the record levels of 73-74 percent.

In the early days of sheep farming a considerable number of wethers were carried, but in the last few decades dry sheep are mainly flock replacements. Obviously with a high proportion of breeding ewes the lamb output from the flock will be high, given good lambing percentages.

## Yield in Lamb Slaughtering

This figure—the percentage of lamb slaughterings to total flock numbers is of considerable importance to the export lamb trade. In the last ten years the yield has been around 45 percent with a range from about 41 percent to 47 percent (Table 2). Obviously, lambing percentage is a main factor and an increase in lambing percentage a goal for increased production.

## The Sheep Slaughter Yield (mainly ewes)

This yield has been around 15 percent but has ranged from just under 14 percent up to 18 percent (Table 2). The yield is low when ewes are held back for flock buildup and high when flocks are stable or being reduced.

**TABLE 2**  
Lamb and Sheep Yields

	Sheep Numbers (‘000)	Lambs Slaughtered (‘000)	Sheep Slaughtered (‘000)	Lamb Yield %	Sheep Yield %
1966/67	57,343	24,157	8,474	42.1	14.8
1967/68	60,030	26,424	10,159	44.0	16.9
1968/69	60,474	26,857	9,603	44.4	15.9
1969/70	59,937	27,539	9,844	46.0	16.4
1970/71	60,276	27,223	10,041	45.2	16.7
1971/72	58,912	27,948	9,379	47.4	15.9
1972/73	60,883	26,772	11,332	44.0	18.6
1973/74	56,684	23,085	9,764	40.7	17.2
1974/75	55,883	25,515	8,084	45.7	14.5
1975/76	55,320	26,049	7,584	47.1	13.7
1976/77	56,400	25,505	7,890	45.2	14.0

Source: Department of Statistics and Ministry of Agriculture and Fisheries.

## Cattle Yields (including dairy stock)

This has been around 35 to 36 percent, but rose steeply in recent seasons with an associated reduction in cattle numbers (Table 3). The range has been from 31 to 42 percent.

**TABLE 3**  
Cattle Yields

	Total Cattle (‘000)	Slaughterings			Yield %
		Cattle (‘000)	Calves (‘000)	Total (‘000)	
1966/67	7,747	1,213	1,219	2,432	31.39
1967/68	8,247	1,495	1,235	2,730	33.10
1968/69	8,605	1,694	1,357	3,501	35.46
1969/70	8,777	1,936	1,311	3,147	35.86
1970/71	8,819	1,828	1,076	2,904	32.93
1971/72	7,995	1,784	1,061	2,945	35.58
1972/73	8,632	2,054	1,068	3,102	36.17
1973/74	8,924	1,813	1,251	3,064	34.33
1974/75	9,311	2,161	1,449	3,610	38.77
1975/76	9,262	2,599	1,303	3,902	42.13
1976/77	8,996	2,314	1,291	3,605	40.07

Source: Calculated from Department of Statistics and Ministry of Agriculture and Fisheries data.

## Net Output of Sheep and Lambs

This is an overall and accurate measure of true flock output. It takes into account slaughtering, retention for flock, lambing percentages and sheep and lamb deaths. In the last six decades from the 1920's to the 1970's the net output rose from 39.8 percent to over 60 percent in the 1960's (Table 4). In the 1970's it is lagging slightly, but likely to improve with recent performance.

**TABLE 4**  
New Zealand Sheep Performance and Net Output  
1920's to 1970's

	Av. Sheep Numbers (Mill)	Breeding Ewes as Percentage of Total Flock	Lambing %	Wool Weight (kg/head)	Flock Loss %	Net Flock Output %
1920's	24.4	54.5	86.6	4.21	6.5	39.8
1930's	29.8	60.1	87.4	4.24	7.1	45.6
1940's*	32.4	63.0	94.6	4.90	7.7	50.6
1950's	37.9	66.2	96.9	5.63	8.7	55.4
1960's	52.5	69.3	98.3	5.60	7.8	60.6
1970's†	58.3	72.6	93.4	5.36	8.3	59.6

\*Six years' average as statistics were not available for part of period.

†Period 1970-1976.

Source: Calculated from Department of Statistics and New Zealand Wool Board Statistics.

This net output does indicate that on average the efficiency of sheep flocks has increased, but naturally the higher levels of output will be harder to maintain and increase.

## Sheep and Lamb Losses

These have tended to rise as would be expected with a higher proportion of breeding ewes in flocks (Table 4). Also in a period of rapid flock expansion as in the 1950's and the 1960's more old ewes were retained for flocks and were more vulnerable to losses. The sheep and lamb figure rose from 6.5 percent in the 1920's to around 8.3 percent at the present time, but reached 8.7 percent in the 1950's.

## Lambing Percentage and Wool Weight

These reached their highest point in the 1960's, but started to decline in the late 1960's and early 1970's following a period of reduced investment in farming and some difficult climatic conditions (Table 4). Both lambing percentage and wool weights are currently showing improvement.

## Some Past History with a Lesson for the Future

Following the collapse of the wool price in 1967 reinvestment in farming fell to a low level, repairs and maintenance work was curtailed, farm machinery was not replaced at the proper time and fertilizer usage fell off considerably.

Before 1967 however, there had been good farm seasons and farm fertility and farm maintenance levels were high and sheep performance at a good level.

So the industry freewheeled for a time after 1967 and got by, living on reserves. However, the recession went on too long and as a result farm inputs were below maintenance level. Poor seasons also compounded the situation. Production and stock performance deteriorated. This manifested itself through into the 1970's despite the upturn in farm product prices as from 1972/73. The performance of livestock, and the production situation is now improving following a few seasons with higher levels of farm spending.

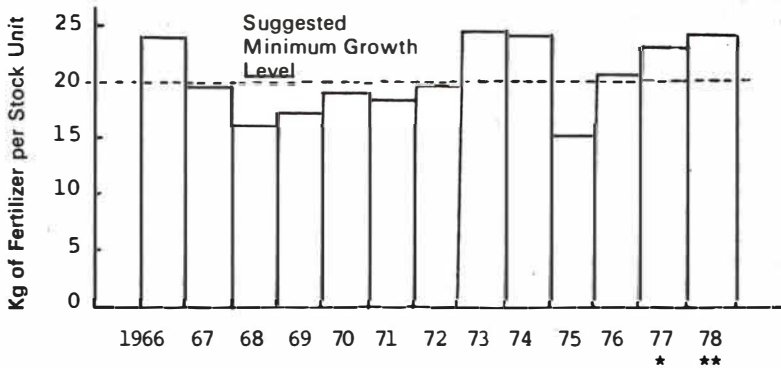
The lesson is clear—the industry takes some time to run down but equally takes a long time to build up again.

## Production Inputs

One of the most significant production inputs into pastoral farming is fertilizer. The most practical measure of fertilizer requirement in livestock farming is the relationship between volume of application and livestock numbers. Naturally the relationship varies between regions for reasons of soil and climate differences and type of farming. The linkage between fertilizer usage and stock performance is well proven but there is the inevitable lag between application and production response from livestock.

The suggestion based on farm records is that a national average fertilizer usage of not less than **20 kg per stock unit** is necessary to achieve **some growth in production** (Table 5).

**TABLE 5**  
Volume of Fertilizer Used per Stock Unit on Meat and Wool Farms  
(1965/66 to 1977/78)



\* Provisional  
\*\* Estimate

Year Ending 30th June

Source: N.Z. Meat and Wool Boards' Economic Service

The average use of fertilizer on meat and wool farms over a period of years shows considerable fluctuations in line with farm incomes, the usage being below 20 kg per stock unit from 1966/67 to 1971/72 and above 20 kg in recent years except for 1974/75.

At a level of 20 kg per stock unit stock performance in subsequent seasons should at least be maintained. This 20 kg per stock unit average level however, would not be high enough for North Auckland and the higher rainfall North Island regions, but too high for some of the lower rainfall South Island areas.

## Comment

Fluctuations in farm income have long been a fact of farming life and a main reason for the considerable variations in farm reinvestment levels. Greater stability in and reasonable levels of farm income would undoubtedly lead to more consistent reinvestment in farming. Overseas prices however will always fluctuate, but the recent Government announcement (Budget June 1978) of supplementary prices for meat and wool two years ahead, will undoubtedly give farming greater confidence to plan ahead for farm expenditure.

It is obvious that industrial peace is one of the most vital objectives yet to be achieved and the one most likely to restore farmer confidence and thereby lead to an increase in production.

This confidence factor is all important—if farmers believe that their products are required and there is real encouragement to produce, not too strongly inhibited by inflation and industrial problems then there is likely to be a production response.

The New Zealand farming industry as a whole is efficient but being at the end of the cost chain is most vulnerable and the area most affected when industrial problems and cost increases occur. Most of the increased costs incurred by other sectors are simply passed on to the farmer. The ability of all concerned to limit their demands and absorb some of their own costs is surely an urgent area for investigation. From time to time, as in the June 1978 Budget, it has been necessary for Government to make adjustments in order to maintain investment in farming. In other sectors there are regular adjustments such as wage orders and cost of living and also export incentives for manufacturing industries.

New Zealand is a long way from its markets and success as an exporter of meat and wool has been dependent on the ability to produce a high quality article at relatively low cost. The ability to produce at comparatively low cost was maintained over a long period and the main factor of concern to producers was the overseas price. The situation is now very different—the level of 'on and off farm costs'—that is, those costs involved in production, processing and transport are reaching critical levels and have almost more impact than the level of overseas prices.

The main aim of this paper has been to promote a better understanding of significant factors of production in meat and wool farming and to indicate areas of production potential.

It is clear that the main requirement is a sustained and adequate level of investment in farming and this can be achieved with the co-operation of other sectors of the community.

ABSTRACTS OF RECENT RESEARCH  
IN  
AGRICULTURAL ECONOMICS AND  
MANAGEMENT  
AT  
LINCOLN COLLEGE

# I. PRODUCTION AND MANAGEMENT

## 1. Development of Computer Based Management Information Services

J. B. Dent

M. J. Blackie

P. L. Nuthall, Department of Farm Management and Rural Valuation

N. Stables, Pork Industry Council

S. Lines, Agricultural Economics Research Unit

The Department of Farm Management and Rural Valuation is involved in the development and implementation of a number of computer-based farm management information services.

- (i) **On Farm Ultrasonic Gilt Testing Analysis Service;** This service is currently operational and is intended to assist the farmer in the selection of superior breeding stock. It forms the basis for the Pork Industry Council's VIP Breeder's Scheme.
- (ii) **Superpig Budgetary Control and Recording Service;** The purpose of this scheme is to provide individual farmers with management information to help in the control of their business. The scheme is operating on a trial basis with New Zealand farmers and it is hoped that it will also be capable of providing information for the New Zealand Pork Marketing Board.
- (iii) **Egg Production Analysis Service;** This service is currently used by a number of farmers. Further development is intended along the lines of the 'Superpig' service to cover all aspects of poultry production.
- (iv) **Dairy Analysis Management Scheme;** Farm pilot trials are currently in operation to test this production and income forecasting and recording scheme.

## 2. Automated Management Aids

P. L. Nuthall, Department of Farm Management and Rural Valuation.

Many farm management decision models and systems that have developed are primarily concerned with the selection of an optimal mix of production methods and products. Frequently, however, the major management problem in the dynamic and uncertain planning environment that exists is the continuous decision making that is involved in implementing basic plans.

Accordingly, a number of projects are underway to develop decision making systems that are designed to provide optimal decision sets at each major planning point within the production cycle of a particular system. This has been referred to as 'continuous planning'. The principles have been explored using porker production as a case example and currently systems for fat lamb farming and income tax planning are being developed.

Further, a number of studies are in progress to evaluate the effectiveness of decision making aids in a practical sense. These studies include the assessment of a range of aids that are offered on a commercial basis.

### *Further Reading:*

Nuthall, P. L. (1977) "*Dynamic Planning and Pig Fattening*," Unpublished Ph.D. Thesis, Lincoln College.

### 3. Management Systems for Barley Diseases

P. S. Teng

R. C. Close, Department of Agricultural Microbiology

M. J. Blackie, Department of Farm Management and Rural Valuation.

Disease control by management techniques has developed as a result of the increasing costs of fungicides and their application, as well as concern for the long-term effects of fungicides on the environment.

Research at Lincoln has been directed at rationalising fungicide use and enabling a simple cost/benefit ratio to be calculated for each fungicide application. Using barley leaf rust as a case study, a simulation model has been constructed which accurately predicts disease progress and the amount of yield reduction due to an epidemic. The effect of control inputs has also been successfully simulated and the model is being incorporated into an on-farm management scheme for barley growers in Canterbury.

#### *Further Reading:*

Teng, P. S., Blackie, M. J. and Close, R. C. (1977). A simulation analysis of crop yield loss due to rust disease, *Agricultural Systems* 2: 189-198.

Teng, P. S., Blackie, M. J. and Close, R. C. (1978). Simulation modelling of plant diseases to rationalise fungicide use.

*Outlook on Agriculture* (in Press).

Teng, P. S. (1978), System modelling in plant disease management. Ph.D. thesis, Lincoln College, University of Canterbury.

### 4. Optimum Forage Cropping Systems

A. C. Bywater

J. B. Dent

P. S. Teng, Agricultural Economics Research Unit

The general objective of the project is to investigate the possibilities of using high yielding forage crops in Canterbury and other South Island livestock and mixed cropping farms.

A linear programming model selects combinations of activities that maximise total expected gross margin within constraints of land use and animal feed requirements. Three economic criteria—economic farm-surplus, return on capital, and surplus to land—have been used to evaluate favourable solutions from the model for a Templeton silt loam farm. Preliminary results indicate that summer maize for use as beef-fattening silage is an important activity for increasing stock carrying capacity and gross margins on Canterbury mixed farms.

It is envisaged that this research will be used for guiding development of systems incorporating new forage crops into existing farms. The systems will act both as supplements to, and in part or in total as substitutes for, conventional pastoral methods.

### 5. Simulation Software for Teaching and Research

P. S. Teng

S. A. Lines, Agricultural Economics Research Unit

B. Fraser, Department of Farm Management and Rural Valuation

Simulation modelling is increasingly proving a valuable tool in corporate management. This project aims at developing an assemblage of computer programs

which can be used in isolation or together, to facilitate the modelling of complex biological and management systems.

- Five broad areas have been identified for software development—
- Data input and output (e.g. sorting, graphing)
  - Data testing and summation (e.g. regression, normality tests)
  - Data manipulation (e.g. generation of random variates, queuing)
  - Model validation (parametric and non-parametric tests)
  - Model experimentation (formal and informal optimisation algorithms)

It is anticipated that the package will be used for teaching graduate students, as well as giving management system researchers access to a package which has been tested on local computer facilities.

## **6. Quantification of Production Constraints in Cereals**

P. S. Teng, Agricultural Economics Research Unit  
R. E. Gaunt, Department of Agricultural Microbiology

This project aims at elucidating the constraints that make farm yield of cereals substantially lower than potential yield.

The basic philosophy is that, if such constraints are quantified and removed, then increased yield, as achieved at the farm level, will represent a breakthrough beyond the efforts of plant breeding. Crop loss models present a means for constraint definition. Although current work has been directed at diseases, the multiple constraint situation in the field means that an increasing interdisciplinary effort is required.

### *Further Reading:*

James, W. C. and Teng, P. S. (1978) The quantification of production constraints associated with plant diseases. In *Applied Biology* (ed. T. H. Coaker) Vol. IV Academic Press, London.

Teng, P. S. and Gaunt, R. E. (1978) Modelling disease-loss systems in cereals. *FAO Plant Protection Bulletin* (in Press).

## **7. Management of a Common Property Resource—The Bluff Oyster Fishery**

W. A. N. Brown, Agricultural Economics Research Unit  
G. A. Elvy, Department of Farm Management and Rural Valuation

The objective of this research is to study the alternative management options for the Bluff Oyster Fishery as an example of a common property resource. The best management plan will maximise the long term economic rent of the resource, since overfishing will lead to resource depletion; and conversely underfishing will lead to the waste of available resources.

The approach adopted is to model the population dynamics of the oyster beds, by relating population number and size to catch levels, die-offs and growth rates. The economics of the fishery will then be assessed using data from the oyster fleet, and alternative management plans evaluated in the context of maximising the overall return from the resource.

## **8. Dairy Cow Replacement Policies**

A. T. G. McArthur, Department of Agricultural Economics and Marketing

The normal dairy cow replacement policy in New Zealand is to replace about one-fifth of the herd each year. Dairy Board surveys indicate that most of the culling is done for reasons of disease and infertility leaving little room for culling on low production. An earlier research report (McArthur, 1973) indicated that the

normal pattern of culling is optimal when it is assumed that no genetic improvement is occurring through the use of Artificial Breeding. This conclusion was reached by using dynamic programming to determine the optimal culling policy given that information on previous performance of cows was available from herd test data. More recently this conclusion has been considerably modified for herds which differ significantly in genetic merit from the merit of the New Zealand Dairy Board's AB stud and where the merit of the AB stud is continually improving. Dynamic Programming indicates that under these conditions a very heavy culling policy with high replacement rates and the elimination of low producers with the aid of herd testing could be the optimal policy. Such a policy can result in substantial gains in profitability. Further work on the combination of a high replacement rate combined with herd testing and artificial breeding is aimed at determining sub-optimal policies which may be slightly less efficient but more readily acceptable to farmers.

*Reference:* McArthur, A. T. G. (1973) The Application of Dynamic Programming to the Culling Decision in Dairy Cattle. Proc. N.Z. Soc. Anim. Prod., 33: 141.  
McArthur, A. T. G. (1979) Dynamic Programming Applied to Animal Replacement Decisions. Ph.D. Thesis, Canterbury University.

## 9. National Flock Wastage Study

G. A. G. Frengley

M. J. McGregor, Department of Farm Management and Rural Valuation

New Zealand breeding ewes are culled between four and five years on average. If the productive life of these ewes is prolonged there may be significant national economic advantages. This study is investigating the financial and management effects of retaining failed mouth ewes for a further year.

The research has involved a detailed survey of farms in Canterbury, Otago and Southland. The survey indicated that the practice of running failed mouth ewes was widespread. Lambing percentages from this class of stock were found to be 10–15 percent higher and wool weights 0.5–1.0 kg lower than that of mixed age ewes.

Gross margin analysis showed over the eight year period 1970–77 that "gummy" ewes were more profitable in four of these years than the next most profitable policy of selling genuine five year olds and breeding replacements. The profitability of the gummy ewe policy was significantly dependent on the relative prices of works ewes and fat lambs. In years when the margin between the cull ewe and fat lamb prices increases, the relative profitability of gummy ewes increases.

It is clear that national policies should encourage farmers to retain more gummy ewes with good constitution to release more lamb for export.

The study at present involves an investigation with the aid of linear programming into the optimal stock replacement policy for both dryland and irrigated Canterbury farms.

### *Further Reading:*

McGregor, M. J. and Frengley, G. A. G. (1977) "A Survey of the Economics and Management of Gummy Ewes". Lincoln College, Department of Farm Management and Rural Valuation, Discussion Paper No. 2, 63pp.

## 10. Energy in Farming

W. A. N. Brown, Agricultural Economics Research Unit

This project is aimed at analysing the direct and indirect energy use by the New Zealand farming sector on a 'to-farm-gate' basis. Process analysis was used to quantify the direct and indirect energy requirements, and average annual

energy input, 1971–1976, was estimated at 22,600TJ. The main components of the energy input were from petroleum fuel (34.5 percent), fertiliser (28 percent) and farm tractors and machinery (16.2 percent).

The overseas contribution to total energy use on New Zealand farms is approximately 90 percent. This means that New Zealand is almost totally currently dependent on overseas energy sources to sustain its present system of farming.

Marked annual variation in energy input to farming occurred over the five year period studied. Energy use is highly correlated with annual movement in farm income, through changes in the consumption of both petroleum fuel and fertiliser.

New Zealand compares well with the USA, UK and Australia in an analysis of energy input to and output from their respective farming systems—for instance the UK, with an intensive system of agriculture, has an energy output : input ratio of around 0.3, compared with a ratio of approximately 2.3 for the extensive farming practised in New Zealand.

*Further Reading:*

W. A. N. Brown and R. G. Pearson (1977) *The Energy Requirement of Farming in New Zealand*. A.E.R.U. Research Report No. 80.

## 11. Liquid Fuel from Biomass

W. A. N. Brown

J. B. Dent

H. T. Wickramesekera, Agricultural Economics Research Unit

The objective of this study is to assess the suitability of a range of traditional agricultural crops in New Zealand as biomass for the production of liquid fuel extenders. The analysis is two-fold : to firstly determine the energetic efficiencies, and secondly estimate the cost levels which would be associated with the use of these crops as a raw material delivered to a processing facility.

All of the 13 crops studied reveal a substantial positive energy balance with, energy ratios in the range of 15–30 for the more common crops. Furthermore, the delivered cost of one of the crops, fodder beet, is such as to generate a final product price of ethanol close to the expected price levels of premium petroleum fuels if used in a petrol : ethanol blend.

Another crop, sugar beet, is also being studied in more detail as to its potential supply in the Mid-Canterbury region. In this case the optimum location of processing facilities within the region will be explored.

*Further Reading:*

Dent, J. B. and Brown, W. A. N. (1978) *Agricultural Crops for Energy Farming in New Zealand*—report to the Energy Farming Research Group of the New Zealand Energy Research and Development Committee (in draft).

Dent, J. B. and Brown, W. A. N. (1978) *Crop Biomass for Energy in New Zealand*. Proceedings of the Alcohol Fuels Conference, Institution of Chemical Engineers, N.S.W. Group, August 9–11, Sydney.

Kardos, W. and Mulcock, A. P. (1977) *"Ethanol from Agricultural Crops,"* N.Z.E.R.D.C. Report No. 28.

## 12. An Economic Survey of New Zealand Wheatgrowers

L. E. Davey, R. D. Lough, S. A. Lines, R. M. MacLean and R. G. Moffitt,  
Agricultural Economics Research Unit

Each year the A.E.R.U. undertakes a survey of New Zealand wheatgrowers on behalf of the Wheatgrowers' Sub-Section of Federated Farmers. Specific attention is focused on the physical characteristics of wheatgrowing farms, the area of

wheat and other crops grown, crop yields, livestock numbers, cultural practices and the direct costs and returns for the wheat enterprise. An attempt is also made to allocate plant and machinery overhead costs to the wheat enterprise on both an historical and current cost basis.

The survey entails visiting 180 farms, selected at random from a list of farms which have grown wheat in the previous five years. These sample farms are visited in the spring following drilling and again in the autumn after harvest.

*Further Reading:*

Moffitt, R. G. and Davey, L. E. (1977) National Wheatgrowers' Survey, No. 1, 1976-77, A.E.R.U. Research Report No. 76, Lincoln College.

A.E.R.U. (1978) An Economic Survey of New Zealand Wheatgrowers. Survey No. 2, 1977-78, A.E.R.U. Research Report No. 92, Lincoln College.

### **13. An Economic Survey of New Zealand Town Milk Producers**

L. E. Davey, R. J. Gillespie, R. G. Moffitt, Agricultural Economics Research Unit.

The A.E.R.U. has now completed four surveys of New Zealand Town Milk Producers. These are undertaken annually on behalf of the New Zealand Milk Board and the Town Milk Producers' Federation and replace the surveys originally conducted by the Milk Board.

The major objective of these surveys is to determine average net farm income received by town milk producers in New Zealand. In addition, the opportunity provided by the surveys is used to collect additional data so that a more comprehensive profile of the industry emerges.

*Further Reading:*

Gillespie, R. J. (1977) Studies in Costs of Production Town Milk Supply Farms 1975-76, A.E.R.U. Research Report No. 77, Lincoln College.

A.E.R.U. (1978) An Economic Survey of New Zealand Town Milk Producers 1976-77, A.E.R.U. Research Report No. 93, Lincoln College.

### **14. The Demand Price for Irrigation Water**

G. A. G. Frengley, Department of Farm Management and Rural Valuation

The research is based on a study of Mid-Canterbury farms which lie within the boundaries of the proposed Rakaia irrigation scheme. A stratified random sample was selected from these farms based on two criteria: soil depth and farm size. Data reflecting input levels, management patterns and productivity were obtained for each stratum. Clear relationships were established demonstrating declining production per hectare but with increasing output per labour unit. There was no indication that aggregate factor efficiency altered with increasing farm size; however, net profit per acre declined as farm size decreased but total profits per farm increased.

Optimum management practices and the profitability of irrigation with varied quantities of water were investigated using a deterministic integer linear programming model. A Cobb Douglas response function was obtained relating expected profit to the quantity of water applied.

An analysis of farmer attitudes to factors affecting investment in irrigation is also being undertaken. In addition, a study of optimum irrigation water pricing policies and legal issues relating to optimum scheme design is being pursued.

## 15. A Survey of Farmers' Attitudes to Growing Sugar Beet

D. Leitch

P. D. Chudleigh, Agricultural Economics Research Unit

G. A. G. Frengley, Department of Farm Management and Rural Valuation

With a renewed public interest in sugar beet production in 1976 and with the possibility of a government feasibility study, a survey of farmers in Mid-Canterbury was carried out early in 1977 in order to ascertain the interest, resources, and attitudes of farmers to the growing of sugar beet in their region. Results indicated considerable interest in sugar beet production. Greater interest was apparent on intensive cropping farms than on mixed cropping and livestock farms. Greater interest was also shown by younger as opposed to older farmers.

Expanding labour requirements associated with sugar beet production was considered a constraint by some of the interested growers. The use of contractors appeared a favoured alternative in gaining access to additional machinery such as a sugar beet harvester and a precision drill.

### *Further Reading:*

Leitch, D., Chudleigh, P.D. and Frengley, G. A. G. (1978) "A Survey of Mid-Canterbury Farmers' Attitudes to Growing Sugar Beet", A.E.R.U. Discussion Paper No. 39, Lincoln College.

## 16. A Survey of Costs and Practices Associated with Insect Pest Control by Firms Involved in Storing Grains and Seeds

J. B. Waller

A. J. Ferguson, Department of Entomology

The aim of the survey was to assess the degree to which insect pests were a problem to South Island commercial firms involved in storing grains and seeds. A firm was defined as any non-farm organisation that stored grain, seed, processed cereals, or stock feed.

An attempt was made to survey by mail all such firms in the South Island. Of the 228 firms so defined 48 replied that they did not store any of the commodities named. The final return was 122 useful replies, of which 78 percent were from the 'grain belt' of New Zealand (Canterbury and Otago).

Ten percent of eligible replies stated that they had recorded no insect infestations, 72 percent recorded irregular infestations, and 18 percent frequent or constant infestation.

The mean value for control costs for the surveyed firms was \$427 per annum. Small firms spent usually under \$50, medium sized firms spent from \$50 to \$600 (mean \$200), and large firms spent from \$50 to \$3000 (mean \$1350). Seventeen percent spent no money on treatment; most of these (83 percent) were small firms.

Such control costs do not include losses due to insect damage, nor the labour cost of control since 60 percent of firms applied control measures themselves and did not employ specialist pest control operators.

## 17. Computer Simulation Models of Pasture Production in Canterbury

G. W. Fick, Department of Farm Management and Rural Valuation (visiting researcher).

The objective of the project was to develop a skeleton model of pasture production on the Canterbury Plains of New Zealand. A series of mathematical models

was developed that simulated leaf area index, available soil water, and yield of green and dead herbage in the pasture. Required inputs include daily mean temperatures and rainfall, soil water holding capacities for each paddock to be simulated and initial yields and digestibilities of herbage.

These models are part of an overall project aimed at determining the optimal allocation of irrigation water on Canterbury farms as irrigation schemes in use generally provide less water than that needed to irrigate a whole farm.

*Further Reading:*

G. W. Fick (1978) "*Computer Simulation Models of Pasture Production in Canterbury: Description and User's Manual*", A.E.R.U. Research Report No. 89, Lincoln College.

## **18. Optimum-seeking Designs for Simulation Experiments**

S. R. Harrison, Department of Farm Management and Rural Valuation (visiting researcher).

This project was concerned with various procedures for determining optimal factor levels from simulation experiments. Procedures studied included traditional experimental designs, univariate search methods, steepest ascent methods and direct search methods. The project has produced listings of a set of fortran computer programs that can be used within simulation models for optimization purposes.

*Further Reading:*

S. R. Harrison (1978) "*Optimum-Seeking Designs for Simulation Experiments with Models of Agricultural Systems*". A.E.R.U. Research Report No. 87, Lincoln College.

## II. MARKETING

### 1. Japanese Textile Industry Study

G. W. Kitson, Agricultural Economics Research Unit

This project is one of a series of studies of the Japanese textile industry. The objective of the studies has been to provide New Zealanders whose activities are related in any way to the Japanese textile industry with a more substantial infrastructure of knowledge on which to make informed judgements about their activities. Results of the current study should therefore be useful for trade and industrial policy makers and for administrators of wool marketing schemes who will find the import demand forecasts for various fibres and textile products in Japan of interest. Major implications from this work are that synthetic fibre consumption is likely to continue to expand rapidly in Japan but that chemical fibre consumption will fall. Natural fibres, worsteds more so than woollens, will experience relatively low growth rates except for blends with synthetics. For these blends consumption growth rates will be quite high. Although demand forecasts for woollen carpets are encouraging it is expected that they will become increasingly confined to the high price high quality sector of the markets and that the major use for wool as a fibre in carpet consumption will be as a blend with synthetic fibres.

The fortunes of wool in Japan are more intimately related to the activities and policies of three large multifibre spinning companies and one synthetic fibre maker than they are to the specialist wool spinning companies.

In trying to analyse the joint impact of oil price changes and exchange rate changes on the synthetics and natural fibre industries in Japan the study has concluded that because nearly 30 percent of Japan's synthetic fibre and synthetic fabric production is exported and cannot therefore be given trade protection, then that sector will have more immediate adjustment problems than wool. However, because oil related costs for synthetic production are much more substantial than for wool and with oil prices effectively falling as the Japanese yen grows stronger the synthetics industry will in the longer term become even more dominant over wool.

Many N.Z. marketers both of wool as a fibre and wool fabrics fail to carry out adequate research in Japan before committing themselves to particular distribution channels. The study suggests that marketers, especially of textile goods, should have a much clearer understanding of the various market niches available for their product type before selection of wholesale channels.

#### *Further Reading:*

G. W. Kitson (1978) *"Interfibre Relationships and Textile Marketing in Japan"* A.E.R.U. Research Report No. 95, Lincoln College.

### 2. Japanese Fishing Industry Research

G. W. Kitson, Agricultural Economics Research Unit

The programme of research into the Japanese fishing industry was inspired by the difficulties faced in negotiation of fishing rights for Japanese in New Zealand's newly established 200 mile economic zone. This research sought principally to do two things. The first was to assess the impact of not only the N.Z. exclusive economic zone on both the Japanese food consumption status and the Japanese fishing industry but also the impact on Japan of similar extensions of territorial

waters in other parts of the World. The second objective was to provide some guidelines for New Zealand marketing organisations on the market prospects for New Zealand fish species in Japan.

The major conclusions to emerge from this research were that Japan was unlikely to feel under any great pressure from a food supply point of view to accede to N.Z. demands for greater market access for her livestock products and timber. Although about 40 percent of her total fish supplies come from economic zones of other countries (mainly the U.S.A. and U.S.S.R.) Japanese policy makers can see only a gradual reduction in fishing quotas in these waters. A more serious but again not a critical implication of exclusion from New Zealand's economic zone is the impact of this on the Japanese fishing industry especially the squid catching and processing industry, and the tuna catching industry. Loss of access to N.Z. waters would result in considerable catching and processing resource becoming idle in the Japanese winter.

The study also concluded that history will probably see New Zealand's choice of linking fishing access to agricultural product access as a good thing as a new respect of Japanese for New Zealand and vice versa will emerge as will the need to understand the other considerably better than in the past.

*Further Reading:*

Kitson, G. W. (1978) "*A Comment on Fisheries and Agricultural Trade Relationships Between New Zealand and Japan*", A.E.R.U. Discussion Paper No. 37, Lincoln College.

### **3. Japanese Trade Cycle Research**

G. W. Kitson, Agricultural Economics Research Unit

The objective of this project is to develop a better understanding of the well publicised problem of boom and bust in Japanese purchases of agricultural commodities, particularly those from New Zealand. This project analyses the cyclical behaviour of many Japanese trade and economic variables in an attempt to show how these interrelate with New Zealand exports of wool, mutton, and forestry products to Japan. Special attention has been given to changes in Japanese financial variables.

The analysis is designed to describe the cyclical behaviour of Japanese imports of agricultural commodities over a period from about 1960 to 1975. It is hoped that the project when completed will be useful in helping New Zealand traders anticipate changes in Japanese import demand.

### **4. Peak Wool Flows Through the Marketing System**

S. Martin

P. D. Chudleigh, Agricultural Economics Research Unit

The major objective of this project has been to assemble available information on seasonality and short-term peaks in New Zealand wool flow. This includes details of shearing patterns, on-farm storage, and movement of wool off farms for South Island regions. Peak wool flows through brokers' stores, private merchants' stores, scours, dumps, testing houses and ports are examined, with consideration being given to demand requirements. The conclusion reached is that seasonal and short-term peak flows of wool are quite marked, although the extent to which this adds to marketing costs, and the degree to which these costs could be reduced if wool flows were smoothed, can only be accurately assessed by further research.

Alternative methods for smoothing these peak flows are discussed. These include differential charging by brokers, payment of a storage increment to woolgrowers, extension of a concept such as the Extra-Choice Scheme, sale by

separation, and acquisition of the wool clip by a central marketing authority. It is maintained that these options are worthy of further consideration to determine their economic viability and political acceptability to the wool industry.

The project has produced a Report which is a useful basis for discussion of this important issue by those connected with the wool industry.

*Further Reading:*

Martin, S. K. (1979) "*Peak Wool Flows Through the Marketing System*", Research Report No. 97, January 1979.

## 5. Livestock Transport Flows to Freezing Works

R. Inness

G. W. Kitson, Agricultural Economics Research Unit

A. C. Zwart, Department of Agricultural Economics and Marketing

At any time of the year, livestock transported from farms to freezing works may travel longer distances than necessary: a large part of 'excess distance' costs are borne by the freezing works industry. In addition, during the peak period, it is reasonable to suppose that the average distance travelled by livestock is greater than that in the off-peak period owing to farmers' desire to timely process livestock.

Research is being carried out to determine the extent of 'assembly-inefficient' flows which are occasioned by traditional farm-works relationships or which originate with works by-passing during the peak. A linear programming model is being used to produce the least cost pattern of South Island livestock flows given estimates of regional supplies, works capacities and transport costs. The model, can generate transport cost savings from an unconstrained optimal flow pattern and from patterns with various levels of livestock holding during the peak period.

Extensions of the model could be made by including works to ports transport costs and other related processing cost advantages of separate works.

Model results to date include:

- an estimate of total excess transport costs for the South Island of \$2.5 million for the 1977/78 year.
- an estimate of excess transport costs for the South Island due to the supply peak of the order of \$500,000 for the 1977/78 year.

## 6. Rural Road Transport

L. Young

P. Chudleigh, Agricultural Economics Research Unit

Two interrelated aspects of rural road transport are currently under investigation. These projects are being undertaken with the assistance of and in conjunction with the Road Research Unit of the National Roads Board.

In particular, it is intended to ascertain the type and quantity of goods carried to and from farms; the origin/destination patterns for these movements; distances travelled, and costs incurred. Similar information is being collected for personal trip generation—with particular emphasis on the frequency, length and purpose of trips.

Data are being obtained from four counties, Matamata, Wairoa, Southland and Ashburton. These counties have been selected as being representative of New Zealand's main primary industries.

A survey of farmers' demand for both freight and personal transport is being undertaken in each of the above counties. The information thus gathered will be

processed in order to classify both the type and level of rural activity according to its trip generation characteristics.

Ultimately this information will be fed into a model developed to assist in the prediction of rural road demand (and hence wear), given a change in the pattern of land use.

Simultaneously, assembly of information is being undertaken to assist in an examination of appropriate distance taxes under the new Road User Charges Act, and to assess the impact of these charges on the rural sector. To this end, all rural general freight carriers in the four counties being studied have been interviewed; selected vehicles have been logged over a two week period, and road-side weighings have been conducted. Results to date include comprehensive data on the size and composition of rural fleets; the types of vehicles most commonly employed; the loads carried and distance travelled by them, and the extent of their utilization. It is planned to repeat part of the study in 1979 in order to ascertain any changes in the fleet structure and utilization resulting from the introduction of the distance tax.

## **7. Canterbury Beef Production and Marketing Survey 1976**

A. R. Mclvor, Department of Farm Management and Rural Valuation

The survey was undertaken with the assistance of the Canterbury Provincial District of Federated Farmers of N.Z. (Inc.) with the objective of investigating the extent to which beef cattle production and marketing was being influenced by the difficulties of having cattle slaughtered in freezing works.

The study which tended to be biased towards farms with higher than average cattle numbers indicated that delays in the removal of fattening cattle from farms for slaughter influenced the purchase of replacement store cattle with a subsequent effect upon store cattle values. Further, the study indicated that some structural change was taking place within the farms surveyed with a reduction in breeding cows in favour of fattening stock.

The implication from the survey is that over all cattle numbers on these farms will begin to decline from 1977 onwards due to fewer calves being born as a result of the planned reduction in breeding stock.

### *Further Reading:*

Mclvor, A. R. "Canterbury Beef Production and Marketing Survey 1976", Farm Management Discussion Paper No. 1, 1977

## **8. The Allocation of Milk Vendors to Supply Points in Christchurch**

R. G. Moffitt, Agricultural Economics Research Unit

In Christchurch each milk vendor begins his day by first collecting his bottled milk from a pick-up or supply point. He then proceeds to his vending area to commence his door-to-door deliveries. The objective of this project was to assign milk vendors to supply points so that total transport costs for this sector could be minimised.

The computer technique of linear programming was used to select an assignment pattern that gave a minimum total transport cost for all vendors. While most vendors can be assigned to their nearest supply point, there will always be some who must be sent to their second nearest. This occurs because of constraints to the numbers of vendors who can be serviced from specific depots.

## 9. Consumer Surveys of Christchurch Households

R. J. Brodie

M. J. Mellon, Department of Agricultural Economics and Marketing

A number of surveys have been conducted in Christchurch that investigate household purchasing and consumption patterns and factors affecting these patterns. Wine, meat, and bread have been the items involved in the three Surveys so far undertaken. The survey results have led to implications regarding marketing operations of the respective industries.

### *Further Reading:*

Brodie, R. J. and Mellon, M. J. (1977) "*Wine: A Consumer Survey of Christchurch Households*", A.E.R.U. Research Report No. 79, Lincoln College.

Brodie, R. J. (1977) "*Meat: A Consumer Survey of Christchurch Households*" A.E.R.U. Research Report No. 82, Lincoln College.

Brodie, R. J. and Mellon, M. J. (1978) "*Bread: A Consumer Survey of Christchurch Households*", A.E.R.U. Research Report No. 91, Lincoln College.

## 10. Marketing Costs for New Zealand Wool

P. D. Chudleigh, Agricultural Economics Research Unit

The objectives of this study were to analyse the aggregate cost structure of the marketing chain for wool from farm gate to f.o.b. over the 1970-1976 period and to identify areas within the marketing chain where cost savings could possibly be made.

Aggregate charges for various wool marketing activities were estimated with the assistance of a mathematical model representing quantities of wool flowing between farms, freezing works, auction centres, scouring centres, private wool stores, dumping centres and ports.

Most unit wool marketing increased at rates faster than the consumer price index or the wage rate index over the period concerned. Scouring charges portrayed the lowest rate of increase, far lower than the consumer price index or the wage rate index.

Marketing charges from farm gate to f.o.b. made up 10-18 percent of a 'derived' f.o.b. price for wool over the six years. Selling charges dominated the total farm gate to f.o.b. charges, making up 33-45 percent of total charges for the years investigated.

It is suggested that priority for further research be given to selling activities; more specifically that studies should be initiated on the economic implications of sale by sample and objective measurement in brokers' stores, and the influence of the seasonal flow of wool on brokers' costs and charges. It is suggested that lack of competition in transport, wool broking, wool dumping, and in port activities should be examined as should methods of charge setting and an apparent lack of incentive for reducing charges in some sectors.

### *Further Reading:*

Chudleigh, P. D. (1977) "*Marketing Costs for New Zealand Wool: 1970/71 to 1975/76*", A.E.R.U. Research Report No. 83, Lincoln College.

## 11. Marketing Costs for New Zealand Meat Exports

P. D. Chudleigh

M. Clemes, Agricultural Economics Research Unit

L. D. Woods, Department of Agricultural Economics and Marketing

The major objectives of the study were to analyse changes in unit charges associated with export meat marketing between 1971 and 1976, and to estimate an aggregate marketing bill for New Zealand meat exports for the six years concerned.

Marketing charges for lamb, mutton, and beef from farm gate up to f.o.b. were identified and trends in unit charges compared with wage rate and consumer price indices. Transport data used suggested that the representative charges published by the New Zealand Meat Producers' Board may underestimate average transport charges from farms to processing works and from processing works to ports.

The absolute size of the killing and freezing bill for meat, the relative increases in killing and freezing charges compared to other charges, and the extent to which livestock are apparently transported past the nearest works, suggest that some priority be given to a study of production-transport-processing interrelationships.

The study has highlighted the proportion of f.o.b. meat values made up by post-farm gate marketing and processing charges. Over the period studied, this proportion has averaged 44 percent for lamb, 61 percent for mutton and 36 percent for beef.

### *Further Reading:*

Chudleigh, P. D., Clemes, M. and Woods, L. D. (1978) "*Marketing Costs for New Zealand Meat Exports*", A.E.R.U. Research Report No. 94, Lincoln College.

## 12. Shipping New Zealand's Agricultural Exports

P. D. Chudleigh, Agricultural Economics Research Unit

The objective of the study was to assemble background information on present shipping systems and to highlight some of the major long term issues currently facing New Zealand Shippers. The importance of the overseas shipping activity in an agricultural marketing context has been studied as have current New Zealand shipping systems and world trends.

The total sea freight bill for New Zealand in 1975/76 has been estimated as around \$700 million. The study has concluded that benefits to New Zealand shippers could accrue from Government or shipper studies, undertaken from the shippers' point of view, to demonstrate where cost savings, improvements, and rationalisation of liner services may be effected, especially in terms of different ship types, scheduling arrangements, and internal cargo movements. The results of such studies could enable conference freight rate negotiations to be concluded more successfully than hitherto and could help mould the most desirable shipping system for New Zealand.

Greater shipper involvement in the planning of pre-shipment operations is particularly required since a large proportion of the freight rate for some cargoes is related to port and even pre-port activities.

It appears as though there is a need for an improved set of machinery to monitor and plan New Zealand's overseas shipping systems from the shippers' point of view. A Shippers' Council together with a Shipping Research Unit is suggested as the kind of organisational structure required.

### *Further Reading:*

Chudleigh, P. D. (1978) "*Shipping New Zealand's Agricultural Exports: Background and Issues*", A.E.R.U. Research Report No. 85, Lincoln College.

### III. AGRICULTURAL POLICY AND RURAL SOCIETY

#### 1. Indirect Benefits from Irrigation

L. Hubbard

W. A. N. Brown, Agricultural Economics Research Unit

In this study the construction and operation of major irrigation schemes are seen as providing a stimulus to the local economy in the form of increased economic activity, which results through the workings of the regional multiplier. This stimulus is the indirect impact of the investment.

In the past the indirect effects resulting from investment programmes have been largely ignored for two reasons. Firstly, under the assumption of full resource employment and no transfer costs, indirect effects cannot produce a net increase in economic activity at the national level. This does not preclude indirect benefits at the regional level, but any increased economic activity in a particular region will be matched by a decrease elsewhere, since all resources in the economy are fully utilized. Secondly, from the regional viewpoint it has been supposed that the indirect benefits arising from similar investment programmes will likewise be similar. As a result, decisions on the allocation of resources between alternative investment projects have been, and still are, made solely on the basis of primary or direct benefits.

The present study is looking to quantify the indirect benefits resulting from the Lower Waitaki irrigation schemes, since it is felt that these benefits, although previously ignored, warrant closer attention. Policies aimed at alleviating some of the regional problems within the national economy are now assuming a more prominent role: there is greater concern with regional shares of the national cake. Also, when resources in the national economy are not fully employed, alternative projects in differing regions will have markedly different impacts at the national level as a result of indirect benefits.

A further consideration is the differing impacts at the regional level from different sectoral investments (i.e. expenditure in agriculture compared with expenditure in manufacturing). Because of the structure of the regional economy, each sectoral investment will generate differing income and employment impacts, and if for instance employment is the main objective of investment, certain sectors will show greater returns than others.

It is believed that in the future these indirect impacts are likely to assume greater importance in decisions of resource allocation.

Having established the primary benefits of an investment programme, attention is focused on estimating the multiplier effects. Whatever the methodology chosen in estimating regional multipliers it will invariably involve the use of proxy measurements, owing to the scarcity of regional data. Several methods of estimation are being tried in the present study including the approximation of an Input-Output table for the region.

#### *References:*

Brown, W. A. N. (1978) *"The Economics of Irrigation to the Nation"*. Paper delivered to the Irrigation Conference, Ashburton, 11 April 1978.

Brown, W. A. N. (1978) *"The Theory of Cost-Benefit Analysis"*. Paper presented to the 1978 Conference of the N.Z. Branch of the Australian Agricultural Economics Society, Christchurch, 7-8 July 1978.

## **2. Resource Allocation in Research**

P. S. Teng

P. D. Chudleigh

J. B. Dent, Agricultural Economics Research Unit

The efficient management of agricultural research is a matter of concern in current resource-limiting conditions. This project aims at developing quantitative algorithms for practical management of research funds.

The project has commenced with a review of research management, considered to comprise five main functions:

- Generation of ideas for potential research projects.
- Research project selection with respect to national and local objectives.
- Estimating the potential benefits from research.
- Implementation of new research projects and evaluation of ongoing applied research projects.
- Evaluation of the impact of results of research.

The project anticipates development of a model system for research management within the New Zealand context and expects to test the system using selected local institutions.

## **3. Economic Evaluation of Soil and Water Conservation Policy in the High Country**

G. T. Harris, Agricultural Economics Research Unit

The objective of this project is to examine past and present policy regarding soil and water conservation in the South Island high country within a cost-benefit framework.

At present Catchment Boards propose soil and water conservation plans to individual run holders. These involve the removal of stock from any highly eroded or erodible land and the payment of subsidies to improve land elsewhere on the run to accommodate the displaced stock units. In many cases no land retirement is involved; in all cases subsidies are paid for approved works which have beneficial effects on soil and water conservation.

The evaluation will investigate the nature of possible benefits from this policy (a matter under some debate in scientific literature) and will attempt to value and compare them with the costs involved. Alternative policies may then be considered.

The results of this research should assist those government agencies involved in soil and water management to most efficiently allocate the resources at their disposal.

## **4. Energy Modelling in New Zealand Agriculture**

A. M. M. Thompson

W. A. N. Brown, Agricultural Economics Research Unit

The objective of this project is to investigate the on-farm implications of alternative future world energy situations. It is hoped to produce predictions of the changes in farm production and energy demand in the light of increasing world energy prices.

A linear programming model is being developed based upon the Lincoln College mixed cropping farm and its use of energy, both directly (in power) and indirectly (in the form of energy sequestered in the production of factor inputs).

By making various assumptions on price and availability of world energy supplies, changes in the optimal resource allocation can be produced. Such studies

should provide information on the ways in which the farm sector may react as farmers adjust production (and energy use patterns) to alternative energy price situations.

It is important that New Zealand maintains its advantage of low cost input structures, the key to competition in overseas markets and a prerequisite of viable exports. The effects of increasing energy prices (or decreasing energy supplies) may threaten the cost advantage which is currently held by New Zealand.

This study should provide some insights into the implications for the future of current policy options. For government it should show the relative merits of farm income support policies, for example, input and output subsidies, and may give some guidance for the placing of these incentives if the demand for imported energy is to be reduced. If this reduction in demand for energy inputs occurs, the likely changes in types of crop produced and the quantities of output will be of interest to the production planners. For farmers it will indicate the flexibility which may be necessary to change to be energy minimisers in order to maintain the level of their incomes.

## **5. Current Cost Depreciation and the Valuation of Farm Tractors and Headers**

L. E. Davey, Agricultural Economics Research Unit

Inflation in farm machinery prices has led to concern that farmers may not be able to maintain production when present machinery needs replacing. At the same time accountants and economists have become increasingly aware that depreciation calculated on an historical cost basis underestimates the real cost to the firm of machinery depleted over an accounting period.

The Richardson Report has recommended to N.Z. government that a form of inflation accounting known as Current Cost Accounting be adopted.

In the current study standard depreciation formulae were adapted to a current cost basis and tested at various depreciation rates to determine which method resulted in the best estimate of actual values for a survey sample of farm tractors and headers. The results support the view that the Diminishing Value method is superior to the Straight Line and Sum of the Years Digits methods.

Depreciation measured on a current cost basis was found to be around 40 percent higher for the survey tractors than that allowed under present taxation laws. For the survey headers this figure was approximately 55 percent. The 40 percent investment allowance on purchases of new farm machinery has been claimed to offset the deficiency of historical cost depreciation. The results show that on average this may be true but that the distribution of allowances is inequitable.

### *Further Reading:*

Davey, L. E. (1978) "*Current Cost Depreciation and the Valuation of Farm Tractors and Headers*", A.E.R.U. Research Report No. 86, Lincoln College.

## **6. Production and Supply Relationships in the New Zealand Sheep and Beef Industries**

K. B. Woodford, Department of Farm Management and Rural Valuation

L. D. Woods, Department of Agricultural Economics and Marketing

The object of this research is to quantify the effect of economic and physical factors on livestock numbers and per head production. This information is important for policy makers, marketing organisations and agricultural servicing industries.

The major emphasis to date has been on the development of single equation time series models to explain annual changes in livestock numbers. Data covering

the period 1964–1975 from the New Zealand Meat and Wool Boards' Economic Service Sheep and Beef Farm Survey have been used to develop models for an eight category classification of sheep and beef farms.

Preliminary results indicate a close relationship between per head production as measured by wool weights per head and subsequent changes in livestock numbers. It has been found that livestock numbers increase faster following a season in which per head production has been high than if per head production is low. It is believed that these wool weights are acting, at least in part, as a proxy for climatic factors that affect feed availability.

Attempts to directly link changes in livestock numbers to economic and climatic factors have met with only limited success. However, there is evidence for some classes of farm that aged breeding stock are withheld from slaughter when meat prices are low, and that livestock numbers increase faster in years of high spring and summer rainfall.

It has not been possible so far to delineate any direct link between farm incomes and subsequent changes in livestock numbers, despite the presence of a strong relationship between farm incomes and subsequent investment as measured by farm expenditure.

*Further Reading:*

Woodford, K. B. and Woods, L. D. (1978) *"Production and Supply Relationships in the New Zealand Sheep and Beef Industries"*. A.E.R.U. Research Report No. 88, Lincoln College.

## **7. Criteria for the Selection of Farm Advisers in New Zealand**

D. H. Lamb, Department of Farm Management and Rural Valuation

The project attempts to define advisers' jobs in terms of their working environment, objectives, resources, personal relationships, communication, attitudes to change, and job satisfaction.

One objective of the project is to produce for prospective employers some indication of the kind of person best suited to farm advisory work. A second objective is to form some guidelines which might help the universities to better train future farm advisers.

Fifty seven personal interviews of advisers (out of an intended total of about 70) have been completed. From the resulting information, some data and conclusions are presented, concerning N.Z. farm advisers and their work, in the form of a progress report on one major aspect of the project. Information on advisers' background, experience and qualifications was gained from interviewing 29 Ministry of Agriculture and Fisheries farm advisers and 22 privately-employed advisers and consultants.

Some differences in the clientele, attitudes and objectives of M.A.F. advisers and the consultant group are apparent. Personal status, recognition and job satisfaction are considered by 70 percent of the advisers to be more important personal objectives than is high income. Working objectives are mainly concerned with helping individual farmers and their families to achieve their goals, whether monetary or otherwise.

Some personality traits common to good advisers are noted. Job satisfaction amongst advisers averages seven on a 1-to 9-scale. Concern about long-term trends in the profession exists, however, and more attention must be given to retaining the right kind of people.

The information from this project should help the employers and administrators associated with farm advisers to pinpoint the factors which help an adviser to be

highly successful in his job. Advisers' opinions on their work and training, as summarised in the project report, should assist those employers and administrators to manage their staff for the greatest benefit of both advisers and farmers.

*References:*

- Lamb, D. H. (1977) "*Criteria for the selection of farm advisers in New Zealand*", N.Z. Agric. Sc. 11(1):43-44.  
Lamb, D. H. (1979) "*Farm Advisers at Work*"; in press.

## **8. Variation in New Zealand Aggregate Wheat Production**

P. D. Chudleigh

L. E. Davey, Agricultural Economics Research Unit

A. C. Zwart, Department of Agricultural Economics and Marketing

Aggregate wheat production in New Zealand has been extremely variable between years. The objective of this study was to determine the source of the variation by partitioning variation into components of planting area and yield per hectare.

The study concludes that fluctuation in area rather than yield is the major cause of wheat production variation. Compared with nine other wheat growing countries, New Zealand has exhibited the most variable wheat area over the recent 22 year period considered in the analysis. Also, the proportion of total wheat production variation due to wheat area variation has been higher for New Zealand than other countries.

If the often stated aim of New Zealand wheat policy is to produce a self-sufficient quantity of wheat, then these results would suggest that the policy has not been successful. Such a policy ought to be expected to produce a relatively stable area of wheat each year with variations in wheat production being due mainly to variation in wheat yield. Alternatively, it could be acknowledged that the major objective of the current New Zealand Wheat policy is not one of assuring stable production close to self-sufficiency but rather one of allowing a less stable production at stable prices.

*Further Reading:*

- Chudleigh, P. D., Davey, L. E. and Zwart, A. C. (1978) "*Sources of Variation in Aggregate New Zealand Wheat Production: Analysis and Implications*", New Zealand Agricultural Science, Vol. 12(2) pp. 54-61.

## **9. Supply and Pricing Policies in the New Zealand Wheat Industry**

A. C. Zwart, Department of Agricultural Economics and Marketing

The objective of this ongoing research is to investigate the effectiveness of wheat pricing policies in New Zealand. The research has analysed the ability of the current policy to obtain its stated objectives and also considered the impact of alternative pricing policies. A theoretical evaluation of alternative policies would suggest that a policy which maintains a domestic price at a level comparable with world price levels would maximise the value of the wheat industry to the nation as a whole.

The major analytical component of the project is an analysis of the economic factors which influence the area of wheat sown in any year. Separate analyses have been conducted for the major wheat growing regions in an attempt to identify any major differences in response between regions. The results of this

analysis have shown that there are no major differences between regions and that for the country as a whole the major factor influencing the area of wheat sown is the price of wheat relative to the price of meat and wool products.

It is anticipated that the estimated supply response relationship will be incorporated in a formal model for the wheat sector which could be used to simulate the impact of alternative pricing policies.

*Further Reading:*

Zwart, A. C. (1978) Economics of the N.Z. Wheat Industry, Proceedings of 1978 Lincoln Farmers Conference, Lincoln College.

## 10. Farmer Opinion Surveys

J. G. Pryde, Agricultural Economics Research Unit

In the New Zealand economy agriculture continues to occupy a major role and the aggregated decisions of farmers have an important influence on the level of internal demand, the balance of payments and investment. There are approximately 45,000 farming 'firms' and in characteristic independent style, many of the important decisions are made by farmers uninfluenced by Government, the agricultural business sector and other farmers.

At least once a year, usually near the end of the production period, it is generally recognised that farmers assess their situation and make important decisions relating to their livestock numbers, output, cropping, farm investment, etc., in the new season ahead. Two postal sample surveys, one in 1977 and one in 1978, have attempted to monitor these decisions and also opinions on a number of important agricultural policy issues.

In each survey, a randomly selected sample of just over 3,000 farmers throughout New Zealand was selected. Each farm had to be at least 18 hectares and the dominant activity had to be either dairying, sheep-beef farming or arable farming.

The questionnaire contained questions on a wide range of topics including intended livestock numbers, cropping programmes, price expectations for the farmer's major products, income expectations, investment intentions, and inflation expectations. In addition respondents were asked for information relating to their use of the main five types of advisory service available in New Zealand (1977 Survey) and details of their indebtedness and assessment of the main organisations providing agricultural finance. There were in addition questions on policies relating to farmer motivation and effectiveness of producer organisations (1977 Survey) and a range of questions on use of agricultural chemicals, animal remedies, fencing, farmer reading and influence of the media, etc., (1978 Survey) were inserted on behalf of subscribing firms and organisations.

Satisfactory response rates were received to the two surveys and the resulting data have been used by those involved in agricultural policy making and the agri-business sector. The information derived from the surveys has been summarised and tabulated in two reports.

Some of the conclusions from the 1978 Survey showed that six percent of farmers have no liabilities and 86 percent of farmers have liabilities of less than \$100,000. The Rural Banking and Finance Corporation holds the largest proportion of farmer liabilities (36 percent), followed by family relatives (17 percent), and trading banks (10 percent). On average farmers pay annually insurance premiums on their own lives averaging about \$680, but only 15 percent have loans from the life insurance organisations. Whereas in the 1977 Survey respondents estimated the rate of inflation in the 1977-78 season would be around 14 percent, in the 1978 Survey the estimate for the 1978-79 season was lowered to 12 percent.

The 1978 Survey disclosed that half the respondents had to revise their production decisions during the 1977-78 season and about a quarter had to revise their decisions relating to investment on the farm. The widespread drought and the

squeeze on profitability were cited as the main reasons for these revisions. The 1978 Survey disclosed that a small majority of farmers support the current wool marketing methods but that two thirds want a direct vote to elect representatives to the Meat and Wool Boards in preference to the present system of merely electing representatives to the Electoral Committee which in turn elects representatives to the N.Z. Meat and Wool Boards.

*Further Reading:*

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Pryde, J. G. (1978) "*Survey of New Zealand Farmer Intentions, Expectations and Opinions*", June–August 1978. Research Report No. 96, November 1978.

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