DAIRY FARMING IN THE BERRIQUIN AND DENIMEIN IRRIGATION DISTRICTS.

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In particular, it is desired to thank the 43 farmers whose willing co-operation made this survey possible.

1. SUMMARY.

Scope and Objectives of the Study.

This article is based on a survey made during the latter part of 1953 of 43 dairy farms in the Berriquin and Denimein Irrigation Districts which are located in the Southern Riverina. (See Figure 1.)

It presents a comprehensive description and analysis of land use practices, methods of herd management, and other characteristics. This is prefaced by a summary of the geography of the survey area and its agricultural history.

The central objective of the study was to examine the character of dairy farming under irrigation in the southern sector of the State and to make an initial appraisal of the potentialities for expanding this part of the industry in the survey area and like regions. Inter-regional comparisons are made so as to emphasize the salient characteristics of the survey farms; these comparisons involve references to previous surveys of farms in the Tongala-Stanhope District of Victoria and two coastal areas in New South Wales.

Major Conclusions.

1. Dairy farmers in the Central Murray Valley have achieved a notable production record which is of special merit in view of the short history of dairying in the region.

2. From a production viewpoint, the average dairy farm in the survey district far outrivals its counterpart in the coastal districts which are the traditional stronghold of dairying in this State.

3. A recent swing to dairying by a significant number of fat-lamb and wool producers and a brief financial analysis of the survey farms support the theory that dairying under irrigation is a profitable enterprise in the Southern Riverina. However, more detailed economic information needs to be secured before this point can be firmly established.

4. Dairying in the survey region presents fair prospects. However, the relative economic merits of dairying and alternative forms of irrigation farming should be the subject of a detailed examination before any firm decision is made on the future role of dairying in programmes for developing irrigation in the inland zone.

2. INTRODUCTION.

How productive are dairy farms in the inland irrigation regions of New South Wales? This was the question which prompted a recent survey of farms in the Central Murray Valley by the Division of Marketing and Agricultural Economics. A group of dairy properties was visited in the Berriquin and Denimein Irrigation Districts and a standard list of questions was asked of their managers. An analysis of the findings of the survey is presented in this article. Dairying in this State has been associated traditionally with the coastal regions, in which the industry has always been concentrated. Official statistics show that only about 20 per cent. of the State's dairy cows are located outside the coastal areas. Consequently interest in the industry has been focussed mostly on the problems associated with coastal production.

Recently some observers have given thought to prospects for inland dairying as part of a programme for the better utilization of the natural water resources in the large river basins of the central and south-western regions of the State.[1]

Although much useful information can be gained from Victorian irrigation areas on the economics of dairying under irrigation, there is no factual information at the farm-level about this side of the industry in New South Wales. No adequate set of figures is available which will show how productive and how profitable dairy farms can be under irrigation in the inland areas. Nor is similar data available for alternative forms of irrigation farming, such as fat lamb production. Hence, the position dairying might occupy in relation to competitive types of farming in the inland areas remains an obscure question. This is a problem of paramount importance when attempting to decide the economic merits of allocating scarce water resources to dairy farms in preference to other types of farms.

This survey has been designed as the initial phase of a more lengthy programme of research which aims to supply factual information on these problems of value to those interested in programmes for water conservation and irrigation in the inland regions. It provides a summary of the main characteristics of land use on an important group of dairy farms in two leading irrigation districts of the Riverina. Current production and management techniques on 43 farms are analysed and, in order to emphasize the merits of these farms in the more general field, comparisons are made with known conditions in other dairying regions.[2] The problem of production costs is also discussed, but not in any detail.

The facts presented in this report cannot be applied *ad hoc* to other irrigation regions since they apply to a precise group of farms in a restricted area. However, the report does provide a fairly reliable, but somewhat conservative, guide as to what could be achieved on other farms if managed with a reasonable degree of skill under conditions comparable with those of the survey districts.

This land use study was conducted in the Berriquin and Denimein Irrigation Districts because they contain the largest single concentration of irrigation dairy farms in the inland regions of the State. They also present geographic conditions which are repeated in other areas of

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[1] See the recommendations made in the Report of the Irrigation Development and Food Production Advisory Committee, Parts I and II, 1952.

[2] The surveys used in these inter-regional comparisons have been discussed in published reports as follows:—

(*a*) Sixty-five farms in the Manning River Region:—*See* J. Rutherford, "Some Aspects of Land Utilization on Dairy Farms on the Lower North Coast", *Review of Marketing and Agricultural Economics*, Vol. 19, No. 4 (December, 1951.) *Also* "Further Aspects of Dairy Farming on the Lower North Coast," Vol. 20, No. 1 (March, 1952.)

(*b*) Seventy-one farms in the Richmond-Tweed Region:—"Dairy Farming on the Red Basaltic Soils of the Richmond-Tweed Region," same journal, Vol. 21, No. 5 (March, 1954).

(*c*) Thirty-four farms in the Tongala-Stanhope Irrigation District of Victoria:—*See*: *Water Requirements in Relation to Irrigated Dairy Farms in the Tongala-Stanhope Irrigation District.* Bureau of Agricultural Economics, Canberra (1949).

the inland river valleys. There is considerable potential for duplicating and improving on the increases in rural productivity which have been achieved in the Berrinquin and Denimein Irrigation Districts.

Notwithstanding the remarkable progress already made on most of its commercial dairy farms, this part of the State is still in a developmental stage. Intensive methods of farming (characterized by heavy rates of soil fertilization and high stocking rates on improved pastures) have not been adopted for sufficient time in the area to build up the soil fertility to its potential level. This fact is amply demonstrated by comparing the soil and pasture conditions of the Berriquin District with those characteristic of neighbouring areas across the Murray River in Victoria. These regions are geographically similar to the Berriquin area, but they have been closely settled for irrigated dairy farming for many decades. A long period of pasture improvement has built up the level of soil fertility well above that of the virgin soils.

3. THE SURVEY AREA.

Description of the Area.

The Berriquin Irrigation District, which comprises the bulk of the survey area, has been described already in a number of published reports. Stocking rates in this region were analysed and a brief history of its development was given by Gruen in a previous issue of this journal.[3] A general description of the geography of the district and a detailed discussion of its soil types has been presented by Smith.[4] Finally, Shaw has analysed in some detail the general character of land use in the survey area and adjacent regions.[5]

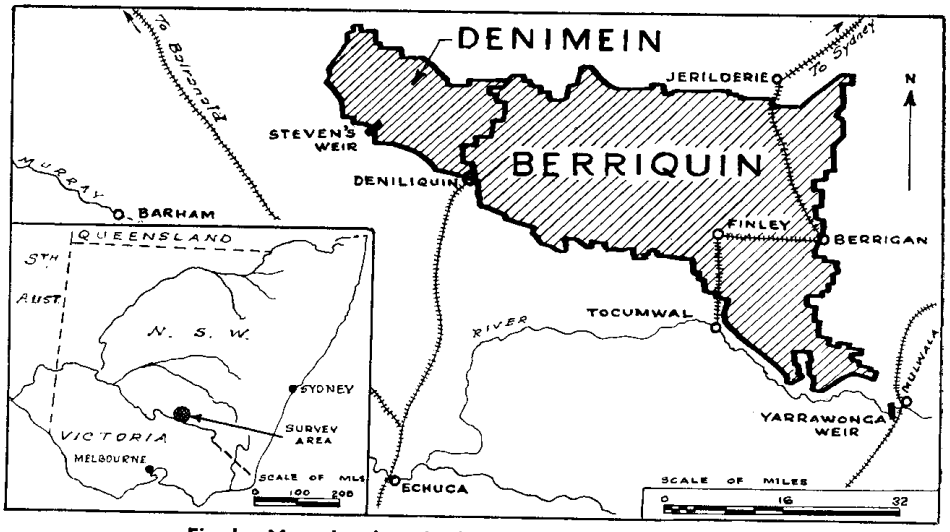

Fig. I.—Map showing the location of the survey area.

[3] F. H. Gruen, "Stocking Rates in the Berriquin and Wakool Irrigation Districts," *Review of Marketing and Agricultural Economics.* Vol. 21, No. 2 (June, 1953).

[4] Robert Smith, "Soils of the Berriquin Irrigation District, N.S.W.," Council for Scientific and Industrial Research, *Bulletin* No. 189 (1945).

[5] John H. Shaw, "Land Use in Deniliquin Region," *The Australian Geographer,* Vol. VI, No. 2 (March, 1953), *pp.* 31-37.

The following is a summary of the more important aspects of the survey area and its development as emphasized in these studies:

Location.

The survey area is located in a region comprising part of the old flood plain of the Central Murray River in the Southern Riverina district of New South Wales. The accompanying map (see Fig. 1) indicates the location of the two districts.

The Berriquin Irrigation District stretches from the towns of Mulwala and Berrigan in the east to Deniliquin in the west. It embraces about 780,000 acres and incorporates slightly more than 900 holdings to which water is delivered. The Denimein Irrigation District lies in the western Riverina adjacent to the north-western corner of the Berriquin District and embraces an area of over 147,000 acres which includes 102 holdings to which water is delivered.[6]

TABLE I.

Average Monthly and Annual Rainfall at Selected Localities.

Station.	Mulwala.*	Berrigan.†	Finley.*	Deniliquin.†
Number of years	39	70	47	85
	Inches.	Inches.	Inches.	Inches.
January	1.14	1.08	1.25	1.00
February	1.17	1.12	0.91	1.04
March	1.51	1.40	1.24	1.24
April	1.45	1.54	1.14	1.35
May	1.70	1.62	1.42	1.58
June	2.25	1.97	2.03	1.75
July	1.80	1.41	1.51	1.32
August	1.89	1.72	1.66	1.42
September	1.65	1.48	1.46	1.48
October	1.64	1.62	1.46	1.50
November	1.30	1.18	1.12	1.06
December	1.31	1.19	1.27	1.04
Annual	18.81	17.33	16.47	15.78

Sources:

* C.S.I.R. Bull. 189, *op. cit.*, p. 9.

† *Results of Rainfall Observations made in New South Wales,* Commonwealth Bureau of Meteorology (1948).

Climate.

The climate of this part of the State has been described as "typical of the middle basin of the Murray River which is interior lowland in the temperate zone"[7]. On the average, most of the rainfall occurs in the winter months, although thunderstorm activity provides valuable summer rains. The summer months are characterized by hot and generally dry conditions and the winters are usually mild with few frosts. High evaporation rates are experienced, the average evaporation rate greatly exceeding the average rainfall.

[6] See the *Report of the Water Conservation and Irrigation Commission for the Year Ended 30th June,* 1953, Appendix C.

[7] C.S.I.R. Bulletin 189, *op. cit.* p. 9.

Average annual isohyets show that rainfall is highest in the eastern sector of the survey area and falls off gradually towards the west. Table I summarizes the average monthly and annual rainfalls at certain centres within and closely adjacent to the survey area. Climatically the area lies partly within and partly beyond the dry marginal zone for commercial wheat growing. It is naturally suited to extensive sheep and cattle raising and, therefore, irrigation is essential for more intensive pursuits such as fat lamb and dairy production. An analysis of the water requirements of plant growth in relation to observed falls of rain and the incidence of evaporation have shown clearly "that for effective pasture production for fat lamb raising, the early autumn irrigations in March-April and the spring irrigation in October are essential".[7] High evaporation rates and lower rainfalls in summer also make summer irrigation a prerequisite for successful dairying during this season.

Topography.

The area has a landform which is characteristic of the Riverina plain country. Moderately sloping and undulating country is found in the east; this merges into very flat plain country in the west, broken only by occasional sandhills. The drainage pattern is ill-defined, and poor drainage results in boggy conditions during the wet winter months, especially on the heavier soil country.

Vegetation.

Although largely removed by settlement, the natural vegetation of the area is of the savannah woodland type in the higher rainfall areas, merging into treeless plains in the drier northern and western sectors. Important tree types include the following: grey box (*Eucalyptus hemiphloia*), Murray pine (*Callitris propinqua*), yellow box (*E. melliodora*), belar (*C. Luehmannii*), black box (*E. bicolor*), river gum (*E. camaldulensis*). The natural pastures of the area are mentioned at a later stage (see page 112).

Soils.

The soils of the survey area fall within two of the major groupings defined by Prescott, viz., red-brown earths (south-eastern sector) and the grey and brown soils of heavy texture (covering the bulk of the area). The soil characteristics, particularly their suitability for certain types of irrigation, vary quite markedly throughout the region, but a fuller description of soils is beyond the scope of this report.[8]

Irrigation Supplies.

The Water Act of New South Wales provides that districts may be constituted for domestic and stock water supply purposes or for stock, domestic and irrigation supplies. The Berriquin and Denimein Irrigation districts form two districts of the latter type created for the better

[7] C.S.I.R. Bulletin 189, *op. cit.* pp. 10-11.

[8] These variations in soil types undoubtedly affect the suitability of the survey area for dairying which depends on heavy summer applications of water. However, no detailed soil survey of the district has been made, so that the influence of soil characteristics on the management of the 43 farms has not been considered.

utilization of the Murray River waters.[10] Water is diverted from the Murray River at Mulwala, upstream from the Yarrawonga Weir, and is transmitted through a series of channels to serve the Berriquin and Wakool Districts. The Mulwala Canal supplements water gained from the Edward River which is an effluent of the Murray River.

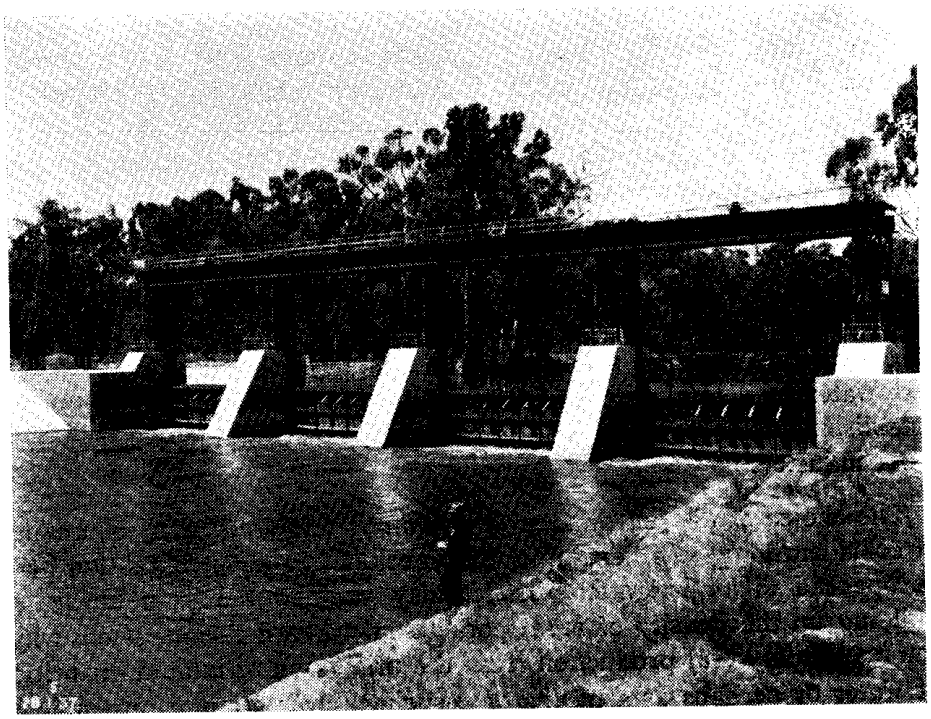

Fig. 2.—Shows the Steven's Weir, on the Edward River, where water is diverted to supply the Wakool Irrigation District.

[Photo by courtesy of the Water Conservation and Irrigation Commission.

From the main canal, water is distributed by means of a series of major channels and is supplied to farms by outlets at convenient places on each property. The amount of water used is gauged by a Dethridge wheel (see Fig. 4) and the farmer is charged a fee for water used.[11] By means of specially constructed channels, graded land surfaces and check banks the farmer is able to distribute required quantities of water over his land.

Successful flood irrigation requires careful preparation of the land and close control over the application and drainage of water. Irrigation water is applied in the spring, summer and autumn periods, that is, at times when the natural rainfall is lowest, according to the particular

[10] Other Districts or Provisional Districts which have been constituted in the Murray River area include: Wakool, Deniboota, Jenargo, and Barramein.

[11] For example, in 1952-53, the charge made in the Berriquin Irrigation District was £1 per acre-foot for the minimum water right and 15s. for additional water used for irrigation.

seasonal requirements of the pastures or crops being watered.[12] The quantity of water applied is governed by a number of factors including the type of pasture or crop involved, the nature of the soil, and prevailing climatic conditions.

As forms of irrigation development, the Berriquin and Denimein Irrigation Districts are to be contrasted to Irrigation Areas. "An essential difference between an Irrigation Area and an Irrigation District is that in the case of the former all the land to be included in it is acquired by the Crown and then subdivided into whatever number of separate holdings as may be determined. With a District, existing ownership of the land is not disturbed, but works such as weirs, canals, etc., are built by the Water Conservation and Irrigation Commission to bring water to existing properties. Development of an Irrigation Area is generally on an intensive scale, an example of which is the horticulture industry on the Murrumbidgee Irrigation Area. Extensive irrigation farming as practised in the Irrigation Districts implies less water on a total acreage basis and is generally associated with the establishment of pastures and grain production and the sheep and wool industry."[13]

The choice of district or area development is governed by a number of considerations. For example, the development of an irrigation area as opposed to an irrigation district may be favoured as a means of building up the density of rural population, or as a means of ensuring the maximum rural production from the utilization of limited quantities of water or perhaps as a means of ensuring the maximum return from any given capital outlay. On the other hand, economic conditions may favour the development of an irrigation district because of the need to expand the production of a grazing industry or to stabilize an existing grazing industry. Irrigation areas have been favoured in Victoria, whereas irrigation districts have been favoured in New South Wales (except, of course, in the case of the Murrumbidgee Irrigation Area and the Coomealla, Curlwaa, Hay and Tullakool Irrigation areas)[14].

Rather than merely stabilize or help to expand a comparatively extensive grazing industry, the provision of water to landholders in irrigation districts may actually encourage a considerable intensification of settlement. This has occurred in the Berriquin Irrigation District.

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[12] A comprehensive discussion of the recommended techniques of irrigation farming in the Riverina Districts is presented in: *Irrigation Farming—with Special Reference to Riverina Irrigation Districts.* (1951), N.S.W. Department of Agriculture.

[13] See: *Water Conservation and Irrigation in New South Wales* (undated). Pamphlet issued by the Water Conservation and Irrigation Commission of N.S.W,. p. 24.

[14] For a discussion of the relative merits of *intensive* and *extensive* irrigation schemes, see: R. O. Kefford, "Intensive or Extensive Irrigation," *Aqua,* Vol. 1, No. 7 (March, 1950), pp. 9-15.

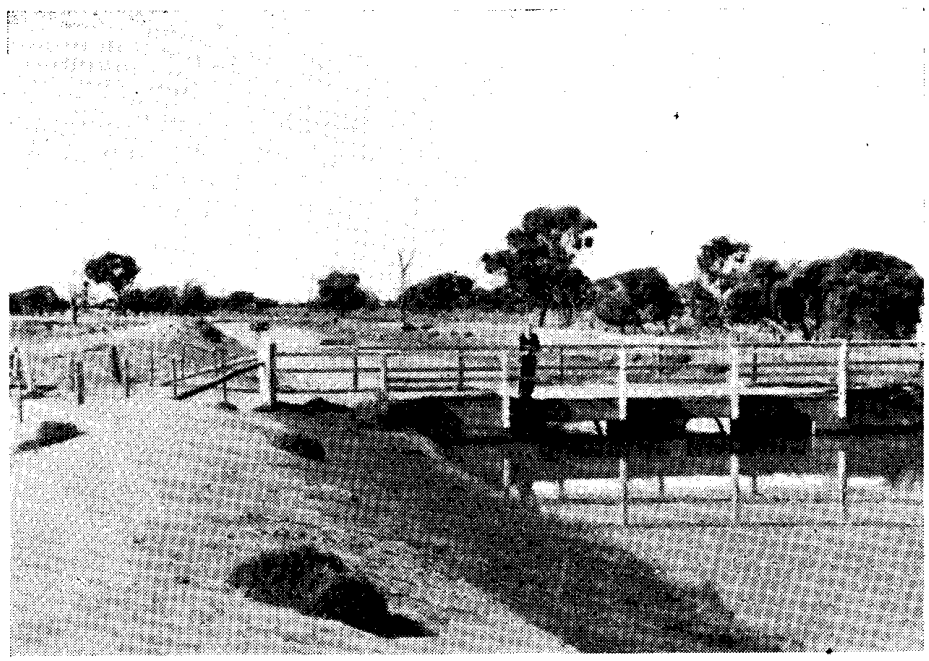

Fig. 3.—Shows a road bridge crossing a major irrigation supply channel.

The influence of irrigation on land utilization in the Berriquin District has been to encourage:

(a) Increased sheep carrying capacity and the evolution of a stable fat lamb industry.

(b) The emergence of a small but growing dairy industry.

(c) A decline of wheat production on most holdings.

Agricultural History.

Shaw[15] has divided the history of land settlement in this part of the State into the following three periods:—

(*i*) *The Period of Extensive Grazing.*

"Early land settlement in this portion of the Murray Valley was typical of the vanguard of the squatting age and was characterized by the advance of pioneering pastoralists in search of new and improved grazing areas." As is largely the case to-day, Melbourne formed the outlet for the meat and wool produced in the area. Deniliquin constituted an important focal centre and was established on a strategic river crossing.

A rapid expansion of settlement took place during the 'fifties, attention being still concentrated on grazing, although "there was a marked tendency to abandon the original preference for cattle, and with a greater understanding of the value of the natural herbage of the drier areas away from the river frontage, to concentrate upon sheep." Thus the production of fine merino wool became an important pursuit in the area. Much attention is still given to this enterprise in the hinterland of Deniliquin.

[15] *op. cit.*

(ii) The Wheat Days.

With the extension of the railway in 1867 from Echuca across the river to Moama and Deniliquin and especially following the 1889 drought, wheat growing expanded in the area. "Considerable property subdivision to the east and south of Deniliquin was effected in the early part of this century to meet the expanding popularity of wheat growing." However, climatic conditions have never proved conducive to economic wheat growing in the region.

(iii) Post-Depression Grazing Trends and the Water Era.

Wheat growing and sheep grazing formed the dominant enterprises over the period 1900 to 1930. ". . . The advent of large scale irrigation, with its assured water supply, wrought a further change in the character of the grazing industries. In the immediate post-depression years there had been a swing towards fat lamb production, and with the first supplies of water to Wakool District in 1935 and to Berriquin in 1939, this trend towards fat lambs was intensified." The interest in dairying has also been characteristic of this latter stage.

Growth of Dairying in the Survey Area.

The growth of dairying in the Central Murray Valley has epitomized the marked changes in land use patterns which have occurred as a result of the development of irrigation.

Commenting on the growth of dairying throughout the Berriquin District and the changes which new types of farming have made to the landscape, Redrup points out that Finley in 1945 was:

> ". . . just another wheat and sheep centre; dusty looking, attractive in its own way, but showing little signs of movement or progress.
>
> Even then, Finley lay in the centre of what was nominally a vast irrigation belt. But although water came in the late 'thirties, lean times, and six years of war had combined to slow down the rate of its actual application to the land.
>
> To-day the picture is very different. Berriquin farmers, with a lifetime's tradition of 'dry' land wheat cropping, wool growing, and fat lamb raising behind them, are rapidly learning the marked difference which irrigation can make, and the acreage of irrigated pasture is leaping every year. This combined with the settling of scores of ex-servicemen on new Berriquin holdings is rapidly boosting the production of the district. In sympathy, Finley itself has acquired a new air of bustle and progress. New shops and cottages are rising everywhere.
>
> However, it is probably the butter factory itself that adds up to the greatest single symbol of the change which irrigation is bringing to the Riverina."

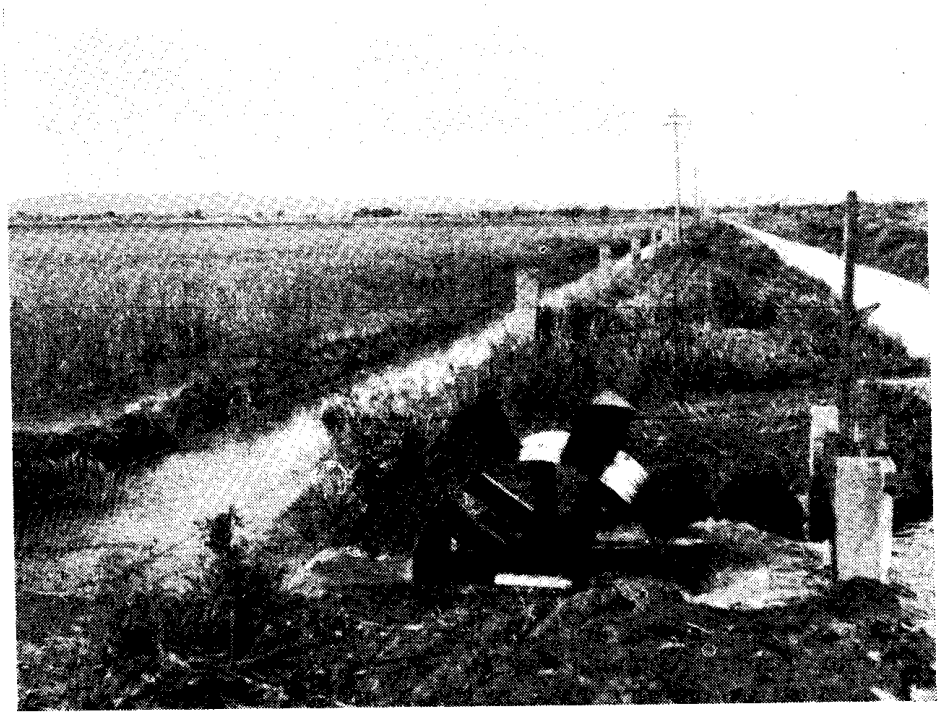

Fig. 4.—A Detheridge wheel in action—a device used to measure the amount of water taken by the farmer from the supply channel.

Fig. 5.—Illustrates the method of laying out the land for irrigation. The irrigation ditch used for supplying water is shown on the left whilst the check banks which control the flow of water over the land once it leaves the ditch are shown on the right.

TABLE II.

Year Dairying First Started on a Commercial Scale.
*43 Survey Farms.**

Year.	Number of Farms.	Year.	Number of Farms.
1952	4	1944	1
1951	6	1941	1
1950	6	1940	2
1949	1	1938	1
1948	8	1935	1
1947	3	1908	1
1946	4		
1945	4	Total ...	43

* The recent marked upward trend in dairying is not completely evident from this Table. Some of the farms included in the survey started dairying in the early post-war years, dropped out of the industry and then came back into it again in recent years. A large number of the farms which have taken up dairying in the last two or three years had not built their production in the 1952-53 season up to, or above, the level of 4,000 lbs. of commercial butter which was taken as the minimum standard for selection in the survey.

Redrup contends that an increasing number of landholders in the Berriquin area are becoming aware of the scope for intensive forms of farming such as dairying as a means of making a handsome living under irrigation conditions. He says that interest in dairying stems from the following factors:—

"1. Properties of less than 1,000 acres, obliged to carry the cost of a one-in-three water-right, can make little economic progress as purely fat-lamb holdings.

2. 'Permanent' pastures (as opposed to spring and autumn watered annual sub. and rye pastures) return best in terms of water, labour and top-dressing costs.

3. Milking cows are far more efficient and therefore more profitable utilizers of permanent pasture than sheep.

4. The general soil, water and weather conditions throughout the Berriquin District make it one of the finest potential dairying districts in Australia"[16].

These are the arguments advanced by the enthusiasts behind the development of dairying in the Berriquin District, but their case is vigorously contested by many of those who favour alternative forms of farming in the region.

Dairying is still a minor form of land use in the Central Murray Valley of New South Wales. Only recently has it been seriously thought that it might become a dominant industry in the area. Commenting on the interest in dairying which followed the introduction of irrigation water into Berriquin (and to a lesser extent into Wakool), Shaw attributes the trend to the fact that dairying "gave a regular, short-term quick return (a cheque maybe every few weeks) for expenditure upon water rights and improvement investments". In Shaw's

[16] These comments were made by John Redrup when describing the growth of the Finley Butter Factory. See *The Leader* (Melbourne), January 6th, 1954, p. 15.

opinion "this initial phase appears, however, to be passing, and tendency in recent years has been to concentrate upon irrigation pastures for sheep raising, primarily for fat lambs and mutton".[17] The scene has changed since Shaw made these observations. Notwithstanding the fluctuating fortunes of dairying in the Central Murray Valley, there is every indication that the industry is now becoming more vigorous, as people interested in relatively small-scale farming become aware of the scope for efficient dairying which the district offers.

TABLE III.

*Farmers' Reasons for Taking up Dairying.**
43 Survey Farms.

Reason.	Number of Farmers Stating this Reason.
Dairying offered a regular and stable income	9
The relatively high prices being paid to farmers for dairy products	8
The farmer had had previous experience dairy farming in the survey area or in Victoria	8
Dairying was the best form of land use in the survey area ...	5
Farmer was compelled to adopt dairying for economic reasons ...	4
To give a son or some relative an interest on the land	4
Farmer has always been dairying either in the survey area or in Victoria	3
Dairying the only satisfactory type of land use for the particular farm (because of its size or irrigable area)	2
Dairying offers a ready source of income in the initial stages before adopting a more extensive form of land use (e.g., fat lambs)	2
As a new venture	1
Because the farm had been exhausted from continuous wheat farming	1
As a sideline activity to supplement wages from non-farm work...	1

* Several farmers gave more than one reason.

Table III summarizes the reasons advanced by the 43 farmers as to why they commenced dairying. It will be seen that, for the majority of these farmers, dairying in the Berriquin or Denimein Districts offered a vocation which was financially attractive and in many cases it was a vocation which they had followed previously in other areas (especially in Victoria).

During the last season the number of suppliers to the Finley butter factory reached approximately 190, representing a remarkable development from the year 1946 when only a few suppliers were recorded. A record production of about 400 tons of butter was achieved by the factory during the 1953-54 season. This was 90 tons more than the previous record established in the 1952-53 season. A remarkable feature of this development has been that the Berriquin and neighbouring Irrigation Districts have the distinction of being in the forefront of the State's dairying industry as far as official herd test records are concerned. (See page 131.) These results are a striking testimony

[17] *Op. cit.* p. 90.

of the remarkable effects which irrigation has had in raising the farming potential of an area which was previously marginal for non-irrigated wheat production and, in its western parts, suited to comparatively extensive sheep and fat lamb grazing.

The judicious application of water and fertilizers (mainly superphosphate) to the soil and the consequent production of lush pastures have wrought a profound change in the landscape of this part of the State—a change which is strikingly evident to even the casual observer who travels from the dry country around Jerilderie into the green belt which begins north of Berrigan and stretches to the west some 50 miles to Deniliquin and beyond.

Choosing the Sample of Farms.

The majority of the dairy farms in the Berriquin and Denimein Irrigation Districts send their product to the butter factory at Finley which was established in 1946. A few farms supply the factory at Cobram in Victoria, whilst several farms produce wholemilk for local town supply. During the 1952-53 season there were known to be more than 200 farms in the area which undertook dairying on a commercial basis. However, for the bulk of these farms, dairying was only a sideline activity of minor importance, chief attention being given to other enterprises such as fat lamb and wool production, wheat growing and beef cattle raising.

Using factory records and other local information, the survey was restricted to those farms which produced for sale, during the 1952-53 season, dairy products equivalent to 4,000 lbs. of commercial butter or more. Following this approach, it was found that 54 farms were eligible for inclusion in the survey. However, it was possible to complete a satisfactory survey of only 43 of these farms as 11 were found to be ineligible for study at the time the survey was undertaken.[18]

The importance of the 43 survey farms in district production can be gauged from the fact that during the 1952-53 season these farms contributed about 70 per cent. of the butter produced in the Berriquin and Denimein Irrigation Districts.

4. LAND USE ON THE SURVEY FARMS.

Types of Farming Activities.

To a great extent, dairying has developed in the Riverina as a sideline activity, and on many farms the importance of the dairying enterprise has varied from year to year in response to the comparative economic advantage it has enjoyed relative to other forms of land use such as wool, wheat and fat lamb production.[19]

The survey indicated that mixed farming is still characteristic of the Finley-Deniliquin area. On only 15 of the farms studied (i.e., about 35 per cent.) was dairying the sole form of land use (with pigs as a

[18] One farmer refused to co-operate in the survey, and the rest were not able to provide all of the desired information.

[19] The fact that many dairy farmers are laying down large areas of summer irrigated pasture (see pp. 113 and 114) suggests that they regard dairying as permanent since these pastures are costly to establish and they have less use for alternative forms of farming.

sideline in all cases.) On the remaining 28 farms, dairying was combined with other enterprises. The production of fat lambs was combined with dairying on 21 properties, and in some cases farmers also produced wool, beef, and wheat. Table IV provides a summary of the types of farming activities on the 43 farms.

Each farmer was asked to nominate the type of enterprise which provided his dominant source of farm income. About three-quarters of the farmers nominated dairying. Fat lamb production was the important income earner on seven of the remaining farms. (See p. 163 for an income analysis of 22 farms.)

TABLE IV.

*Types of Enterprises on the 43 Farms.**

Enterprise.	Number of Farms.
Dairying	15
Dairying with fat lambs, wool, and wheat	7
Dairying with fat lambs and wool	7
Dairying, fat lambs, wool, beef, and wheat	5
Dairying and wheat	3
Dairying and wool	2
Dairying, fat lambs, wool and beef	2
Dairying, wool and wheat	2
Total	43

* All the farms had pigs as a sideline enterprise.

TABLE V.

Comparison of Farm Size.

43 Survey Farms Compared with 34 Farms in the Tongala-Stanhope District (Victoria).

Range of Farm Size.	43 Farms—Berriquin and Denimein Districts.		34 Farms Tongala-Stanhope District.
	Whole Farm.	Dairying Section.*	Whole Farm.
Acres—	Number of Farms.	Number of Farms.	Number of Farms.
Less than 100	...	1	12
100–199	2	9	22
200–299	1	12	...
300–399	2	6	...
400–499	8	3	...
500–599	12	9	...
600–699	6	3	...
700–799	3	...	...
800 and over	9	...	...
Average acreage	631 acres.	329 acres.	111 acres.

* See footnote 21 p. 104.

Farm Size.

The question of farm size has long held a prominent place in discussions on land settlement policy in New South Wales. With regard to the Riverina and Murray Valley areas these discussions have raised inter-regional comparisons in which the relatively intensive patterns of farming that have developed in the irrigation areas of Victoria have been compared with the more extensive types of settlement encouraged in many of the irrigation regions of New South Wales.

In their present form, most of the 43 farms studied in this survey were originally designed for types of land use other than dairying, including fat lamb production, and wool and wheat growing. The new interest in dairying being displayed in the Berriquin, Denimein and Wakool irrigation districts has not been manifested long enough to encourage the degree of closer settlement that one might expect to occur in areas where landholders enjoy the present water rights. The latter allow farmers to obtain one acre-foot of water for every three acres of irrigable land on their holdings, with a maximum water right of 200 acre-feet. A considerable quantity of excess water is also made available when the storage permits.

The bulk of the survey farms are larger than is necessary for efficient dairying under irrigation conditions if farms are to be worked on a family basis with limited sideline activities other than pig raising. It is reasonable to expect that a continuance of the present interest in dairying will encourage a breaking up of the larger holdings. The majority of recent sales in the area have shown this tendency.

Total Acreage.[20]

A summary of the size of the 43 farms is shown in Table V. Properties ranged in size from as low as 100 acres to as high as 1,400 acres. The average size was 631 acres. The bulk of the farms were within the range of 400 to 700 acres, a feature which to some extent has been influenced by the fact that a number of farms of this size have been established under War Service Land Settlement in the area.

It is of interest to compare the size of the 43 farms with farm size in the survey districts as a whole. The average size of all farms in the combined areas of the Berriquin and Denimein Irrigation Districts during 1952-53 was about 910 acres. This is much larger than the average for the 43 dairy farms which suggests that the growth of dairying in these regions has been a development more common to the smaller farms and/or the new type of farming has already encouraged some degree of closer settlement.

Acreage Devoted to Dairying.

Much of the data collected during the survey suffers from the disadvantage that it applies in many cases to mixed farms on which dairying was conducted in association with other grazing activities (see pp. 100 and 101). Without some modification, figures relating to pasture areas on these farms would be of limited value to those interested in the question of determining a suitable farm size for efficient dairying under irrigation conditions.

[20] The acreage of each of the 43 farms is shown in Appendix IV.

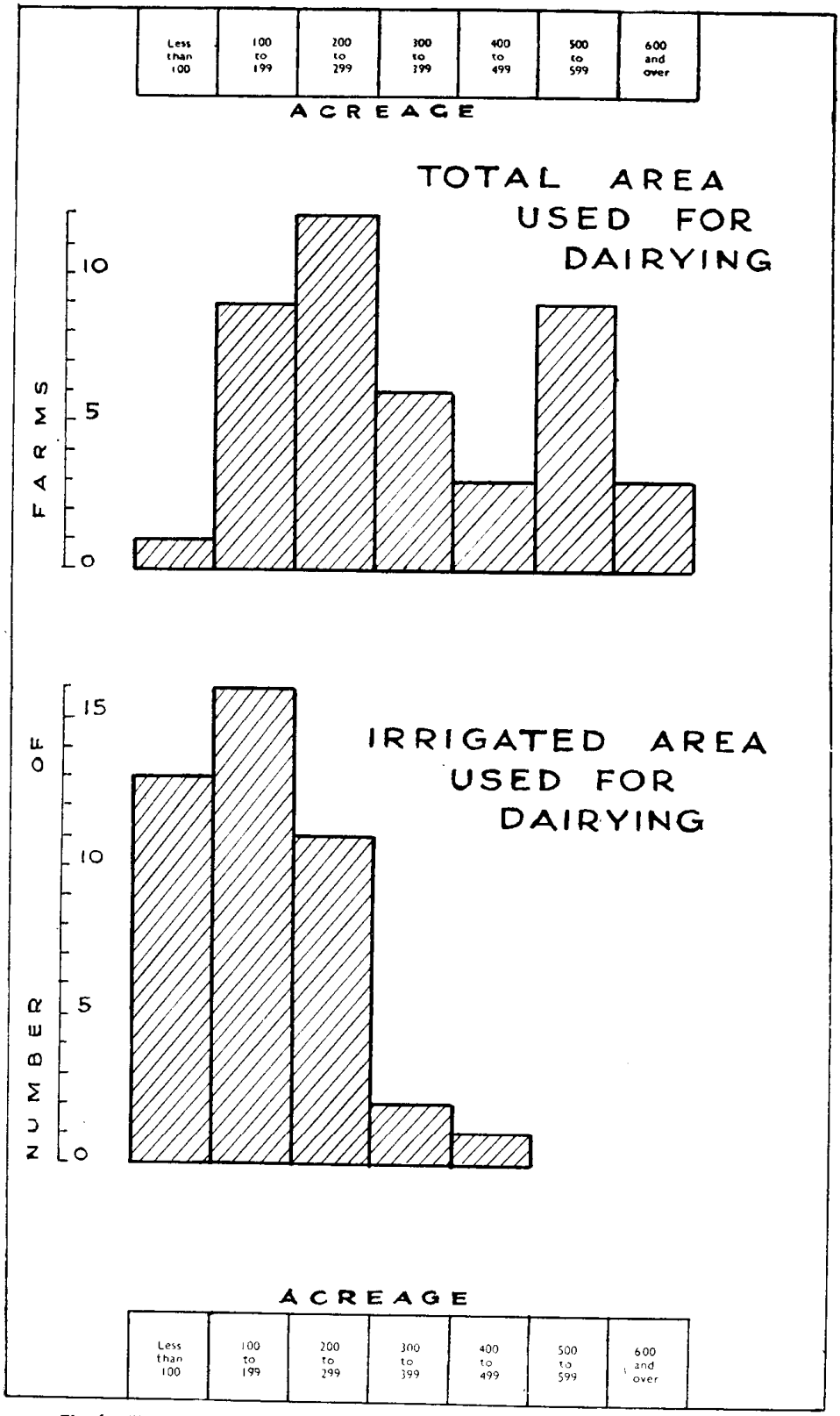

Fig. 6.—Total and irrigated areas used for dairying on 43 dairy farms in the Berriquin and Denimein Irrigation Districts. Note that the irrigated area (which constitutes the main resources for dairying) is much smaller by comparison with the total area used.

To overcome this difficulty, much of the data applying to mixed farms has been adjusted on the basis of advice given by the farmers so as to eliminate those farm resources which did not apply to the dairy enterprise. With regard to farm areas, this has been done by estimating the extent to which each paddock was devoted to dairying as distinct from other grazing pursuits.[21] From these estimates, and the figures supplied by the operators of straight dairy farms, it has been possible to calculate the equivalent acreage devoted to dairying.

The acreage devoted to dairying (see Table V and Appendix V) varied considerably from farm to farm. The average for the farms as a group was 329 acres, but it ranged from as low as 70 acres (supporting 53 milkers) to as much as 690 acres (supporting 58 milkers). However, it will be noted that about half the farms were using areas within the range of 100 to 300 acres. (See Figure 6.)

Area Irrigated.

The figures for the areas devoted to dairying include, in many cases, large amounts of unirrigated natural grass country which plays only a minor role in the dairying enterprise. The area irrigated is a much better indication of the land resources available.

The area irrigated on each of the 43 farms is shown in Appendix IV. Appendix V shows the estimated portion of this area which is used for dairying. The average area irrigated was 262 acres, whilst the average irrigated area used for dairying was 164 acres. This meant that, on the average, the 43 farms had 3.9 acres of irrigated land per cow.[22] Figure 6 summarizes the irrigated areas used on the farms.

As a general rule, the actual area irrigated was only a comparatively minor fraction of the area suitable for irrigation. Lack of suitable land, therefore, was not a limiting factor in the irrigation programme on most farms, although the unsuitability of some land for certain plants (e.g., lucerne) was a handicap on some of the properties.

Farmers' Opinions on Desirable Farm Size.

In view of the current interest in the question of farm size in irrigation development, each of the farmers was asked to express his opinion on the subject. It was not considered practicable to consider farm size in isolation as it is reasonable to expect that a farmer, when commenting on this aspect, would make certain assumptions as to the desirable amount of irrigated pasture required, the labour force necessary to work a farm of a certain size, and the number of cows to be milked.

To take account of this consideration, each of the 43 farmers was asked to nominate what he considered was a necessary acreage for dairying *under irrigation conditions comparable to the survey area.* He was asked also to indicate his assumptions when making this estimate as to: (*a*) the area to be irrigated for summer and winter

[21] These estimates apply to both pasture and cropping areas. For example, if in the opinion of a farmer the feed produced off one paddock during the latest season was used in the ratio of one-third to the dairy stock and two-thirds to other stock, one-third of this paddock's acreage was counted in the assessment of farm size, pasture and/or crop areas devoted to dairying.

[22] Of course, some of this pasture was too immature to be useful for dairy production during the 1952-53 season. The calculated "effective" acreage of irrigated pasture per cow in the season was only 2.8 acres (see Appendix III for a summary of the way in which "effective" acreages have been calculated).

pasture and the residual crop or dry land required; (*b*) the labour force necessary for such a farm; and (*c*) the number of milkers to be carried on the farm. Appendix II summarizes the opinion expressed by each farmer.

There was considerable difference in the farmers' opinions on these matters, but the following points emerge from a study of Appendix II.

Total Area Required.

The average area required was stated to be 320 acres, but areas ranged from as low as 100 acres to as much as 1,000 acres. However, 70 per cent. of the farmers stated an acreage which fell between 200 acres and 400 acres (inclusive). It will be noted that the present average area used for dairying (see Appendix V) is similar to the average of the desirable areas quoted by the bulk of the farmers.

Irrigated Pasture Areas and Dry Areas Required.

Ten farmers (23 per cent.) were of the opinion that the ideal farm they had in mind would be made up entirely of irrigated pasture with no cropping areas or dry pasture land. The practice of having no dry land is one which has been followed to some extent in Victoria, but it has not been recommended by authorities in New South Wales.

The majority of the farmers considered that an efficient dairy farm under the conditions characteristic of the Berriquin District should have both irrigated pasture and dry land with some area for cropping. However, it will be seen that considerable differences of opinion existed between farmers as to the amounts of winter and summer pasture needed.

The following table illustrates the range of opinions expressed on these matters:—

Irrigated Pastures Necessary.	Opinions of 43 Farmers.		
	Average Estimate.	Maximum Estimate.	Minimum Estimate.
	Acres.	Acres.	Acres
Total area of irrigated pasture	210	360	90
Summer pasture	103	300	30
Winter pasture	107	300	0

As might be expected in the case of an area in which dairy production is concentrated into the spring and summer months, all of the farmers considered that relatively large amounts of summer pasture (paspalum, white clover, and lucerne) would be needed for efficient dairying under inland irrigation conditions. It is of interest to note, however, the variety of opinions with regard to the areas of winter pasture required for successful dairying. In comparing the estimates for both winter and summer pasture, it should be remembered that the feed value of one acre of summer pasture is about twice that of one acre of winter pasture. On balance, it appears that the farmers favoured summer pasture which is in line with present developments (see pp. 112-114).

It is of benefit to compare the farmers' opinions of the desirable areas of winter and summer pasture with the areas they had at their disposal at the time of the survey (see Appendix V). On the average, it will be noted that the areas of pasture established by the 1952-53 season were well below the stated desirable areas. It might be concluded from this that an expansion of present pasture areas will take place, given sufficient resources.

Number of Cows to be Milked.

The average desirable number of cows to be milked was 61. Half of the farmers quoted numbers ranging from 40 to 60 head. This compares fairly well with the number milked during the 1952-53 season, so that the farmers as a group seem to have reached the desirable optimum with regard to the numbers of milkers carried.

There was no apparent relationship between the stated size of herd and estimates of the required areas of pasture. Obviously opinions varied with regard to the intensity of stocking rates possible on irrigated pastures.

Labour Force Needed.

Most of the farmers thought that more than one man would be required for managing an efficient dairy farm under inland irrigation conditions. This is in line with current developments since most of the farmers at present have more than one labour unit (see pp. 108 and 109).

Management and Labour.

Previous studies of the dairying industry in New South Wales have emphasized that the size and character of the labour force has an important bearing on the scale and effectiveness of farm operations.[23] In the present survey a brief study of the management and labour structure on the 43 farms has been made.

The Status of Manager and Farm Operator.

Table VI summarizes the status of those persons who were responsible for the making of the management decisions on the farms and those persons who actually worked the properties.

It will be seen that it was most common for the management function to be performed by one or more members of a farm family who had a vested interest in their property. About half the farms were managed by one owner-operator who was not responsible to any other person, whilst one-third of the farms were controlled by several members of a family partnership which took the form, in all cases, of a share-farming arrangement between one or more sons and their parents. As a general rule, most persons participating in the management also took part in the actual operation of their farms. Hence, in most cases, the farms were worked either by members of a family partnership or by a single owner-operator.

Using the surveys of the Manning River and Richmond-Tweed districts as guides, it would appear that the coastal farms often differ quite markedly from the irrigation farms in these respects. Particularly in the north, it is very common for dairy farms to be worked and

[23] For example, see J. Rutherford, "Further Aspects of Dairy Farming on the Lower North Coast," *Review of Marketing and Agricultural Economics*, Vol. 20, No. 1 (March, 1952).

managed by share-farmers with relatively little or no vested interest in their farms. On the whole, it is likely that this difference is responsible in part for the more efficient farming methods adopted on the irrigation properties.

TABLE VI.

Status of Persons Responsible for Management Decisions and Manual Work on Survey Farms.

Management Decisions made by—	Number of Farms.	Dairy Farm worked by—	Number of Farms.
Family partners*	14	Family partners*	14
Non-family partners ...	2	Non-family partners ...	1
Owner-operator ...	22	Owner-operator	21
Share-farmer†	1	Share-farmer†	5
Family partners and share-farmer†	1	Paid manager	1
Paid manager	1	Owner's daughter	1
Owner and share-farmer†...	2		
Total	43	Total	43

* Close relations (*e.g.*, brothers, father and sons, etc).
† Not related to the owner.

TABLE VII.

*Composition of Management and Permanent Labour Force on 43 Farms.**

Persons responsible for Management and Permanent Work.	Number of Farms.	Persons responsible for Management and Permanent Work.	Number of Farms.
Group A.—Family Labour only—		Group B.—Family and Non-Family Labour—	
Farmer alone	2	Farmer and 1 hired man...	1
Farmer and 1 son ...	12	Farmer, 1 son, 1 hired man	2
Farmer and 2 sons ...	7	Farmer, wife and 1 hired man	1
Farmer and 3 sons ...	1	Farmer, 3 sons and 1 hired man	1
Farmer and wife ...	1	Farmer and 2 hired men...	3
Farmer, 1 son and 1 daughter	2	Partners, 1 son and 2 hired men	1
Farmer, wife, 1 son and 1 daughter	1	Partners and 1 hired man	2
Farmer, wife, 2 sons and 1 daughter	1	Partners alone	2
Farmer, 3 sons and 2 daughters	1	2 sons and 2 hired men...	1
Mother and daughter ...	1		
Total	29	Total	14

* This includes all persons permanently engaged on the farms who were wholly or partly responsible for managing or working the dairy enterprise on each farm. Temporary hired labour is excluded.

Size of the Work Force.

A more detailed summary of the composition of the management and permanent work force on the 43 farms is shown in Table VII. Two groups have been distinguished: Family labour only and family labour with non-family labour. Twenty-nine farms (67 per cent.) were managed and worked only by members of the farm family. Included in the "family" category are share-farmers and their immediate family in view of the fact that on the few farms where this group was present they were responsible for both managing and working the farm. The balance of the properties were managed and worked by family labour employing the assistance of one or more workers (unrelated to the family) hired on a permanent basis and residing on the farm.

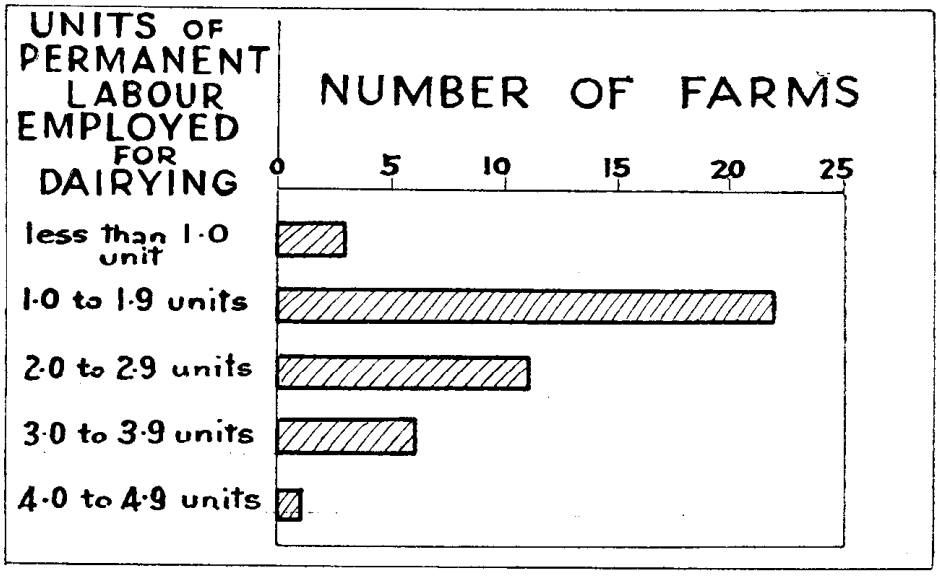

Fig. 7. Number of survey farms with various units of permanent labour engaged in dairying activities.

One significant feature of the irrigation farms was the relatively large number which used permanent hired labour—the proportion amounted to 28 per cent. of the properties surveyed. In contrast, this type of non-family hired labour was employed on only three of the sixty-five farms (5 per cent.) studied in the Manning River District.

Each farmer was asked to estimate the unit value of those employed in work associated with dairy production. This was done by assessing the equivalent value of each person employed, using an adult male as the basic unit. An adult male who devoted half of his average working day to work in the dairy was classed as one-half of a labour unit. A similar value was given to an adult male who spent the same period of time on general farm work associated with the dairy or pig enterprise and any other minor sidelines. Hence a full labour unit was equivalent to an adult male who was engaged in both these activities or full-time on the latter type of activity. Where time was spent on other activities, the farmer was asked to estimate the equivalent fraction of a labour unit applicable to dairy production as described above. The same was done in the case of juvenile or female labour.

Using these estimates, a figure has been derived for each of the 43 farms which indicates the labour force available for dairy production expressed in terms of units of adult male labour. The number of farms with various units of labour are shown in Table VIII. About half the farms had from one to two labour units engaged in dairying activities, whilst about three-quarters of the farms had from one to three units. In most cases, this comprised several adult males who spent all their working time on dairy farming.

Ten farms employed temporary labour (not included in the foregoing analysis) which was engaged for relatively short periods of the year for various purposes such as fencing and ploughing. Invariably these farms were those which had limited quantities of permanent labour.

TABLE VIII.

*Units of Permanent Labour used for Dairying on 43 Farms.**

Units.	Number of Farms.
Less than 1.0	3
1.0 to 1.9	22
2.0 to 2.9	11
3.0 to 3.9	6
4.0 to 4.9	1
Total	43

* This excludes temporary hired labour. The units have been calculated to take account of the value of male and female labour of different ages. An adult male engaged full-time on dairying activities is equivalent to one full unit.

Pastures.

The pastures of the survey region can be divided into two main groups: (i) irrigated improved pastures, and (ii) unirrigated natural grasses. The former group forms the basis of the more intensive types of land use found in the area, viz., dairying and fat lamb production.

Types of Pastures.

The irrigated pastures can be grouped into winter and summer pastures.

Winter Pastures.—The dominant species in this group are Subterranean clover (*Trifolium subterraneum*) and Wimmera Rye grass (*Lolium rigidum*). Minor species are: Perennial Rye grass (*Lolium perrene*) which is now losing favour, and Phalaris (*Phalaris tuberosa*) which is becoming more prevalent.

Subterranean clover and Wimmera Rye grass are normally sown as mixtures rather than as separate pastures. Subterranean clover is a vigorous self-seeding annual which provides palatable feed during the autumn, winter and spring months, with maximum growth in autumn and spring. Wimmera Rye grass is similar in growth habit. Phalaris is a perennial plant which also makes its growth in the autumn, winter and spring. Mixed with sub-clover, it is destined to become an important pasture in the Berriquin-Wakool Irrigation Districts for dairy cattle particularly.

Fig. 8 illustrates the lush growth of clovers and grasses achieved on an irrigation farm in the survey area.

Fig. 9. A view of dry country typical of the unirrigated lands of the Central Murray Valley.

The bare ground and poor grass growth is in sharp contrast to the type of country developed under irrigation.

Summer Pastures.—The dominant species in this group are Paspalum (*Paspalum dilatatum*), irrigation white clover (*Trifolium repens*) and Lucerne. The first two plants are becoming much more prevalent than the latter on dairy farms.

Paspalum is a nutritious and vigorous summer growing perennial which is very suited to the irrigated areas of the southern Riverina. It can be sown with white clover to form a good summer pasture.

White clover is a perennial plant which makes vigorous growth and provides nutritious feed during the late winter, spring and early summer months. It does best after soil fertility has been built up and a surface cover formed. There are a number of strains of white clover in use, but Victorian Irrigation White Clover (Dingee and Tongala) gives the best results of the types available at present.

The winter pastures are normally watered during the autumn and spring months and provide their bulk of feed during these seasons. They are largely dormant during the winter and summer months. By contrast, the summer pastures are watered in the spring, through the summer into the autumn and provide feed throughout this period. They provide little or no feed at all during the winter months.[24]

The winter pastures, when at a mature state, require less intensive water applications[25] and provide less bulk of feed than the summer pastures. On the average, one acre of winter pasture will maintain three to four sheep on an annual basis compared with an average of eight to nine sheep carried on one acre of summer pasture.[26]

TABLE IX.

Species of Pastures Developed on the Survey Farms.

Type of Pasture (alone or with other plants).	Number of Farms.	Type of Pasture (alone or with other plants).	Number of Farms.
Lucerne	29	Italian Rye Grass	2
Paspalum	32	Rhodes Grass	3
White Clover	28	Phalaris	10
Kikuyu	2	Cocksfoot	6
Subterranean Clover ...	42	Poquatica Swamp Grass ...	1
Wimmera Rye Grass ...	41	Red Clover	1
Perennial Rye Grass ...	16	Prairie Grass	1

[24] A fuller description of pastures suited to the survey area and recommendations for their management are presented in *Irrigation Farming, with Special Reference to Riverina Irrigation Districts, op. cit.* Pp. 52-56.

[25] For example, during the five years ended 1952-53, the average annual quantity of water applied to irrigated pastures in the Berriquin Irrigation District was as follows: Summer pasture, 2.2 acre-feet; winter pasture, 1.0 acre-feet. (Source: *Annual Reports of the Water Conservation and Irrigation Commission*, N.S.W.)

[26] For a detailed analysis of stocking rates in the Berriquin and Wakool Irrigation Districts, see Gruen, *op. cit.*

TABLE X.

Number of Farms with Various Pasture Types as an Important Source of Feed for Dairy Stock.

Type of Pasture.	Number of Farms.
Lucerne...	17
Lucerne and White Clover	1
Lucerne, White Clover and Paspalum	1
Paspalum	6
Paspalum and White Clover	12
Paspalum and Lucerne	1
White Clover with plant types other than any of the above (*e.g.*, Perennial Rye)	3
Subterranean Clover and Wimmera Rye grass	40
Subterranean Clover (with or without other plant types such as Perennial Rye grass)	4
Wimmera Rye grass	1

Natural Grass Pastures.

Prior to the introduction of irrigation, the extensive grazing industries which had developed in the Central Murray Valley were based on the grazing of natural pastures. Because of the low and erratic rainfall, these pastures support low stocking rates which average about one sheep to 2½ acres, being somewhat higher in the east than in the west because of the westward decline in average rainfall.

Whilst irrigated pastures and crops form the basis of the modern intensive sheep and dairying industries of the region, natural pastures are still used during their period of seasonal growth. On dairy farms they are used for running "dry" stock and young stock.

The important natural pasture species in the survey area are: *Danthonia* spp., corkscrew (*Stipa* spp.), barley grass (*Hordeum leporinum*), burr trefoil (*Medicago denticulata*) and crowfoot (*Erodium* spp.).

Changes in Types of Irrigated Pasture.

As indicated in Table XI, there has been a marked build-up of irrigated pastures in the Berriquin and Denimein Irrigation Districts during recent years.[27]

TABLE XI.

Area of Irrigated Pastures—Berriquin and Denimein Irrigation Districts.

Year.	Irrigated Winter Pasture.	Irrigated Summer Pasture.*
	Acres.	Acres.
1948–49	56,044	19,403
1949–50	57,158	19,967
1950–51	81,756	17,762
1951–52	72,531	20,875
1952–53	94,683	20,837

*Includes lucerne.

[27] These figures have been adapted from the Annual Reports of the Water Conservation and Irrigation Commission of New South Wales.

It will be observed that the overall development of irrigated improved pasture in these districts since 1948-49 has been confined mainly to winter pastures; the acreage of summer pasture has shown little change. The main reason for this trend is that most farmers in the area concentrate on sheep raising with fat lamb production as a dominant enterprise. Winter pastures enable the farmers in this part of the State to produce first quality fat lambs for the profitable early spring market.

In contrast to the generality of farmers, dairy-farmers have displayed a marked interest in irrigated summer pastures, especially paspalum and white clover. An inspection of Appendix IV will show that a large proportion of the irrigated pastures on the 43 farms was of the summer type. This is particularly the case if the portion of mixed farms devoted to dairying is considered along with the figures for the straight dairy farms.

TABLE XII.

Pasture Types—43 Survey Farms Compared with District Totals for 1952-53.

Area.	Total Area of Irrigated Winter Pasture.	Total Area of Irrigated Summer Pasture.	Summer Pasture as a Proportion of all Irrigated Pasture.
	Acres.	Acres.	Per cent.
Berriquin and Denimein Irrigation Districts excluding the Survey Farms	89,314	17,833	17
43 Survey Farms (*Entire Farm*)...	5,369	3,004	36
43 Survey Farms (*Dairying Section*)	3,296	2,648	45

Table XII shows that, as far as irrigated pastures are concerned, the 43 dairy farms differed quite markedly from the generality of farms in the district. In the case of the latter, approximately one acre in six of the irrigated pasture was of the perennial or summer variety. On the other hand, more than one acre of irrigated pasture in every three was of this type on the survey farms considered as a whole. The proportion was even greater (almost one in two) if only the dairying section of each farm was considered.

The comparison between the survey properties and the rest of the farms in the Berriquin and Denimein Irrigation Districts is shown graphically in another form by Figure 10, which also shows data for areas of natural grass, summer fodder crops, fallow, etc. It will be seen that the survey farms also had relatively large amounts of summer fodder crops.

The preference of the dairy farmers for summer pasture is a reflection of the fact that most farms produce during the spring and summer period when these pastures are at their peak. It should be noted that a large proportion of the irrigated pasture on the survey farms was established in a period when the farmers had a greater interest in fat lamb and wool production. Naturally much of the older pasture is made up of

stands of Subterranean clover and Wimmera Rye grass. Recent pasture sowings on the farms have been devoted mainly to summer varieties (paspalum and white clover). This trend will continue so that the comparison between the dairy farms and the generality of farmers will become even more marked in future years.

An analysis of the times when the various pastures were put down has shown that comparatively more attention has been given in latter years to paspalum and white clover than was the case in earlier years. Lucerne, the dominant summer pasture in earlier periods is becoming of minor importance.

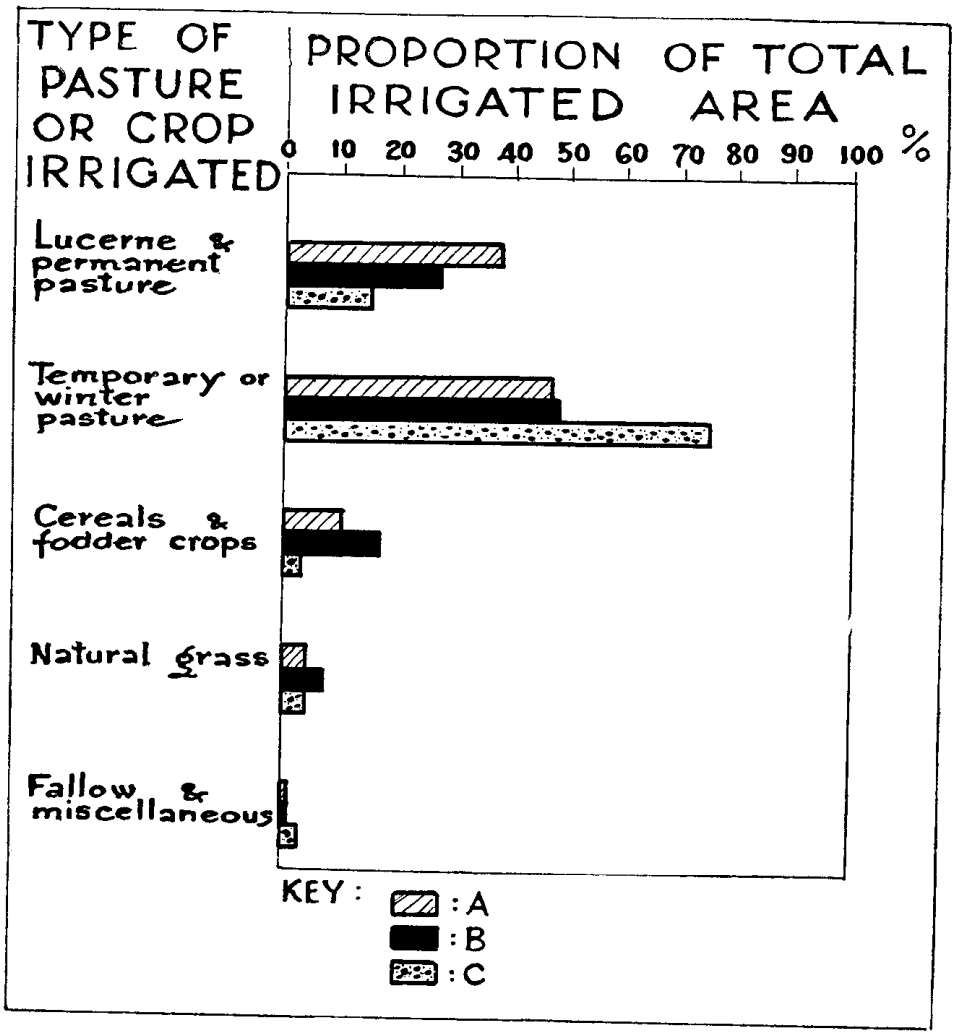

Fig. 10. Proportion of irrigated area devoted to various uses. Forty-three dairy farms compared with the remaining farms in the Berriquin and Denimein irrigation districts.

A—The " dairy section " of the survey farms.

B—The survey farms as a whole.

C—The Berriquin and Denimein irrigation districts excluding the survey farms.

The graphs illustrate the relative preponderance of summer pastures on the dairy farms and winter pastures on the other district farms. Crops are also relatively more important on the dairy farms.

Pasture Areas.

Appendix IV and Appendix V show for each of the 43 farms the acreage of various pastures, crops and fallow areas. To obviate the problem of those farms which employed some of their area for non-dairying purposes (e.g., fat lambs), the data is shown in two forms: (*a*) for each farm as a whole, and (*b*) for the calculated "dairy section" in each case.

The figures for the "dairying section" (Appendix V) on mixed farms were calculated on the basis of farmers' estimates of the extent to which the resources in each paddock were used by dairy stock. An important problem arose when computing the aggregate areas of winter and summer irrigated pasture on the survey farms, due to the fact that the various pastures had been put down at widely different intervals and radically different pasture plants were involved. These differences naturally result in widely different carrying capacities of pastures which would normally be combined under the crude headings of either summer pasture and winter pasture. For purposes of inter-farm comparison, this problem has been dealt with by converting all pastures to "effective" acreages, keeping winter pasture separate from summer pasture. A summary of the procedure adopted in this calculation is presented in Appendix III. The figures for "effective" acreages are also shown (Appendix IV and Appendix V) for each farm along with the respective figure for actual acreages.

For convenience, part of this data is summarized in Table XIII.

TABLE XIII.

Improved Irrigated Pasture Used for Dairying on 43 Survey Farms—1952-53.

Range of Areas.	Irrigated Winter Pasture.		Irrigated Summer Pasture.	
	Actual Area.	"Effective" Area.	Actual Area.	"Effective" Area.
	Acres.	Acres.	Acres.	Acres.
Largest area	256	256	212	128
Smallest area	0	0	0	0
Average area on the 43 farms	77	59	62	39

It will be seen from these figures that there were wide variations in the amounts of improved irrigated pasture available for dairying on the 43 farms. At one extreme was one farm which possessed 256 acres of winter pasture, all of which was sufficiently mature to be classed as "effective". At the other extreme was a farm which had no improved irrigated winter pasture. In the case of this farm, no irrigated summer pasture was available either, the dairy stock relying on fodder crops and natural pasture.

Total Irrigated Pasture.

To facilitate comparison between farms and between districts, the acreages of winter and summer irrigated pasture (i.e., improved pasture) have been converted to an aggregate figure, viz., the total amount of irrigated pasture available. Appendices IV and V summarize this information for the 43 farms again in terms of the "actual" and "effective" areas available on the farms—the whole farm being distinguished from the "dairying section". This has been calculated on the assumption that two acres of irrigated winter pasture are equal in grazing value to one acre of irrigated summer pasture.

It will be seen that the average amount of irrigated pasture available on the survey farms was 132 acres. For the farms as a whole the "effective" area available was 86 acres. If attention is given only to the "dairying section" of mixed farms, the average area of irrigated pasture on the 43 farms falls to 99 and the average "effective" area to 68 acres. Naturally there were wide variations from farm to farm.

Fig. 11. Friesian cattle grazing on irrigated improved pasture.

Irrigated Acres per Cow.

Irrigated pasture provides the dominant source of feed for the dairy stock in the survey area. The available amount of the pasture has an important bearing on the levels of production attained on farms.

TABLE XIV.

Acreage of Irrigated Land per Cow.

*Comparison between 43 Survey Farms and 34 Farms in the Tongala-Stanhope District, Victoria.**

Acres per Cow.	Berriquin and Denimein.		Tongala-Stanhope, Total Area.
	Total Area.	"Effective" Area.	
Acres.	Number of Farms	Number of Farms.	Number of Farms.
0.0–0.9	2	8	...
1.0–1.4	3	...	...
1.5–1.9	4	9	13
2.0–2.4	5	5	12
2.5–2.9	4	7	6
3.0–3.4	5	1	2
3.5–3.9	2	4	...
4.0–4.4	4	1	1
4.5–4.9	2	3	...
5.0–5.4	5	1	...
5.5–5.9	2	1	...
6.0–6.4	...	1	...
6.5–6.9	1	...	...
7.0–7.4	4	2	...
Total Farms	43	43	34
	Acres.	Acres.	Acres.
Average acres per cow	3.9	2.8	2.2

* See B.A.E. report *op. cit.* p. 16.

Table XIV summarizes the amount of irrigated land (pasture and crop land) used per cow on the survey farms (see Appendix VI) compared with the average yearly amount available on the 34 Tongala-Stanhope farms over the three year period ended 1947-48.

The latter survey revealed that on the average 2.2 acres of irrigated land were used per cow. By contrast, the average amount available on the 43 farms was 3.9 acres if actual areas are considered and 2.8 acres if only "effective" areas are considered. Hence, much more irrigation land is being used by the survey farmers than they need in the long run to attain a higher production. The Tongala-Stanhope area is geographically similar to the survey area and its farmers achieve a higher output per cow (see p. 148) despite smaller areas of irrigated land per cow. This difference is to be expected since the fertility of the soil in the Berriquin and Denimein Irrigation Districts is lower than that which has been built up in the Victorian region after years of intensive pasture improvement. Much higher productivity per acre should be developed in New South Wales after the passage of a number of years (perhaps 5 to 10 years). When this has occurred, farmers should be able to carry much larger herds or devote less of their areas to carrying the present number of cows. There is obviously a potential for greatly increasing the production already attained in the Berriquin and Denimein Irrigation Districts.

Fig. 12. Sheep grazing on irrigated improved pastures. Note the dry irrigation ditch in the foreground and the flat nature of the terrain which is typical of the survey area.

Use of Superphosphate.

Comparatively heavy application of superphosphate to both winter and summer irrigated pastures has formed a key part of the developmental programme on most of the farms in the Berriquin and Denimein Irrigation Districts. Information gained from the farmers concerning the applications made on each paddock since the pasture was established show the following two facts:—

(*a*) On the average, the annual amount of superphosphate applied ranges from 90 to 180 lb. per acre on the winter pasture and from 180 to 360 lb. (more in selected cases) on the summer pasture. The amounts applied in recent years have shown a distinct upward trend.

(*b*) It might be expected that variations in the amounts of superphosphate applied to pastures would influence the production levels on the farms. With regard to the amount of superphosphate applied on the summer and winter pastures, there is insufficient difference between the farms to warrant close analysis at this stage.[28]

Farm Equipment.

An analysis was made of the various items of equipment on the farms. As might be expected, most properties possessed a variety of machines and implements used for the cultivation of pastures and crops as well as machines and implements for the milking and feeding of dairy cattle. The irrigation farms are better equipped than many coastal dairy farms. Figure 13 summarizes the proportion of farms which possessed various machines, and other items of equipment. It also shows the comparative figure for a group of farms in the red-soil country of the Richmond-Tweed region.

[28] The problem of relating superphosphate applications to production is complicated by the fact that the pastures differed very much in age and the extent to which they have been devoted to dairying rather than other uses.

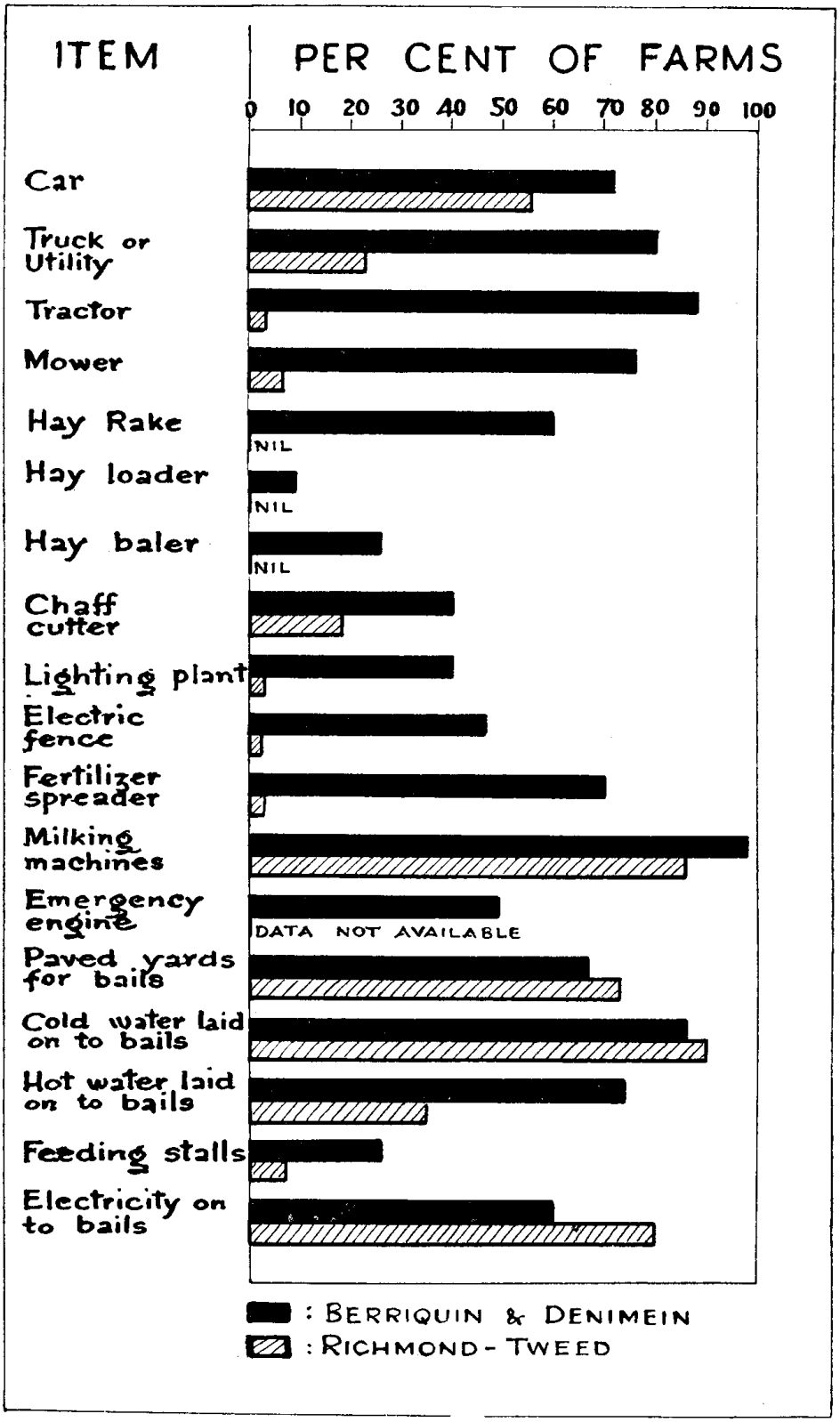

Fig. 13. illustrates the proportion of survey farms with various items of machinery and equipment. Forty-three farms in the Berriquin and Denimein irrigation districts compared with seventy-one farms in the Richmond-Tweed district.

Tractors and Rotary Hoes.

The possession of a tractor or rotary hoe is not a common feature of coastal dairy farms. A survey in the Manning River District during 1951 showed that only 11 out of 65 farms had a tractor or rotary hoe. Similarly, only 7 farms out of 71 in the Richmond-Tweed area had this equipment. On the other hand, most farms (89 per cent.) surveyed in the Denimein and Berriquin Districts had a tractor. The main reason for this difference is that the cultivation of crops for farm use and for sale is a common practice in the Riverina districts, whereas it forms only a very limited pursuit in the coastal areas, where arable land is much more restricted. The possession of tractor power on the Riverina farms greatly facilitates the pasture improvement programme on these properties and improves the effectiveness of the available labour force.

Farm Implements.

All of the farms possessed one or more ploughs for soil tillage. Because of the prevalence of tractors, these implements were usually of the multi-furrow type. Two and three furrow ploughs were far more common than on most of the coastal farms which rely more on horse power.

As noted elsewhere, the bulk of the irrigation farms made a practice of conserving surplus pasture growth and, therefore, mowers, hay rakes, hay loaders, balers and chaff cutters were fairly common. As this type of conservation is unusual in coastal districts, the necessary implements are not prevalent in these areas.

Almost half of the farms possessed an electric fence which, if they were effectively used, implies a fairly high degree of control over pasture grazing. Strip grazing with an electric fence is not commonly adopted in coastal areas, although it has been recommended for a number of years as a means of ensuring efficient use of improved pastures.

An indispensable part of the improved pasture programme on the irrigation farms has been the heavy use of superphosphate during the establishment and maintenance of the pastures. Most of the farms apply their own top dressings so that fertilizer distributors and manure spreaders are common items of equipment on most farms in these areas. This is not the case on many dairy farms in coastal areas, particularly the red-soil country of the Richmond-Tweed region.

Milking Machines.

The introduction of milking machines has been almost a universal development on dairy farms in recent years. This has greatly reduced the amount of drudgery associated hitherto with dairying.

Ninety-eight per cent. of the farms studied in the Berriquin and Denimein Districts were using milking machines and the following is a summary of the number of units on the 42 farms. Comparable figures are also given for 61 Richmond-Tweed farms with machines.

Number of Units.	*Number of Farms.*	
	Berriquin-Denimein.	*Richmond-Tweed.*
One	.. –	1
Two	.. 7	28
Three	.. 22	25
Four	.. 8	5
Five	.. 1	–
Six	.. 2	1
Seven	.. 1	–
Eight	.. 1	1
Total ..	.. 42	61

Whereas most of the irrigation farms were using milking machines, 14 per cent. of those surveyed in the Richmond-Tweed areas and 17 per cent. of 65 farms studied in the Manning River district did not use machines. However, the practice could have become somewhat more prevalent in the latter district since these farms were surveyed in 1951.

The average number of units per machine for both groups of coastal farms was 2.7, whereas the Riverina farms averaged about 3.5 units. However, these farms were milking more cows than were the properties on the Manning but less than the farms on the Far North Coast.

The following figures show the comparison between the Berriquin and Denimein Districts and the Manning River area with regard to the number of cows milked per milking machine unit.

TABLE XV.

Number of Cows per Milking Machine Unit—Two Survey Districts.

District.	Number of Cows per Unit of Milking Machine.				
	5–9	10–14	15–19	20–24	25 and over.
Berriquin and Denimein (1952–53)	12	16	8	6	Nil
Manning River (1951–52) ...	3	17	18	12	4

Bails.

Naturally, all farms possessed bails and a dairy but the type of construction varied quite markedly. The following is a summary of the types of wall construction on the forty-three farms:—

Bails and Dairy.

Wall Construction.	*Number of Farms.*
Galvanized iron	9
Fibro-cement	3
Brick (mostly concrete or cement)	6
Weatherboard	3
Concrete	19
Brick and fibro-cement	1
Concrete and iron	2
Total	43

According to regulations, all bails and dairies were equipped with concrete floors. Forty-one units had galvanized roofs whilst two units had roofs of tiles. The general manner of dairy and bails construction contrasts markedly with that common in coastal districts. All the bails and dairy units on the 71 Richmond-Tweed farms were constructed of weatherboard walls and galvanized iron roofs. A similar position applied on the 65 farms studied in the Manning district. The prevalence of the sturdier cement or brick structures, with their lower susceptibility to weathering, gave the inland dairies a neat and efficient appearance.

Other Facilities at the Dairy.

Two out of every three farms surveyed had at least one concrete paved yard adjacent to the bails, a facility which is only too rare in many coastal areas. Paved yards are an invaluable asset, especially on farms where drainage or soil conditions are conductive to the formation of boggy conditions under heavy cattle traffic.

(i) *Water Supplies.*—Considerable quantities of water are required during the milking operation both for cleaning the bails and dairy and for washing the cattle and dairy utensils. The provision of adequate supplies of both hot and cold water at the dairy is therefore a prerequisite of efficient milk production. Most of the 43 farms possessed cold water laid on to the dairy (as was the case in the two coastal areas). Efficient hot water units and steam pressure sterilizers were in use on seven out of ten farms, whilst the remaining farms used a more simple device such as an outside copper-boiler. This latter type of equipment is much more commonly used on coastal farms.

(ii) *Feeding Stalls.*—One farm in five had feeding stalls for the milking cows. These took the form of small feed boxes at the head of the bails which allow cows to be given small quantities of concentrates and other supplementary feedstuffs whilst being milked. This type of stall feeding is a common practice in the inland irrigation districts of this State and Victoria but is somewhat less common in the coastal areas of New South Wales where many farmers do not make a practice of supplementary feeding.

(iii) *Electricity at the Bails.*—The provision of electricity at the bails both for lighting and power is one feature of the modern process of rural electrification which is greatly improving the amenities available on Australian farms. Some districts have shared in this development more than others as the extension of the rural electricity zones has occurred at different rates throughout country areas. Electricity supplies at the bails (and on the farm generally) were more prevalent in Far North Coast areas than was the case in the Manning and Berriquin-Denimein Districts.

5. HERD MANAGEMENT AND PRODUCTION.

In some respects, the character and management of dairy herds on the 43 Riverina farms are similar to the conditions characteristic of coastal areas, particularly the cream zones.

Size of Herds.

An attempt was made to secure a reasonably accurate measure of the number of dairy stock on the farms, and particularly the number of milkers carried during recent years. The latter figure has been employed as a measure of the scale of operations on the farms and to compute output per cow as one index of the technical efficiency of farm management. The number of milkers carried over a period of years is shown in Appendix VII. This data is summarized in Table XVI, which shows similar information for two groups of coastal farms surveyed during recent years. The three groups are not strictly comparable since the data relates to different time periods. However, there seems no reason to assume that this difference would have had a significant influence on the numbers of milkers carried on the farms.

In the Riverina district, the most common numbers of milkers carried was between the range of 40-49 cows in a total herd of 70-90 head. The smallest number of cows milked was 15 and the largest 135. The average number of milkers was 48.

On balance it will be seen from Table XVI that the 43 farms were milking significantly more cows than were the 65 farms surveyed in the Manning River District, but somewhat less than the number milked by farmers on the red soil areas of the Far North Coast. The prevalence of share-farming in the latter district might explain the comparatively large herds in this region.

Breeds of Cows.

Jerseys (18 farms) and Friesians (4 farms) were the main pure breeds of cattle on the 43 farms. An increasing interest was being displayed by the farmers in Friesians, whilst a few farmers possessed Ayrshires. The bulk of the farmers were maintaining true dairy lines, beef bulls being introduced on only six properties with a view to breeding beef progency from present dairy herds. It should be noted that this practice, which has been criticized by many authorities, has become prevalent on a considerable number of marginal coastal farms, encouraged by the relatively attractive returns offering for beef stock. The present breeding policy of the 43 farms can be inferred from Tables XVII and XVIII which show the types of cows in use on the farms.

TABLE XVI

Number of Cows in the Milking Herd.
43 Survey Farms Compared with Two Groups of Coastal Farms.

Herd Size.	Berriquin and Denimein.*	Manning River.†	Richmond-Tweed.‡
Number of Cows.	Number of farms.	Number of farms.	Number of farms.
Less than 20	2	3	...
20–29	7	11	3
30–39	9	18	15
40–49	11	14	20
50–59	3	12	10
60–69	4	3	6
70–79	2	2	4
80–89	3	1	6
90–99	...	1	3
100 or more	2	...	1
Total Number of Farms ...	43	65	68
Average Herd Size	48 Cows.	42 Cows.	53 Cows.

* 1952-53 only.
† Average of the three-year period ended 1951-52.
‡ Average of the three-year period ended 1951-52.

TABLE XVII.

*Breed of Dairy Stock other than Mature Bulls on 43 Survey Farms.**

Breed.	Number of Farms.	
Jersey	24	
Friesian	8	
Australian Illawarra Shorthorn	4	
Dairy Shorthorn	4	
Ayrshire	2	
Mixed Breeds—		
Jersey x A.I.S.	1	15 Jersey Cross.
Jersey x Dairy Shorthorn	3	
Jersey x Guernsey	1	
Jersey x Hereford	1	
Jersey x Red Poll	1	
Jersey x Type Unknown	8	
A.I.S. x Type Unknown	3	
Friesian x Jersey	7	11 Friesian Cross.
Friesian x Guernsey	1	
Friesian x Hereford	1	
Friesian x Type Unknown	2	
Dairy Shorthorn x Type Unknown	1	2 Dairy Shorthorn Cross.
Dairy Shorthorn x Guernsey	1	
Very Mixed Types	1	

* Whether the dominant breed or not.

TABLE XVIII.

Dominant Breed of Each Dairy Herd.

Breed.	Number of Farms.
Jersey	18
Friesian	4
Dairy Shorthorn	1
Jersey x Friesian	2
Jersey x Dairy Shorthorn	3
Jersey x Australian Illawarra Shorthorn (A.I.S.)	1
Jersey x Type Unknown	6
Friesian x Guernsey	1
Friesian x Type Unknown	1
A.I.S. x Type Unknown	4
Dairy Shorthorn x Type Unknown	1
Mixture of unknown types (very mixed)	1
Total	43

TABLE XIX.

Farms with Registered Stock.

Stock Registered.	Number of Farms.
Bull only	19
Minority of herd including bull	2
Majority of herd including bull	3
Minority of cows only	6
No registered stock	13
Total	43

Herd Management.

It was on the side of herd feeding and general management that many of the survey farmers were found to be superior to numbers of farms throughout the coastal parts of the State.

Registered Stock.—Eleven farms (about 26 per cent.) kept some registered cows, and 24 farms (56 per cent.) were using one or more registered bulls. Grade stock made up the bulk of most herds. The numbers of farms with registered and/or grade stock is summarized in Table XIX.

In general, the survey showed that registered stock, or stock with well-defined production backing, were more prevalent in the Berriquin and Denimein Irrigation districts than is the case in many coastal regions. About three-quarters of the farms were using a bull with a production backing, that is to say, the production record of the bull's mother could be traced. Comparable figures are not available for coastal areas, but reports indicate that this practice is not so prevalent in many parts of the coast.

Herd Replacement.—The purchase of replacement stock is a fairly common practice in the Finley-Deniliquin area. Table XX summarizes the numbers of farms breeding their own replacements in contrast to the number buying replacements. The source of purchased stock is also shown.

TABLE XX.

Herd Replacent on 43 Farms.

Herd Replacements.	Number of Farms
A. *Source of Replacements*—	
All bred on the farm	21
Some purchased	17
All purchased	5
B. *Source of Purchased Replacements*—	
From private registered herds	1
From private herds not registered but tested ...	6
From saleyards, the origin of the stock known ...	15
From saleyards, the origin of the stock unknown ...	10

In most cases, where replacements were being purchased, it was the practice to buy stock from some source whose reputation was known to the purchaser. However, only in a minority of cases was stock obtained from sources where accurate records of the production backing of the stock could be assessed. Nevertheless, it was the practice of many farmers to buy their stock from the high-producing and well-established Victorian areas to the south of the survey region. On balance it would seem that a good class of dairy stock is being developed in the Finley-Deniliquin region.

Breeding Records.—Twenty-four farms kept records of the breeding practices followed, including for each of their cows such details as times of mating, time of calving, length of lactation and the identity of the offspring.

Other Herd Management Practices.—The following additional practices were observed:—

(i) Twenty-four farmers (56 per cent.) were using strain 19 inoculation against contagious abortion.

(ii) Ninety-eight per cent. were using milking machines. Thirty-four farmers (79 per cent.) did not strip their cows. Of the remainder, three farms stripped by hand and six used machines.

(iii) Twenty farms (47 per cent.) owned an electric fence, but it was not possible to determine how regularly this equipment was used.

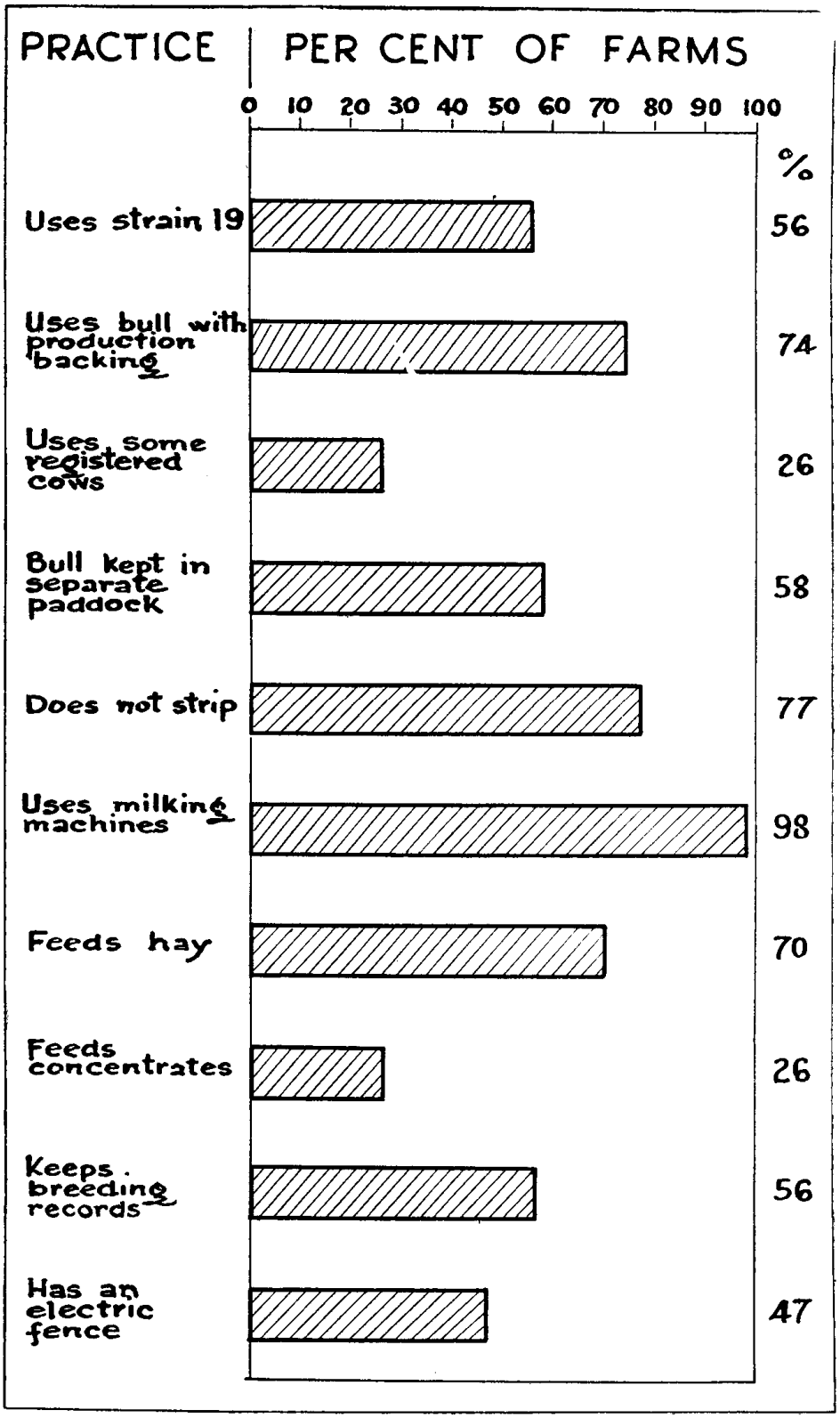

Fig. 14. Proportion of survey farms employing various management practices.

TABLE XXI.

Annual Butter Production.

*43 Survey Farms Compared with Two Groups of Coastal Farms.**

Commercial Butter.	Berriquin and Denimein Districts.†	Manning River District.‡	Richmond-Tweed District.§
lb.	Number of farms.	Number of farms.	Number of farms.
4,000– 5,999	8	19	6
6,000– 8,999	11	23	24
9,000–11,999	7	9	11
12,000–14,999	7	2	6
15,000–17,999	1	1	2
18,000–20,999	6	...	1
21,000–23,999	...	...	3
24,000–26,999	1	...	...
27,000–29,999	1	...	...
30,000–32,999	1	...	...
Number of Farms	43	54	53
Average Annual Production (lb.)	11,673	7,500	9,764

* Includes only those farms which averaged more than 4,000 lb. Any whole milk produced for sale has been converted to the equivalent butter figure.
† 1952-53 year only. ‡ Average of the three years 1948-49 to 1950-51.
§ Average of the three years 1949-50 to 1951-52.

TABLE XXII.

Production per Cow.

43 Survey Farms Compared with Two Groups of Coastal Farms.

Commercial Butter Produced Per Cow Milked.	Berriquin and Denimein Districts.*	Manning River District.†	Richmond-Tweed District.‡
lb.	Number of farms.	Number of farms.	Number of farms.
Less than 100	1	4	...
100 to 149	1	12	11
150 to 199	9	29	28
200 to 249	10	12	9
250 to 299	13	2	2
300 to 349	5	1	...
350 to 399	2	...	...
400 to 449	1	...	...
450 to 499	1	...	...
Number of Farms	43	60	50
Average Production per Cow ...	249 lb.	170 lb.	177 lb.

* 1952-53 year only.
† Average of the three years 1948-49 to 1950-51. These figures relate to six more farms than are included in Table XIX.
‡ Average of the three years 1949-50 to 1951-52. Suitable cow numbers were not obtainable for three of the farms shown in Table XXI.

Production.

As a general rule, the output of dairy products on farms in the Berriquin and Denimein Irrigation Districts is much higher than that attained on many coastal farms. This applies both to total annual production and to average annual output per cow.

Figure 15 summarizes the comparison between the 43 irrigation farms and farms in two coastal areas with regard to annual butter production (or the equivalent in whole-milk). This data is shown statistically in Table XXI. (See also Appendix IX.) Similarly, Figure 16 demonstrates a comparison between the three regions with regard to annual production per cow. (See Table XXII).[29]

Annual Butter Production.

It will be seen that the three regions were similar to the extent that more farms had an annual butter production in the 6,000 to 8,999 pounds' group than in any other of the production groups considered. However, farms in the Berriquin-Denimein area and those in the Richmond-Tweed region displayed a greater range of annual production than did the farms in the Manning River district. It is of note that about half of the irrigation farms produced more than 10,000 lb. of butter during the year, whereas this level was attained by only 15 per cent. of the farms studied in the Manning area and 30 per cent. in the Richmond-Tweed region.

The average yearly production of commercial butter achieved by farms in each district was as follows:—Berriquin-Denimein, 11,673 lb.; Manning River, 7,057 lb.; and Richmond-Tweed, 9,764 lb.

Production per Cow.

Using the calculated number of cows milked during the 1952-53 season (see page 124) the equivalent amount of butter produced per cow in this season has been derived for the forty-three farms. The 43 irrigation farms proved to be superior to farms in either coastal area. This is well illustrated by Figure 16. They also displayed a far greater range of production per cow. The overall average for the forty-three farms was 249 pounds per cow compared with 170 and 177 respectively in the other two regions. The modal (i.e., mostly frequently occurring) production bracket for the three regions was as follows:—Berriquin-Denimein, 250-299 lb. per cow; Manning and Richmond-Tweed, 150-199 lb. per cow. The two coastal areas are fairly typical of the production levels attained on the average throughout the State, so it can be inferred that, as a group, the 43 irrigation farms rank very high in the State's dairying industry.[30]

[29] The reader is referred to the footnotes to Tables XXI and XXII which indicate that different time periods have been taken for these inter-regional comparisons. An average of the latest three-year period for which figures are available has been taken for the two coastal areas. By this process, seasonal fluctuations, due to the vagaries of climate, have been compensated for to some extent. However, in the case of the irrigation farms, only the latest year has been taken since climatic fluctuations are not so vital to these farms. What is more, these farms have developed rapidly in recent years so that an average of years would seriously underestimate the level of current production. It has been assumed that a significant expansion in the scale of operations has not been a feature of the coastal farms.

[30] In the three-year period ended 1952-53, the average amount of butter produced per cow in New South Wales was 166 pounds. This average includes the following individual figures:—1950-51, 174 lb.; 1951-52, 136 lb. (a bad year); and 1952-53, 187 lb.

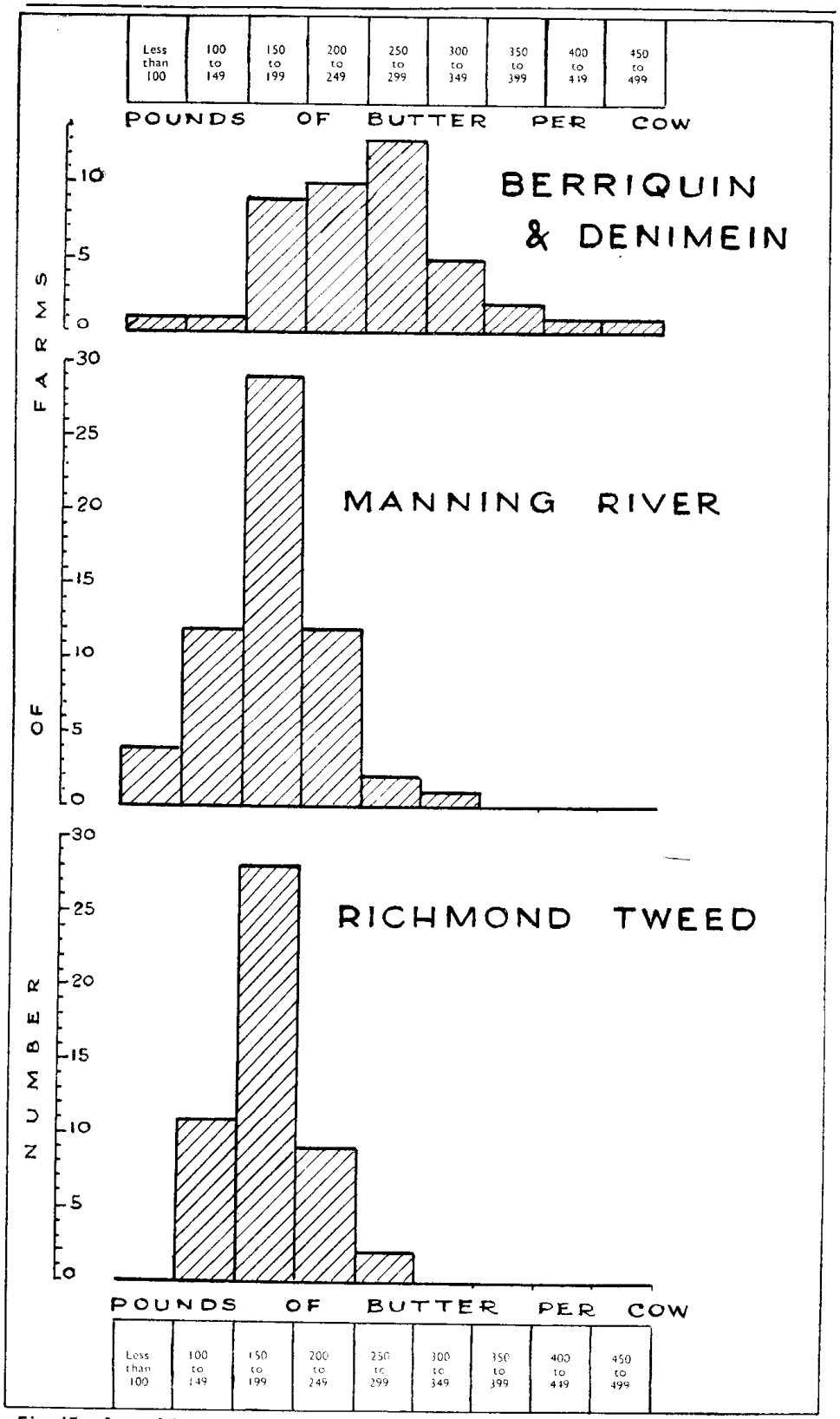

Fig. 15. Annual butter production. Forty-three farms in the Berriquin and Denimein irrigation districts compared with fifty-four farms in the Manning River district and fifty-three farms in the Richmond-Tweed district of Coastal New South Wales.

Note that a higher and wider range of production is characteristic of the irrigation farms.

It is of note that about half of the irrigation farms produced more than 250 pounds of butter per cow in the 1952-53 season, the top farm averaging 476 pounds from forty milkers. One farm produced 31,185 pounds of butter from 82 cows, an overall average of 380 pounds per cow. There is every reason to assume that, with reasonably efficient management and established pastures, production per cow within the range of 250-350 lb. of butter can be attained by the average commercial dairy under irrigation. It must be remembered that the Berriquin and Denimein areas are in an early stage of development as far as dairying from irrigated summer pastures is concerned. This point has been stressed in an earlier section. When pastures become more mature and soil fertility is built up these areas should achieve a higher output than that attained at this early stage.[31]

High production per cow in the Berriquin and Denimein Districts can be attributed mainly to the grazing of improved irrigated pastures, and to the presence in the pastures of clover all the year round, together with the feeding of pasture hay, grains and other concentrates. This ensures continuity of adequate feed at all times and enables cows to be in production over a period which reaches a higher peak and occupies a much longer period than that characteristic of a large number of coastal farms in New South Wales, particularly those on the North Coast. A lactation period extending from eight to ten months is a common feature of dairy farms in the Riverina, whereas an average of seven months is typical of most coastal areas.

The high production of the farms under irrigation has been achieved only after considerable capital outlay in preparing the land for irrigation and establishing and maintaining improved pastures. Fairly heavy expenses are incurred annually to meet water charges, the cost of superphosphate top dressings and labour costs, which are prerequisites of successful production under irrigation conditions. For this reason, the comparative advantage which these farms enjoy by concentrating on dairying production rather than on other forms of farming, and the comparison they present with coastal dairy farms, requires much closer examination than a mere appraisal of production levels. It is proposed to comment on the problem of production costs at a later stage (see pp. 139-141).

Results of Herd Tests.—In recent years, the Berriquin, Denimein and Wakool Irrigation Districts have figured prominently in the results of herd tests made by the New South Wales Department of Agriculture throughout twelve State-wide recording districts. Herds in these irrigation areas come within the 7A dairying district and have achieved a splendid record of butter-fat production.[32]

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[31] The average of 277 lb. per cow achieved in the Tongala-Stanhope area provides a guide as to the scope for expanding production in the geographically similar districts of Berriquin and Denimein.

[32] A full summary of the results of these tests for the year 1952-53 is contained in the following publication: *Herd Recorders' Letter* (January-February, 1954), N.S.W. Department of Agriculture.

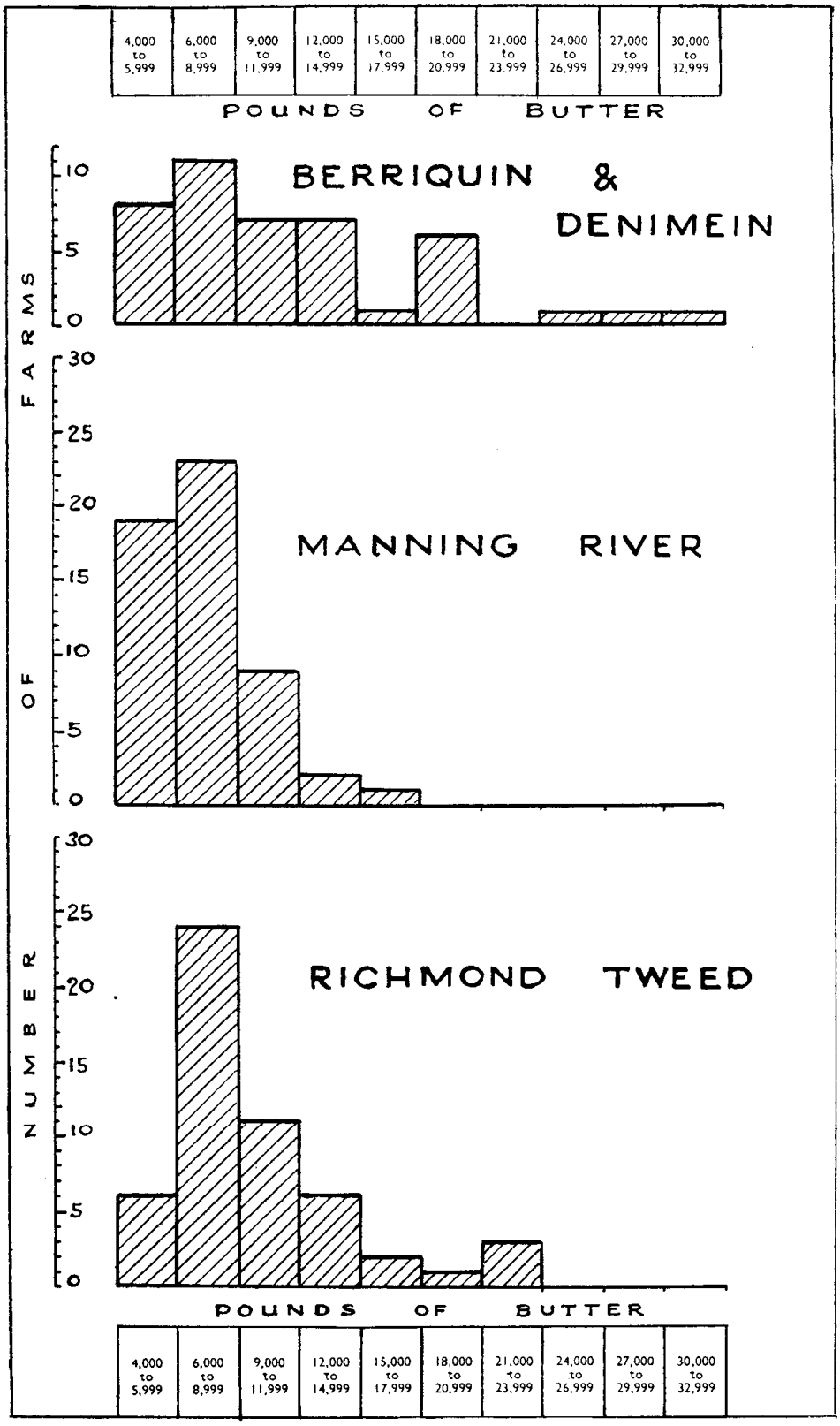

Fig. 16 illustrates the higher annual production per cow attained on forty-three farms in the Berriquin and Denimein irrigation districts compared with production on sixty Manning River farms and fifty Richmond-Tweed farms.

In the results for the year 1952-53, the 7A district was ranked second in the list of the best herd for each of the twelve districts. This herd belonged to Mr. N. W. Crosbie (Berriquin Irrigation District) and included 39 Friesian cows which achieved a test result of 11,045 pounds of milk with an average content of 3.5 per cent. of butter-fat. This provided an average yield of 389 pounds of butter-fat. In the same district, Mr. L. R. Merrifield's two-year-old Jersey cow "Dellfield Duchess" produced 8,070 lb. of milk, with 6.1 per cent. butter-fat average, i.e., 493 lb. of butter-fat for the year. This was the best result for a two-year-old during the 1952-53 season.

Considering cows of all ages, 1,241 cows tested in the 7A district during 1952-53 yielded an average of 274 lb. of butter-fat per cow. This was by far the highest average yield attained by any district. The next highest district (No. 7, centred on Wagga Wagga) achieved an average of 236 lb. of butter-fat per cow. With the exception of the Far South Coast District, which attained an average of 226 lb., no coastal district averaged as high as 200 lb. of butter-fat per cow.

It is interesting to note that, in a ranking of the ten worst herds tested in each district, only one herd in the 7A district averaged less than 200 lb. of butter-fat (181 lb.). Only one other district in the entire State (District No. 9, in the North-west) had any herds which attained a yield of more than 200 lb. of butter-fat in this ranking.

Production per Irrigated Acre.

On 42 farms using irrigated improved pastures for dairy production, the average production per "effective" irrigated acre was 107 pounds of commercial butter. The production per actual acre used for dairying was 84 pounds of commercial butter. From these figures it would appear that the output per acre compares unfavourably with that achieved in the Tongala-Stanhope area, where the equivalent figure was 126 pounds of commercial butter for the three-year period ended 1947-48.

Production per Acre Foot of Water Used.

The 43 farmers appeared to be using an amount of water which was, on average, considerably in excess of that used in the Tongala-Stanhope area at the time of the Commonwealth Survey of that district. They were using more water per irrigated acre and more per cow milked. The results show, also, that whereas the 34 farmers in the Tongala-Stanhope district achieved an average output of 87 pounds of butter-fat per acre-foot used, the seventeen survey farmers in New South Wales for which suitable water records are available achieved only 52 pounds of butter-fat per acre-foot of water used. These comparisons would indicate that these farmers have not attained the potential level of efficiency in the use of water on pastures.

Seasonality of Production.

Monthly production on the 43 farms as a group followed a seasonal curve similar to the characteristic pattern of coastal districts. Most farmers aimed to have their cows in peak production by spring so that the bulk of production was undertaken during the spring and

summer period. This can be inferred from the following figures which show the number of farms which reached their maximum monthly production in the various months of the year 1952-53.

Month.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Total.
Number of Farms	...	...	10	16	2	11	1	...	1	...	...	...	43

The concentration by farmers on spring and summer production is the chief reason for their interest in the establishment of summer irrigated pastures (paspalum, white clover and lucerne) as mentioned earlier in this article (see pp. 111-114).

During the survey each farmer was asked to nominate what seasons of the year he considered were best for dairy production in his area. The following are the seasons preferred by the 43 farmers:—

Seasons Preferred.	*Number of Farmers.*
Spring-summer	29
Autumn-winter	5
Winter-spring	3
Even production with no seasonal concentration	6
Total	43

Whilst the bulk of farmers preferred to concentrate their milking programme into the spring-summer period, about one-third favoured a different pattern. Eight farmers thought relatively more attention should be given to the cooler months, whilst six farmers thought that an even production pattern throughout the year was the best policy.

In coastal areas, many farmers rely heavily on the seasonal growth of paspalum pastures which explains their concentration on spring and summer production. However, in irrigation districts such as Berriquin and Denimein, the feed programme can be more flexible for two reasons: (*a*) Both autumn-spring irrigated pastures and spring-summer irrigated pastures can be established with success which ensures a continuity of pasture feed; (*b*) under irrigation conditions lush pasture growth enables large quantities of pasture hay as well as oaten and other hay to be made to bridge the gap in pasture feed which occurs in late summer and mid-winter. Summer irrigated pastures produce a much greater bulk of feed than do winter pastures, and there is strong local opinion amongst a number of farmers and other interested observers that summer pastures are more profitable, despite the fact that they are more costly to maintain because of the comparatively heavy rates of water and fertilizer applications required. This tends to favour summer production. Another factor is that milking in the cooler months is more unpleasant, due to the cold windy conditions and the fact that farmers have to milk in the dark.

An even production pattern is favoured by those farmers who prefer to have the work load more evenly distributed rather than have a heavy concentration of work in one season. Of course, the disadvantage of this is that a holiday break from the milking programme cannot be secured unless relief labour is available.

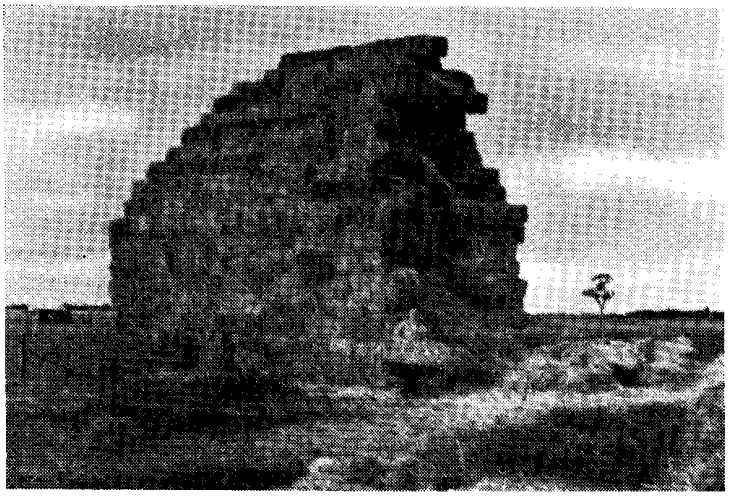

Fig. 17.—A stack of conserved hay.

Fig. 18.—Distributing hay to dairy stock by means of a tractor drawn trailer.

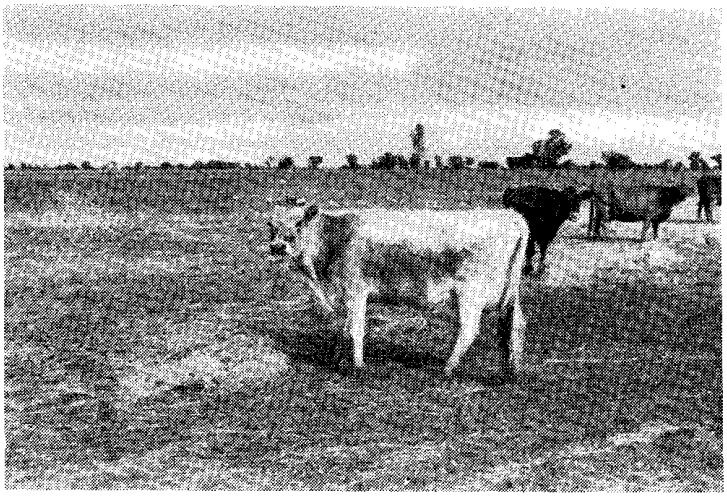

Fig. 19.—Cows feed on pasture hay.

It can be concluded that dairy farmers in the irrigated areas of the Riverina have far more choice about the seasonality of production than have their counterparts in the coastal regions. This provides much greater flexibility to the production programme and is conducive to a more effective use of labour and capital resources.

Supplementary Feeding of Dairy Stock.

Dairy farmers in the Berriquin and Denimein Irrigation Districts owe much of their notable success to the judicious use of supplementary fodders. The provision of supplementary feed for the milking herd during the periods when pastures are not at their peak, ensures a good continuity of nutriments. Eleven farms fed some concentrates to their dairy stock during the 1952-53 season; four farms using purchased bran and one using purchased crushed oats. Farm-grown crushed oats was fed on seven properties. Invariably, all these supplements were fed to the milkers by means of stalls in the bails.

More prevalent than concentrate feeding was the practice of feeding non-concentrates such as hay and chaff. The lush growth achieved on improved pastures under irrigation enabled 25 farmers to conserve large quantities of meadow, lucerne and oaten hay during 1952-53. Altogether, 30 farms (70 per cent.) fed these supplements during 1952-53. In most cases the feed was farm grown, although some farmers made purchases from local sources. The usual practice was to feed hay or chaff to the dairy stock during the cooler period from April to August when pastures were at their lowest ebb.

TABLE XXIII.

Supplementary Feeding Practices on 34 Survey Farms 1952-53.

A. TYPES OF SUPPLEMENTS FED—	Number of Farms.
(i) *Concentrates*—	
Purchased	4
Farm Grown	7
(ii) *Non-Concentrates*—	
Purchased Lucerne or Meadow Hay	4
Purchased Oaten Hay or Chaff	3
Farm Grown Lucerne or Meadow Hay	12
Farm Grown Oaten Hay or Chaff	11
B. SUMMARY—	
Number of Farms Feeding—	
(i) Concentrates Only	4
(ii) Hay or Chaff Only	23
(iii) Concentrate and Hay or Chaff	7
Total number of farms feeding supplements	34

The expressed attitudes of the 43 farmers to the economic merits of various types of supplementary feeding can be divided into the groups shown in Table XXIV.

TABLE XXIV.

Attitudes Towards Supplementary Feeding—43 Farmers.

Type of Feeding.	Number of Farmers.
Those who thought it paid to feed purchased concentrates	11
Those who thought it did not pay to feed purchased concentrates ...	26
No opinion about the subject	6
Those who thought it paid to feed farm grown non-concentrates ...	14
Those who thought it did not pay to feed farm grown non-concentrates...	21
No opinion about this subject	8

It is interesting to compare these attitudes with the numbers of farmers practising various types of supplementary feeding as shown in Table XXIII. All of the 11 farmers who fed concentrates thought that it was a payable practice whether they were purchased or farm grown. The bulk of the farmers not feeding concentrates held the firm opinion that concentrates of either origin were not an economic type of feed at current price levels. It should be noted, however, that 26 farmers (60 per cent. of those surveyed) had never had personal experience in the feeding of concentrates to dairy stock.

Pig Production.

The raising of pigs forms an important supplementary enterprise on all of the farms. As mentioned earlier, most of the farms sell cream to the local butter factory so that large quantities of skim milk are available to support a pig industry.

Of the 43 properties studied, all raised pigs for sale. However, not all of the farms bred pigs; some purchased store pigs which were fattened for sale as porkers or baconers. The following is a summary of the practices followed during the 1952-53 season:—

Practice.	*Number of Farms.*
Breeding	21
Buying stores for fattening only	13
Breeding and buying stores	9
Specializing in the sale of—	
Porkers	8
Baconers	22
Stores	1
Porkers and Baconers	4
Stores and Baconers	4
Porkers and Stores	4

Thirty farms (70 per cent.) kept one or more sows for breeding purposes; nine of these farms also purchased store pigs for fattening. The rest of the farms did not breed pigs but concentrated on the fattening of stores.

The raising of pigs to baconer stage was the most common practice. Several farmers purchased fairly large quantities of wild pigs which were obtained from the dry country north of the survey area. These pigs were fattened on the farm for several weeks and then sold at Victorian markets. From information supplied by the farmers, it is clear that pig production is expanding throughout the Berriquin region. On most of the farms, the pig raising enterprise had been enlarged in recent years. Table XXV summarizes the pig feeding practice adopted on the 43 farms during the 1952-53 season.

TABLE XXV.

*Pig Feeding Practices—43 Farms.**

Type of Pig Feed Used	Number of Farms
Skim Milk Only	3
Skim Milk plus—	
Grazing	2
Farm Grown Grains	14
Farm Grown Grains and Grazing	17
Purchased Grains	4
Purchased Grains and Grazing	2
Purchased Grains, Farm Grown Grains and Grazing	1
Total	43

* Only one farm used the deep litter system for pig rearing.

6. FINANCIAL ANALYSIS AND FUTURE DEVELOPMENT.

Financial Analysis.

Each of the 43 farmers was asked if he would make available financial records for his farm business to cover the year 1951-52, which was the latest period for which this data was readily available. Thirty-nine farmers agreed to do this but only in 22 cases was it possible to obtain complete records. These records are summarized in Appendices X to XII.

An attempt has been made to estimate: (*a*) percentage return on capital invested, and (*b*) the cost of butter production for each of the 22 farms.

Return on Capital.

The amount of capital invested in the farm was determined by applying approximate 1951-52 market values to all farm assets.[33] In determining net farm income, the farmer was allowed a wage of £800 for his own labour and management. Appendix XI shows the computed percentage net return on capital for the 22 farms. On two farms costs (including allowances) exceeded receipts. On the remaining 20 farms, returns on capital ranged from as low as 0.6 per cent. to as high as 24.0 per cent. The average return for the 22 farms was 8.3 per cent.

[33] See footnote to Appendix XI.

In the case of mixed farms, the analysis of return on capital refers to the *whole* farm business and not merely to dairying. It was impossible to distinguish the capital employed for dairying purposes in these situations. Hence, the computed net returns on capital can be used as measures of the profitability of dairying on the 22 farms only if it can be assumed that the dairying enterprise on mixed farms was neither more nor less profitable than the other enterprises. There are indications that dairying was generally more profitable in the survey area, so that the computed figures for return on capital are probably conservative.

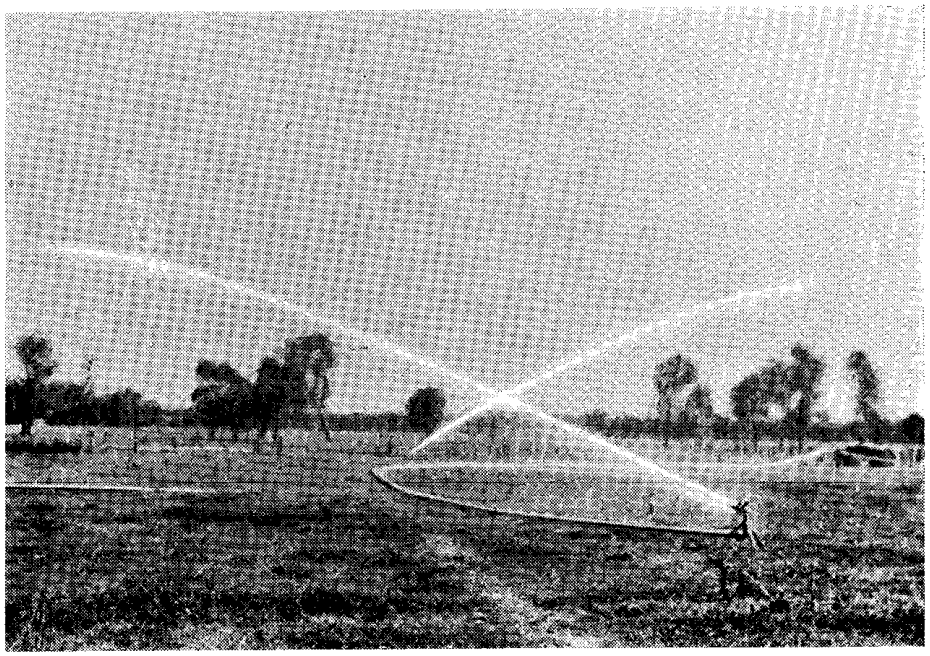

Fig. 20 shows a high pressure irrigation plant in operation on a dairy farm near Barham. Using flexible mains and slow circular moving jets of water, large areas of land can be watered. This plant is being operated by a pump attached to a stationary tractor. Systems of spray irrigation are employed by a small group of farmers working in close proximity to the Murray River but outside the scope of the flood irrigation districts.

Many of the farms were still in a development stage, and there are *a priori* reasons for assuming that the estimated returns on capital are below the levels which these farms should attain as pastures become more mature and thus more productive. However, this theory cannot be supported by an analysis of the financial data for the 22 farms. There was no evidence that low costs were associated with the longer established pastures.

Cost of Butter Production.

The cost of butter production on the 22 farms was calculated mainly for the purpose of comparing farms and analysing probable reasons for variations in the level of costs. The calculations have a very limited value when attempting to measure the actual costs incurred by the farmers, particularly because computed costs are undoubtedly higher than actual costs for the following reasons:—

(i) Labour costs were calculated, using award rates which were not paid by any of the farmers, judging from their income tax returns.

(ii) No allowance was made in the primary analysis of labour costs for labour employed in pig production.

(iii) The values of farm assets were calculated using 1951-52 local market values which undoubtedly are higher than the values usually taken for costing purposes.

Appendix XII shows the computed cost of butter production for the 1951-52 season on 22 farms. It will be seen that unit costs ranged from as low as 1.9 shillings per pound to as high as 6.6 shillings per pound. The average cost was 3.9 shillings.

In determining costs, dairying was assumed to be as profitable as other enterprises. Hence, dairy costs were assumed to bear the same ratio to total costs as the ratio of gross income from butter sales to total farm income.

If a more conservative basis of estimation is used when valuing farm assets and allowance is made for labour used in pig production, the computed costs are significantly lower than the costs calculated along the aforementioned lines. The average cost becomes 3.4 shillings per pound if labour costs are arbitrarily reduced by 10 per cent. (to allow for pig production) and only 60 per cent. of the assessed market value of farm assets is used. On the other hand, the average becomes 3.6 shillings per pound if 80 per cent. of the value of farm assets is used. An average cost within the range of 3.4 to 3.6 shillings is probably a fair assessment for purposes of comparison with the Australian 1951-52 computed average cost of butter production.

During the 1951-52 season, dairy farms in Australia were paid an average price of 3.5 shillings per pound for their butter, which represented the average cost of production as computed by Commonwealth authorities. It seems reasonable to assume that, in the same season, the 22 farmers incurred an average cost of production which was similar to or perhaps slightly less than the Australian average cost figure. Many farms in the coastal sector of New South Wales are known to be high cost producers by these standards, so that the survey region compares fairly well with these areas in view of the short history of dairying in the area.

It can be concluded, however, that dairying in the survey region is fairly costly since the Australian average cost figure of 3.5 shillings was sufficiently high to give concern to many authorities interested in the economic future of the dairying industry. A close inspection of the 43 farms as a group suggests that there are no empirical reasons for assuming that the 22 farms included in the cost analysis differed significantly from the remaining 21 farms in those factors most likely to cause variations in cost of production (e.g., total output per cow and per man).

Factors Causing Variations in Costs.

Variations in the computed production costs can be attributed to differences in the efficiency of management. An adequate explanation of these cost variations would be of considerable value to extension workers and others interested in improving the economic efficiency of farm management.

It has been a common practice in overseas studies to relate cost of butter (or milk) production to one or a number of factors which include the figure for total production. Such factors include: production per acre, production per cow, and production per man. Quite commonly, cost per unit of output has been related to total output itself. It has been demonstrated in these studies that cost per unit of output is *negatively correlated* with any one of these factors. Low costs were shown to be associated with high output—so that the higher output, the lower the cost and *vice versa*.

An examination of the data collected for the 22 survey farms (for which cost data was available) shows that there was a negative relationship between cost per pound of butter produced and each of the following factors: total butter production, butter production per cow milked, and butter production per unit of labour employed for dairying. These relationships are graphically illustrated by Figures 21, 22 and 23. What do these graphs imply? How strong is the relationship in each case? A negative relationship between unit cost of production and each of these factors could be expected to occur purely by chance in a situation where total production costs and total production were completely unrelated. In the case of the 22 dairy farms it is extremely unrealistic to assume that the latter is the case. However, it can be concluded that it is not valid to calculate the appropriate correlation coefficient as a measure of the strength of the relationship between cost and these production indices.

Measures such as output per cow have been taken as convenient yardsticks of a more complex group of farm management practices which affect output. Since these measures of production cannot be related statistically to cost per unit of output, it follows that more complicated methods have to be employed to explain cost variations.

Variations in unit production costs arise from differences in the efficiency with which the various factors of production are used. In dairying, a large variety of management factors have significant effects on the level of output and on the cost of each unit of production. These practices include pasture top dressing, subdivision of pasture, supplementary feeding, stock water facilities, and the quality of stock. To explain adequately variations in production costs between farms, it would be necessary to measure differences in many of these management practices. It is very unlikely that one or a small regimen of management techniques would be responsible for the greater part of the variation in costs.

Experience in other surveys suggests that it is not sufficient in this type of situation to analyse differences in management merely in *qualitative* terms. What is needed are *quantitative* measures of the efficiency of farm management. That is to say, differences between dairy farms as regards levels of production and unit production costs are due to differences in the efficiency with which farmers employ various techniques of management. Such differences in production and costs are not due in most cases to the fact that some farmers undertake certain key practices whilst others do not employ such techniques. To effectively measure differences in the efficiency of management is a complex task beyond the scope of the type of land use survey on which this report is based. For these reasons, the observed variations in costs on the 22 farms cannot be explained in terms of the data collected.

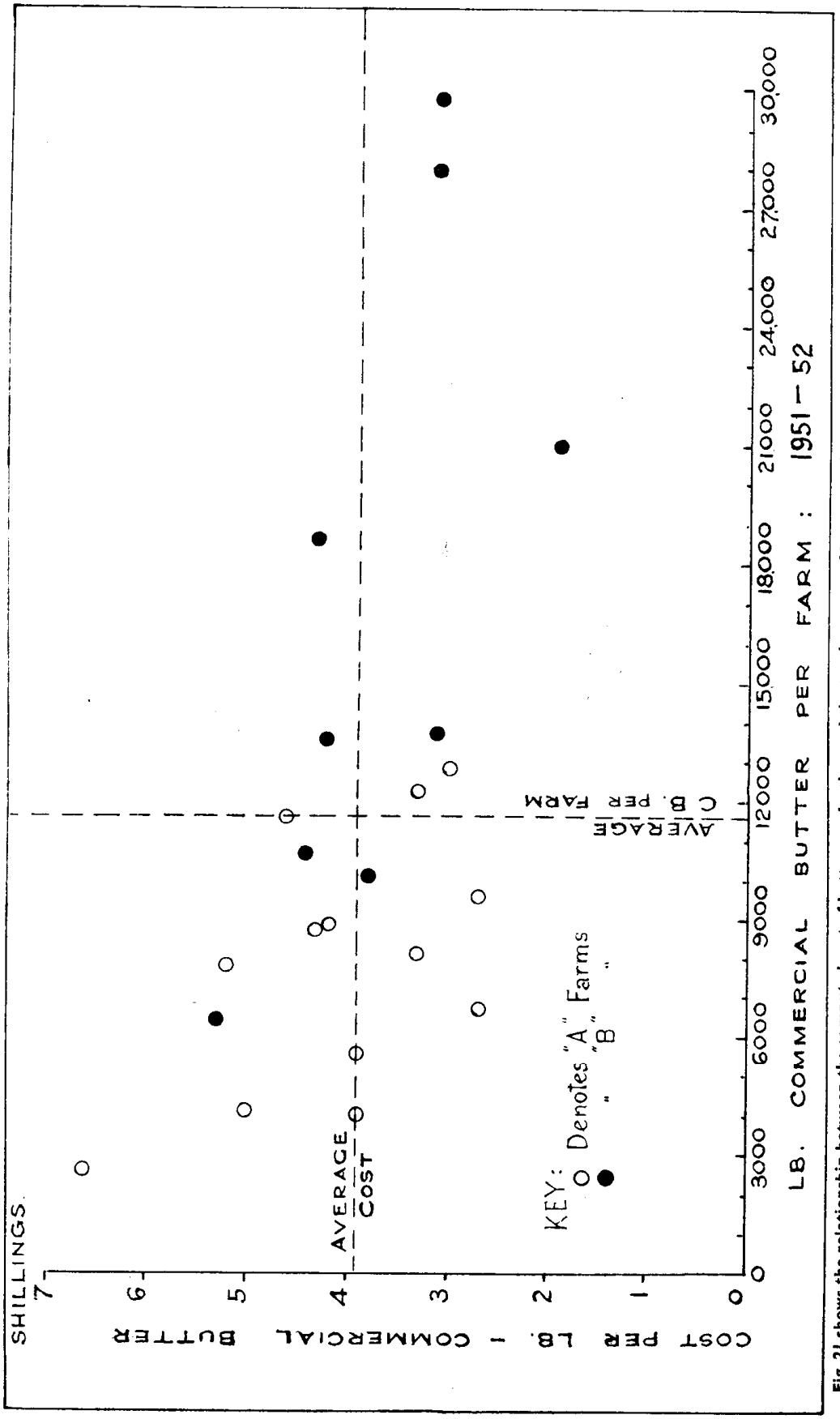

Fig. 21 shows the relationship between the computed cost of butter production and the total amount of butter produced on twenty-twofarms dnring the 1951-52 season. It will be noted that the higher the output the lower the cost.

- "A" farms:—Butter gross income more than 50 per cent. of total gross income. "B" farms:—Butter gross income less than 50 per cent. of total gross income.

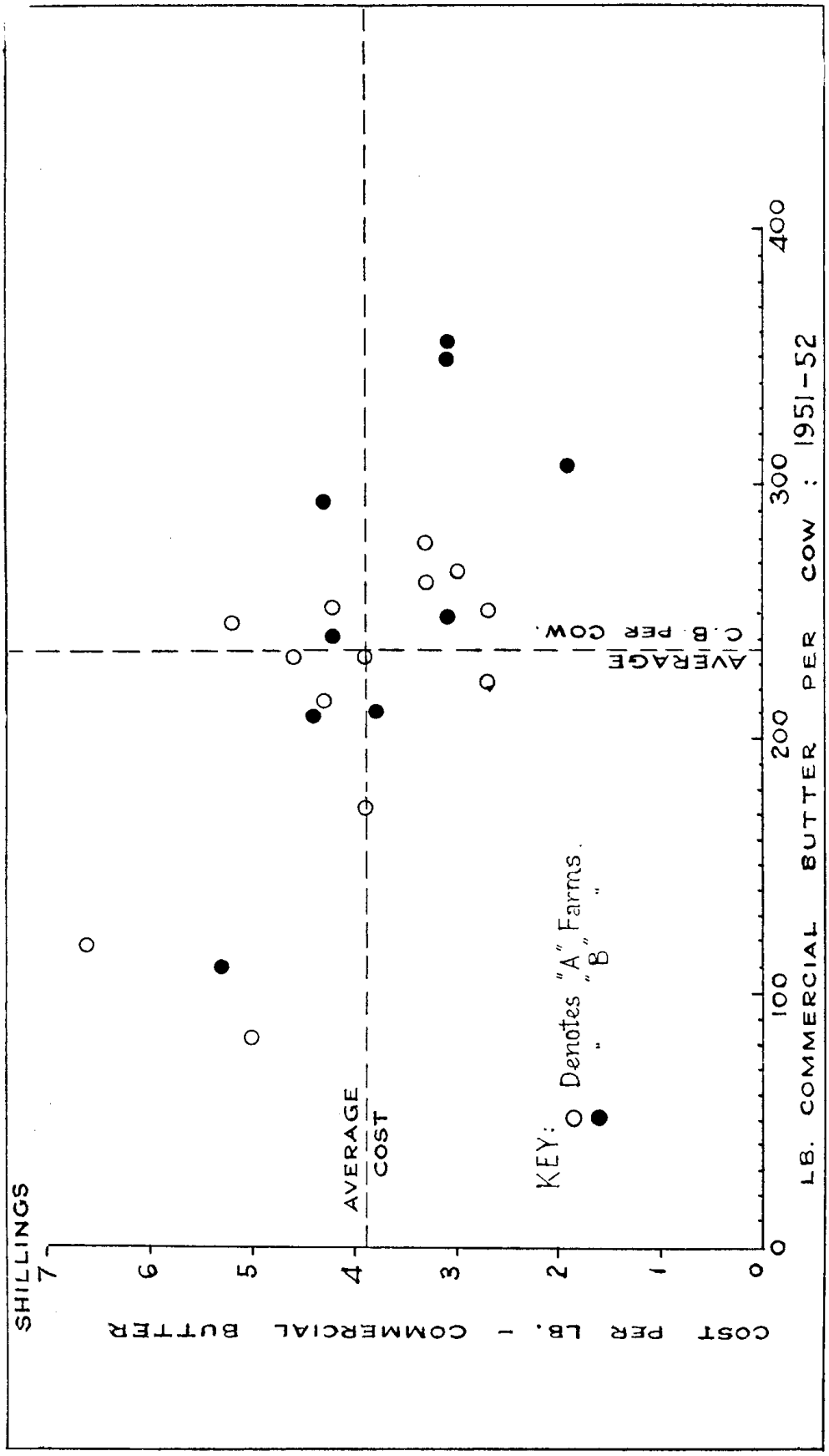

Fig. 22 shows the relationship between butter production per cow and the computed cost of butter production during the 1951-52 season on twenty-two farms. It will be noted that the higher the output per cow the lower the cost.

"A" farms:—Butter gross income 50 per cent. or more of total gross income. "B" farms:—Butter gross income less than 50 per cent. of total gross income.

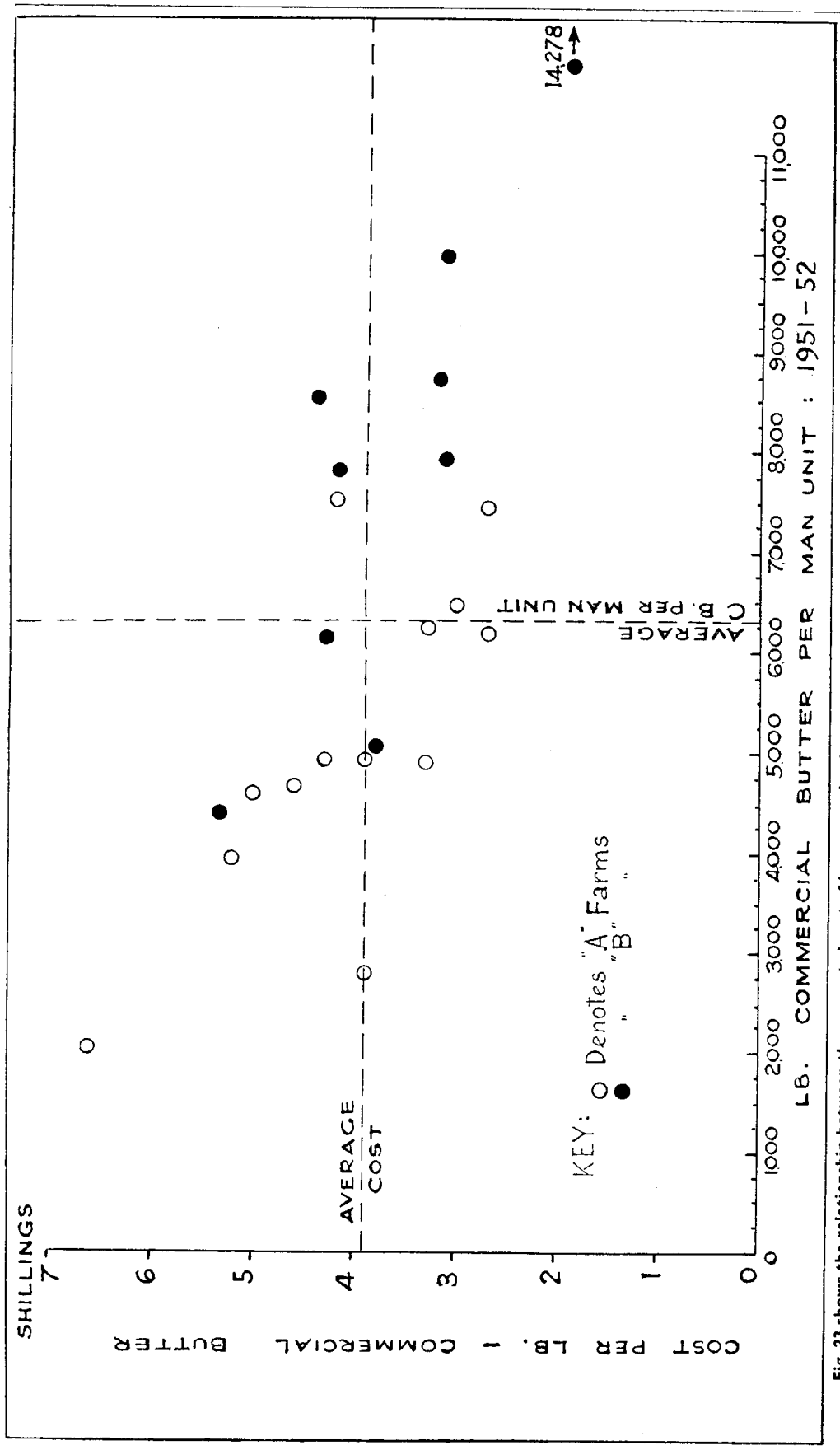

Fig. 23 shows the relationship between the computed cost of butter production and the amount of butter produced per man unit of labour on twenty-two farms for the year 1951-52. The higher the output per man the lower the cost.
"A" farms:—Butter gross income 50 per cent. or more of total gross income. "B" farms:—Butter gross income less than 50 per cent. of total gross income.

Prospects for Dairying in the Survey Area.

Each of the 43 farmers was asked to express his opinion on two matters: (*a*) the future prospects for dairying in the survey area, and (*b*) apparent difficulties facing the development of dairying in the area.

Prospects for Dairying.

Forty-two farmers out of 43 considered that there were good prospects for dairying in the survey area. The one exception considered that dairying had fair prospects but that fat-lamb production was just as attractive in the long run.

It would be misleading to assume that this consensus of opinion necessarily proves that, under current and foreseeable economic conditions, dairying is profitable in the survey region by comparison with alternative forms of production. There would be a natural tendency for present-day farmers to express favourable opinions on the prospects for the type of land use which they had freely adopted in place of the several alternatives open to them. However, there are numerous examples of farmers who have switched to dairying in recent years from wool growing and fat-lamb production. There is no reason to assume that this has occurred only in the case of farmers who have lacked sufficient resources for fat-lamb production or other types of farming requiring more capital than dairying. The switch to dairying has occurred on a number of successful fat-lamb holdings at a time when fat-lamb production was still economically attractive and, in most cases, dairying now forms the dominant type of farming on these properties. Only in a few cases has dairying been adopted on fat-lamb farms as a share-farm type of sideline activity.

Problems of Expanding the Industry.

Undoubtedly there are a number of difficulties in the way of any significant expansion of dairying under irrigation in the Riverina districts. However, some of these difficulties are not peculiar to this part of the State. It is of interest to summarize the various opinions expressed by the survey farmers on this question. Some farmers raised more than one difficulty. For the purposes of the report the opinions can be classified into the following groups:—

(i) *Finance.*—Some farmers thought that lack of finance would be a handicap to the young man wanting to establish himself on a farm in the area, especially as existing properties were usually much larger than necessary for dairying (on a family-farm basis) so that surplus land had to be purchased.

Several farmers expressed the view that dairying was an economic proposition in the area only so long as present price levels continued. Because of the high costs to be met for water, superphosphate and other materials, they believed that any significant reduction in butter prices would make dairying uneconomic in the area.

A fairly large group of farmers thought that water charges were too high for profitable dairying under present economic conditions. However, an equally large group of farmers considered that current water rates were not excessive.[34]

(ii) *Labour.*—The problem of obtaining adequate and efficient labour was raised by a number of farmers. Whilst some labour is available in the area at the present time, several farmers expressed the view that it was not reliable in most cases. A lack of adequate labour is a production problem which has been raised by farmers in most dairying areas of the State for many years. However, the survey area is one of the few dairying districts where farmers make a practice of employing non-family labour on a permanent basis (see p. 107). The views of such farmers on the shortages of efficient labour must therefore be given a hearing perhaps more sympathetic than that given to the same view expressed by farmers who, as a matter of tradition, have relied only on family labour.

(iii) *Marketing.*—Distance from the butter factory, lack of all-weather roads and the scattered nature of farms were conjoint problems raised by a number of farmers.

(iv) *Type of Farmer.*—As mentioned previously, the Berriquin and Denimein Irrigation Districts have been associated traditionally with sheep raising, so that most of the older farmers have been accustomed to extensive grazing over large areas. Some of the farmers considered that this type of background makes many of their neighbours unsympathetic towards dairying which is a much more intensive type of farming than that in vogue on most of the farms. As one farmer expressed it: "New blood is needed in the area if dairying is to be a success on a significant scale." An analysis of the rural experience of the 43 farmers shows that most of them were familiar with dairying when they first started in the district. Many had been on farms in Victorian irrigation districts.[35]

The current attitudes of the generality of farmers in the area will undoubtedly affect the immediate future of dairying in this part of the State. Most of the sheep farms in the district are far too large for efficient dairying on a family-farm (non-share farm) basis. Unless present owners are willing to subdivide their properties, the progress of dairying must inevitably be handicapped. Of course, if the industry displays a persistent long-term economic advantage over other types of farming, closer settlement should take place as a voluntary process. As stated elsewhere, recent land sales in the area indicate an increase in such voluntary subdivisions. There is very keen demand for farms from 100 to 300 acres in size.

[34] On this point, Appendix X shows the money spent by a group of farmers on various items during the year 1951-52. On the average water charges were less than 10 per cent. of the total costs. Although water rates have been raised, it would seem that the cost of water is not a major item of production cost in the survey area.

[35] One of the features of the survey area is that current land values are low by comparison with the value of land with a similar production potential in Victoria. A large number of Victorian farmers are interested in the survey area because it offers them the opportunity of realizing on small and well-established properties in Victoria and re-establishing themselves on much larger farms in New South Wales, with a prospect of greatly increasing their capital assets.

(v) *Adequacy of Drainage and Water Supply.*—When laying out a district for irrigation development, one of the problems is to make provision for adequate drainage. A problem of development raised by several farmers was the possible inadequacies of drainage if large numbers of farmers switch from fat lamb and wool production to dairying. The latter requires more concentrated applications of water, and some farmers believe that many of the present properties (designed for fat lamb production) will not be able to provide adequate drainage if they commence dairying on a large scale.

An allied problem is the possibility that a widespread switch to dairying in the area would give rise to shortages of water during the critical irrigation season. In fat lamb production, water is applied to the land over a longer period of the year than is the same amount of water on a dairy farm. Hence, smaller channels are required for irrigating fat lamb farms. According to this viewpoint, the present irrigation works in the survey area may not be able to meet the possible contingencies of a large-scale dairying development.

These two problems—sufficient drainage and sufficient water—are matters for the irrigation engineer to decide and it is not competent for this report to comment on them. However, there is an obvious problem to be considered: Can irrigation districts be designed which are sufficiently flexible to permit of the growth of more intensive settlement such as occurs when large numbers of farmers switch from sheep grazing to dairying or even vegetable production?

From a physical viewpoint, dairying appears to have a fairly attractive future in the survey area and in other irrigated regions of the Central Murray Valley. Leaving aside economic considerations, it seems most likely that a well managed irrigated dairy farm in the Riverina can achieve a production success which is outstanding by comparison with a large portion of dairy farms in the coastal parts of the State.

However, apart from the various problems which have been raised in the foregoing paragraphs, one vital factor which will affect the future of inland dairying under irrigation is the *net returns* which farmers can expect to achieve in dairying compared with returns from alternative forms of production (e.g., fat lambs, beef, etc.). In the long run, this will determine the extent to which farmers adopt dairying in the Riverina.

This report has not been able to answer many of the vital issues involved in a study of the comparative advantage of dairying over other forms of farming. However, it has established that dairy farmers in the Berriquin and Denimein Irrigation Districts who produce more than 4,000 pounds of commercial butter per year can do this at a cost apparently on a par with the average Australian cost of production. The survey farmers have been able to produce at a high level and have thus been in a position to earn a relatively large net income. Whether these farms could have made greater profits by producing fat lambs, beef or other products cannot be answered at this stage.

Nevertheless, the fact that more than 50 farmers have made significant investments to develop a fairly large-scale dairying enterprise suggests that dairying has been an attractive economic proposition in recent years throughout the survey area. The majority of the farmers stated that they intended to expand further this activity. Presumably, they thought that dairying would continue to be relatively attractive.

The actions of these farmers can be used as a fairly accurate guide in this respect since many of them have had considerable experience in other forms of farming, and few of them are dairying because they lack the necessary capital to adopt alternative pursuits.

TABLE XXVI.

43 Survey Farms Compared with 34 Tongala-Stanhope Farms. Summary Comparison of Major Characteristics.

Characteristic.	Tongala Stanhope District.*	Berriquin and Denimein Districts.
Total area	110 acres	631 acres.† 329 acres.‡
Total irrigated area	90 acres.	262 acres.† 164 acres.‡
Area of winter pasture used for dairying.	20 acres.	77 acres.§ 59 acres.‖
Area of summer pasture used for dairying.	67 acres.	62 aces.§ 39 acres.‖
Water used for dairying	105 acre-feet.	241 acre feet.¶
Number of cows carried	40	48
Water used per acre of irrigated land used for dairying.	1·4 acre-feet.	2·3 acre-feet.¶
Irrigated acres used per cow ...	2·2 acres.	3·9 acres.§ 2·8 acres.‖
Dairy production per irrigated acre	126 lb. commercial butter.	84 lb. commercial butter.§ 107 lb. commercial butter.‖
Production per acre-foot	106 lb. commercial butter.	64 lb. commercial butter.
Water used per cow	2·6 acre-feet.	4·7 acre-feet.¶
Production per cow	277 lb. commercial butter.	249 lb. commercial butter.

* Adapted from the B.A.E. report, *op. cit.*

† Whole area.

‡ Area used for dairying.

§ Actual area.

‖ "Effective" area.

¶ Seventeen farms on which all irrigated land was used for dairy production.

Comparison with the Tongala-Stanhope District.

In this study, the results of the survey of 34 farms in the Tongala-Stanhope District of Victoria carried out by the Bureau of Agricultural Economics have been used as a measure of the scope for expansion of dairying in the Berriquin and Denimein Irrigation Districts. The former survey shows what can be achieved under an intensive dairying programme once the soil fertility has been built up by pasture improvement.

Table XXVI shows a summary of the comparisons between the two surveys to emphasize the main points of difference between the two regions. An examination of this Table will show the following points:—

(i) Much more land was being used by the farmers in this State than was the case in the Victorian area. Total areas devoted to dairying and areas of irrigated land per cow were much larger.

(ii) The 43 farmers in the Berriquin and Denimein Irrigation Districts achieved a significantly lower output than did the Victorian farmers, taking account of such factors as output per cow milked, output per irrigated acre used or output per acre-foot of water used.

(iii) More water was being used by the 43 farms in New South Wales to achieve results that were still below the Victorian standard.

This inter-regional comparison does not deprecate the achievements of the 43 farms reviewed in this article. It merely serves to emphasize the attractive potentialities for expanding the efficiency and numbers of dairy farms in the survey region in view of the geographic similarity of these areas to the Tongala-Stanhope region. Once the improved pastures in the areas have been established for a sufficient time to build up soil fertility to its potential level, there seems no reason why the average farm on the New South Wales side of the Murray cannot match the achievements of the average farm in the Victorian area as summarized in Table XXVI.

7. APPENDICES.[36]

Appendix I.

Household Amenities.

In recent years, surveys have been conducted in a number of the more important dairying districts of New South Wales and some of these studies have been devoted in part to an appraisal of housing conditions. It is of interest at this juncture to compare the results of these surveys where similar factors have been studied.

Figure 24 shows a graphical comparison between three groups of dairy farms with regard to the numbers of farm houses which possessed various household amenities. Whilst these groups of farms were not surveyed during the same period, the comparison does suggest that there were few significant differences in living standards between the rural areas.

On balance, the 43 farms studied in the Berriquin and Denimein Irrigation Districts demonstrate a higher standard of household amenities. This applies particularly to those amenities which the farmer can provide for himself and less to those for which the farmer would normally rely in most cases on community development, such as electricity and the telephone. The Richmond-Tweed region rates better in this comparison than the Manning River district. This could be due to the fact that the latter area was studied two years earlier than the former area and conditions could have improved since then in view of the fact that recent years have seen a general rise in rural living standards. The difference could also be due to the fact that the farmers on the Far North Coast appeared to be earning a much larger income in most cases.

The graph emphasizes the large proportion of dwellings which still have no electricity supplies. The provision of electric appliances and lighting facilities in country homes has been one of the chief factors making for the upward trend in rural living standards of recent years. However, there are obviously many farms still to benefit in this development.

[36] Throughout the Appendices farms are listed in descending order of production per cow in 1952-53.

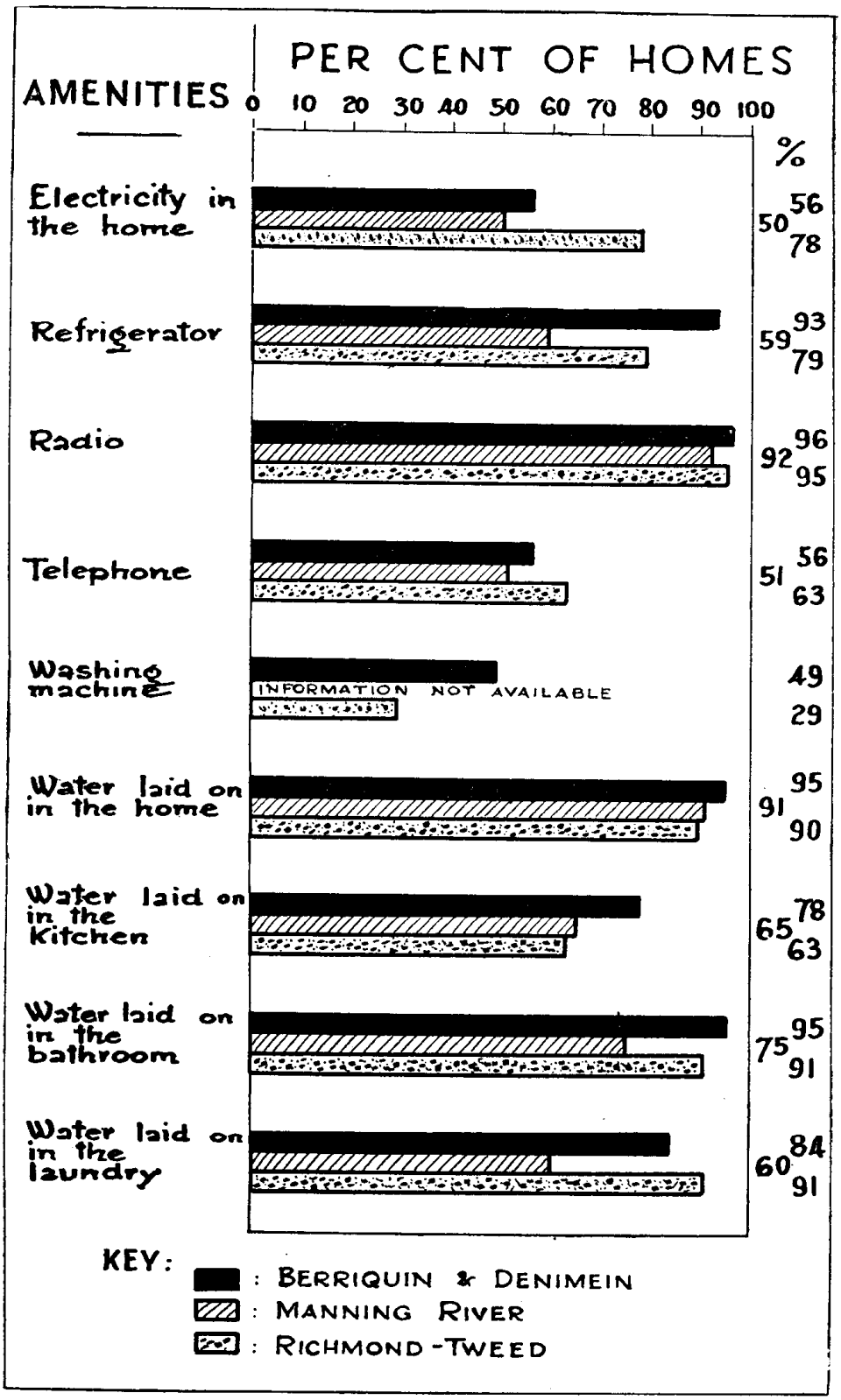

Fig. 24. Proportion of farm homes with various amenities. Thirty-four farms in the Berriquin and Denimein irrigation districts compared with sixty-five farms in the Manning River district and seventy-one farms in the Richmond-Tweed district.

On balance, the homes on the irrigation farms rate highest on this scoring of household amenities. However, there are few marked differences between the three areas.

Appendix II.

Farmers' Opinions on the Amount of Land and Other Resources Necessary for Efficient Dairying in the Survey Area.

Farm No.	Total Acreage.	Acreage to be Irrigated.		Dry Land and Crop Land.	Number of Cows to be Milked.	Labour Force Required.
		Summer Pasture.	Winter Pasture.			
	Acres.	Acres.	Acres.	Acres.	Number.	
1	300	60	100	140	40	1 man.
2	200	100	50	50	80	2 men.
3	200	200	Nil.	Nil.	80	2–3 men.
4	600	50	150	400	45	2 men.
5	300	100	100	100	55	2 men.
6	200	120	80	Nil.	45	2 men.
7	150	40	60	50	40	2 men.
8	200	85	65	50	40–50	2 men.
9	350	100	100	150	55	2 men.
10	180	120	60	Nil.	70	2 men.
11	250	100	150	Nil.	*	*
12	275	150	125	Nil.	70	3 men.
13	320	70	70	180	35	1 man.
14	250	150	50	50	100	2 men.
15	300	200	50	50	100	2 men.
16	200	100	100	Nil.	50	2 men.
17	200	100	100	Nil.	40	1 man.
18	300	60	130	110	40	1 man.
19	350	100	200	50	*	*
20	320	*	*	*	*	*
21	300	60	100	140	35	1 man.
22	400	100	200	100	60	2 men.
23	500	60	200	240	50	2 men.
24	200	100	100	Nil.	70	2 men.
25	250	50	150	50	80	2 men.
26	250	100	100	50	45	2 men.
27	200	100	50	50	60	1 man.
28	200	80	110	10	40	1 man and 1 boy.
29	100	50	50	Nil.	50	1 man and 1 boy.
30	320	90	190	40	50	1 man.
31	250	80	120	50	45	2 men.
32	500	150	150	200	50	2 men.
33	1,000	100	300	600	100	1 man and 2 boys.
34	150	125	Nil.	25	50	2 men.
35	300	150	50	100	50	2 men.
36	700	150	50	500	100	3 men.
37	320	60	40	220	80	2 men.
38	250	30	60	160	60	3 men.
39	600	300	Nil.	300	100	3 men.
40	220	70	70	80	60	2 men.
41	650	80	200	370	80	3 men.
42	500	120	240	140	100	3 men.
43	200	100	100	Nil.	35	2 men.
Averages ...	321	103	107	114	61	...

* Farmer was not able to give an opinion.

Appendix III.

Calculation of the "Effective" areas of Irrigated Pasture.

As part of the calculation of the aggregate amounts of irrigated improved pasture on each of the 43 farms, the acreage of each of the relevant paddocks was multiplied by the undermentioned fractions to take account of differences in the age and plant composition of the pastures. By this means an attempt was made to reduce the pasture areas to commensurate terms as regards effective value for grazing.

The arbitary adjustments made were as follows:—

Type of Pasture.	Age of Pasture in Years.	Fraction by which the actual paddock acreages were multiplied to determine "effective" acreage.
1. All summer pasture except lucerne	One or less.	0·25
	Two to three.	0·5
	Three or more.	1·0
2. Lucerne	Up to six.	Same as winter pasture.
	Seven and eight.	0·75
	Nine and ten.	0·5
	Over ten.	0·33
3. All winter pasture	One.	0·33
	Two to three.	0·75
	Three or more.	1·0

In all cases, when "effective" winter pasture has been added to "effective" summer pasture, two acres of winter pasture have been counted as equivalent to one acre of summer pasture.

Appendix IV.

Acreage of Pasture and Crop on 43 Survey Farms during 1952-53.

Entire Farm.

Farm Number.	Total Area of Farm.	Total Farm Area Irrigated.	Irrigated Improved Winter Pasture.		Irrigated Improved Summer Pasture.		Natural Grass.		Crop.		Fallow.	
			Actual.	Effective.*	Actual.	Effective.*	Irrigated.		Irrigated.		Irrigated	
							Yes.	No.	Yes.	No.	Yes.	No.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
1	1,400	1,110	245	245	165	145	60	250	640	40	...	...
2	640	416	315	155	101	53	...	224	...	...	...	...
3	535	259	66	66	121	74	72	241	...	35	...	...
4	960	518	20	12	28	9	470	442	...	...	...	...
5	500	347	256	256	91	85	...	79	...	74	...	...
6	438	402	230	80	99	67	22	36	20	...	31	...
7	992	451	133	133	98	62	18	476	182	65	20	...
8	320	59	24	19	35	22	...	189	...	10	...	62
9	580	50	50	37	...	...	...	285	...	45	...	200
10	522	115	40	40	56	6	13	287	12	120	...	...
11	500	278	159	135	83	44	...	222	36	...	...	...
12	686	142	67	67	75	75	...	544	...	...	...	...
13	580	171	87	32	74	19	...	390	10	19	...	...
14	506	168	40	40	88	82	40	338	...	...	...	...
15	1,108	455	176	96	189	57	...	373	90	280	...	...
16	457	198	60	60	118	59	...	76	20	153	...	30
17	720	370	158	158	212	60	...	150	...	200	...	...
18	1,240	175	145	145	20	11	...	838	10	227	...	...
19	1,367	465	182	100	131	107	...	782	140	120	12	...
20	492	417	208	98	44	44	...	75	165	...	...	...

For footnotes see next page.

APPENDIX IV—*continued.*

Acreage of Pasture and Crop on 43 Survey Farms during 1952-53.—*Entire Farm*—continued.

Farm Number.	Total Area of Farm.	Total Farm Area Irrigated.	Irrigated Improved Winter Pasture.		Irrigated Improved Summer Pasture.		Natural Grass.		Crop.		Fallow.	
			Actual.	Effective.*	Actual.	Effective.*	Irrigated.		Irrigated.		Irrigated.	
							Yes.	No.	Yes.	No.	Yes.	No.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
21	503	282	175	82	62	62	...	221	45	...	...	...
22	915	220	150	92	70	17	...	435	...	260	...	...
23	536	242	242	221	...	...	...	250	...	44	...	...
24	950	503	383	186	80	30	...	294	40	153	...	...
25	470	301	244	121	44	35	...	71	13	98	...	...
26	486	248	93	73	90	57	...	213	65	25	...	...
27	200	67	41	26	26	26	...	62	...	71	...	...
28	960	373	339	191	34	22	...	467	...	120	...	...
29	164	91	49	49	27	12	...	73	15	...	...	...
30	640	162	34	29	68	55	23	383	37	95	...	...
31	500	156	52	15	9	...	...	344	95	...	...	...
32	690	217	171	171	46	46	...	473	...	...	...	...
33	605	200	160	100	10	...	...	405	...	...	30	...
34	100	90	42	42	48	36	...	10	...	...	...	...
35	537	267	80	80	8	...	115	270	27	...	37	...
36	784	286	42	42	46	17	...	518	178	...	...	...
37	400	71	22	...	49	...	...	299	...	30	...	...
38	735	190	106	...	54	35	...	505	30	40	...	...
39	440	128	...	...	128	128	...	117	...	75	...	120
40	473	189	105	21	47	20	...	284	27	...	10	...
41	550	252	158	150	94	51	...	228	...	10	...	60
42	320	137	20	20	87	80	...	183	30	...	...	...
43	640	44	...	...	44	44	...	596	...	...	...	...
Average ...	631	262	125	86	70	43	19	302	45	56	3	11

* The actual acreages of irrigated improved pasture have been converted to equivalent " effective " acreages where this was necessary to take account of differing age and plant composition. (See Appendix III.)

Appendix V.

Acreage of Pasture and Crop on 43 Survey Farms during 1952-53.
*Equivalent Dairying Section.**

Farm Number.	Total Farm Area Devoted to Dairying.	Total Irrigated Area Devoted to Dairying.	Irrigated Improved Winter Pasture.		Irrigated Improved Summer Pasture.		Natural Grass. Irrigated.		Crop. Irrigated.		Fallow. Irrigated.	
			Actual.	Effective.†	Actual.	Effective.†	Yes.	No.	Yes.	No.	Yes.	No.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
1	257	213	30	30	138	118	...	24	45	20	...	...
2	114	94	21	8	73	33	...	20	...	...	...	...
3	535	259	66	66	121	74	72	241	...	35	...	...
4	313	121	16	10	23	7	82	192	...	...	...	...
5	500	347	256	256	91	76	...	79	...	74	...	...
6	290	254	94	44	87	67	22	36	20	...	31	...
7	337	231	133	133	98	62	...	106	...	...	...	...
8	320	59	24	19	35	22	...	189	...	10	...	62
9	182	40	40	30	...	...	...	142	...	...	...	...
10	522	115	40	40	50	6	13	287	12	120	...	...
11	500	278	159	135	83	44	...	222	36	...	...	...
12	586	142	67	67	75	75	...	444	...	...	...	...
13	109	62	10	7	42	11	...	36	10	11	...	...
14	506	168	40	40	88	82	40	338	...	...	...	...
15	193	190	75	55	60	38	...	3	55	...	...	...
16	417	198	60	60	118	59	...	66	20	153	...	...
17	620	370	158	158	212	60	...	150	...	100	...	...
18	112	81	54	54	17	8	...	10	10	21	...	...
19	543	465	182	100	131	107	...	78	140	...	12	...
20	231	164	105	39	43	43	...	67	16	...	...	...
21	458	237	175	82	62	62	...	221	...	...	...	...

For footnotes see next page.

Appendix V—*continued.*

Acreage of Pasture and Crop on 43 Survey Farms during 1952-53—continued.

*Equivalent Dairying Section.** —continued.

Farm Number.	Total Farm Area Devoted to Dairying.	Total Irrigated Area Devoted to Dairying.	Irrigated Improved Winter Pasture.		Irrigated Improved Summer Pasture.		Natural Grass. Irrigated.		Crop. Irrigated.		Fallow. Irrigated.	
			Actual.	Effective.†	Actual.	Effective.†	Yes.	No.	Yes.	No.	Yes.	No.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
22	291	164	94	56	70	17	...	37	...	90	...	...
23	202	143	143	134	...	...	...	55	...	4	...	...
24	213	158	126	64	32	8	...	20	...	35	...	...
25	248	185	128	27	44	35	...	45	13	18	...	...
26	236	211	71	57	75	51	...	...	65	25	...	...
27	200	67	41	26	26	26	...	62	...	71	...	...
28	237	138	109	68	29	17	...	90	...	9	...	...
29	164	91	49	49	27	12	...	73	15	...	...	...
30	522	144	29	29	55	15	23	315	37	63	...	...
31	206	44	35	9	9	...	...	162	...	...	...	...
32	690	217	171	171	46	46	...	473	...	...	...	...
33	600	200	160	100	10	...	...	400	...	...	30	...
34	100	90	42	42	48	36	...	10	...	...	...	...
35	137	100	27	27	8	...	45	37	5	...	15	...
36	397	266	42	42	46	17	...	131	178	...	...	...
37	155	71	22	...	49	...	...	74	...	10	...	...
38	310	50	2	...	36	35	...	245	12	20	...	...
39	440	128	...	...	128	128	...	117	...	120	...	75
40	214	57	22	18	27	...	...	157	8	...	...	...
41	550	252	158	158	94	51	...	228	...	10	...	60
42	305	137	20	20	87	80	...	168	30	...	...	...
43	70	44	...	...	44	44	...	26	...	...	...	...
Average:	329	164	77	59	62	39	7	137	17	24	2	5

* These figures refer to the calculated areas used for dairying purposes. In the case of farms running non-dairy stock, the figures represent the farmers' estimates of the extent to which areas were used for dairying purposes.

† See footnote Appendix IV.

Appendix VI.

Total Area of Irrigated Improved Pasture per Farm and per Milking Cow on 43 Survey Farms during 1952-53.*

Farm Number.	*Column A.* Total Area for Entire Farm.	*Column B.* "Effective" Area for Entire Farm.†	*Column C.* Total Area for Equivalent Dairying Sections of Farm.‡	*Column D.* "Effective" Area for Equivalent Dairying Section of Farm.	*Column E.* Number of Milkers in 1952–53 Season.§	Acreage of Irrigated Improved Pasture per Milker in 1952–53 Season.‖			
						Col. A. Divided by Col. E.	Col. B. Divided by Col. E.	Col. C. Divided by Col. E.	Col. D. Divided by Col. E.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
1	287	267	153	133	40	7·2	6·7	3·8	3·3
2	258	130	83	37	44	5·9	3·0	1·9	0·8
3	154	107	154	107	82	1·9	1·3	1·9	1·3
4	38	15	31	12	21	1·8	0·7	1·5	0·6
5	219	213	219	204	41	5·3	5·3	5·3	5·0
6	214	107	134	89	28	7·6	3·8	4·8	3·2
7	164	128	164	128	83	2·0	1·5	2·0	1·5
8	47	31	47	31	42	1·1	0·7	1·1	0·7
9	25	18	20	15	16	1·6	1·1	1·3	0·9
10	76	26	70	26	43	1·8	0·6	1·6	0·6
11	162	111	162	111	83	2·0	1·3	2·0	1·3
12	108	108	108	108	68	1·6	1·6	1·6	1·6
13	117	35	47	14	15	7·8	2·3	3·1	0·9
14	108	102	108	102	74	1·5	1·4	1·5	1·4
15	277	105	97	60	41	6·8	2·6	2·4	1·5
16	148	89	148	89	38	3·9	2·3	3·9	2·3
17	291	139	291	139	48	6·1	2·9	6·1	2·9
18	92	83	44	35	20	4·6	4·2	2·2	1·8
19	222	137	221	157	40	5·6	3·9	5·5	3·9
20	148	93	95	62	30	4·9	3·1	3·2	2·1
21	149	103	149	103	78	1·9	1·3	1·9	1·3
22	145	63	117	45	40	3·6	1·6	2·9	1·1
23	121	110	71	67	27	4·5	4·1	2·6	2·5
24	271	123	95	40	30	9·0	4·0	3·2	1·3

For footnotes see next page.

Appendix VI—*continued.*

Total Area of Irrigated Improved Pasture per Farm and per Milking Cow on 43 Survey Farms during 1952–53*—continued.

Farm Number.	*Column A.* Total Area for Entire Farm.	*Column B.* "Effective" Area for Entire Farm.†	*Column C.* Total Area for Equivalent Dairying Sections of Farm.‡	*Column D.* "Effective" Area for Equivalent Dairying Section of Farm.	*Column E.* Number of Milkers in 1952–53 Season.§	Acreage of Irrigated Improved Pasture per Milker in 1952–53 Season.‖			
						Col. A. Divided by Col. E.	Col. B. Divided by Col. E.	Col. C. Divided by Col. E.	Col. D. Divided by Col. E.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
25	166	95	108	48	34	4·9	2·8	3·2	1·4
26	136	93	110	79	60	2·3	1·6	1·8	1·3
27	46	39	46	39	32	1·4	1·2	1·4	1·2
28	203	117	83	51	29	7·0	4·0	2·9	1·8
29	51	36	51	36	27	1·9	1·3	1·9	1·3
30	85	69	69	29	62	1·4	1·1	1·1	0·5
31	35	7	26	4	36	1·0	0·2	0·7	0·1
32	131	131	131	131	58	2·3	2·3	2·3	2·3
33	90	50	90	50	67	1·3	0·7	1·3	0·7
34	69	57	69	57	48	1·4	1·2	1·4	1·2
35	48	40	21	13	23	2·1	1·7	0·9	0·6
36	67	38	67	38	41	1·6	0·9	1·6	0·9
37	60	...	60	...	38	1·6	...	1·6	...
38	107	35	37	35	38	2·8	0·9	1·0	0·9
39	128	128	128	128	135	0·9	0·9	0·9	0·9
40	99	30	38	9	37	2·7	0·8	1·0	0·2
41	173	126	173	130	130	1·3	1·0	1·3	1·0
42	97	90	97	90	50	1·9	1·8	1·9	1·8
43	44	44	44	44	53	0·8	0·8	0·8	0·8
Average ...	132	86	99	68	48	3·3	2·2	2·2	1·5

* The areas of irrigated pasture have been derived by converting all the irrigated improved pastures listed in Appendix V to summer pasture. For this conversion one acre of summer pasture was classed as equal to two acres of winter pasture.

† See Appendix III. ‡ See page 102. § The equivalent number of cows completing a full lactation. See Appendix VII.

‖ These ratios have been derived from the data in columns A to E. For example, Column C divided by column E indicates the total acreage of irrigated improved pasture available per milker during the 1952–53 season.

Appendix VII.

*Number of Milkers on 43 Survey Farms.**

Farm No.	Years.			
	1950–51.	1951–52.	1952–53.	1953–54 (intended).†
1	24	42	40	unknown
2	...	...	44	70
3	75	78	82	80
4	5	9	21	40
5	...	...	41	120
6	53	47	28	70
7	130	130	83	45
8	35	37	42	45
9	...	9	16	21
10	27	32	43	38
11	53	95	83	80
12	26	50	68	82
13	38	20	15	28
14	66	68	74	73
15	40	48	41	44
16	39	42	38	45
17	48	48	48	48
18	10	16	20	20
19	60	50	40	40
20	30	30	30	unknown
21	76	78	78	75
22	25	35	40	45
23	...	...	27	3
24	31	31	30	44
25	...	...	34	45
26	49	49	60	63
27	19	24	32	35
28	24	24	29	30
29	...	12	27	23
30	49	36	62	unknown
31	12	25	36	55
32	58	58	58	70
33	67	67	67	67
34	48	48	48	48
35	9	11	23	20
36	25	29	41	45
37	...	26	38	30
38	19	29	38	4
39	68	83	135	150
40	14	23	37	unknown
41	130	130	130	130
42	50	50	50	50
43	52	52	53	50
Average number of Milkers	44 (36 farms).	45 (39 farms).	48 (43 farms).	53 (39 farms).

* This includes cows completing a normal lactation plus an equivalent value for those disposed of in milk. For example, if a cow was disposed of after milking 3 months of its lactation when usually this lactation could be expected to be 9 months it was counted as one-third of a unit.

† The number planned at the time of the survey (i.e., late winter and early spring, 1953).

Appendix VIII.

*Water Usage on 17 Survey Farms.**

Farm No.	Acre-Feet of Water Used.	Acre-Feet Used per Cow Milked.	Pounds of Butter Produced per Acre Foot of Water Used.	Approximate Acre-Feet of Water Used per Acre Irrigated.
	Acre-Feet.	Acre-Feet.	lb.	Acre-Feet.
3	321	3.91	97.15	2.08
5	615	15.00	22.57	2.81
8	191	4.55	70.28	4.06
10	208	4.84	61.76	2.97
11	317	3.82	76.89	1.96
12	306	4.50	62.83	2.83
14	319	4.31	62.54	2.95
16	304	8.00	33.46	2.05
17	117	2.44	109.30	0.40
19	161	4.03	64.14	0.73
27	172	5.37	40.88	3.74
29	98	3.63	56.86	1.92
33	241	3.60	55.29	2.68
34	187	3.89	50.30	2.71
41	197	1.51	99.73	1.14
42	301	6.02	21.26	3.10
43	48	0.91	105.56	1.09
Average for 17 farms	241.3	4.72	64.16	2.31

* These were the only farms which used all their irrigated land for dairy production in 1952-53.

Appendix IX.

Butter Production on 43 Survey Farms—1952-53.

Farm Number.	Commercial Butter Produced 1952–53.*	Commercial Butter Produced per Cow 1952–53.	Commercial Butter Produced per Irrigated Dairying Acre.
	lb.	lb.	lb.
1	19,252	481	90
2	17,963	408	191
3	31,185	380	120
4	7,487	357	62
5	13,881	339	40
6	9,172	328	36
7	27,045	326	117
8	13,423	320	228
9	4,978	311	124
10	12,847	299	112
11	24,374	294	88
12	19,226	283	135
13	4,204	280	68
14	19,950	270	119
15	10,973	268	58
16	10,172	268	51
17	12,788	266	35
18	5,254	263	65
19	10,327	258	22
20	7,630	254	47
21	19,665	252	83
22	9,996	250	61
23	6,680	247	47
24	6,918	231	44
25	7,567	223	41
26	13,332	222	63
27	7,031	220	105
28	6,151	212	45
29	5,572	206	61
30	12,786	206	89
31	7,355	204	167
32	11,796	203	54
33	13,326	199	67
34	9,406	196	105
35	4,486	195	45
36	7,912	193	30
37	6,507	171	92
38	5,958	157	119
39	20,648	153	161
40	5,617	152	99
41	19,647	151	78
42	6,399	128	47
43	5,067	96	115
Average ...	11,673	249	84

* Where necessary, wholemilk sold has been converted to pounds of commercial butter.

Appendix X.

Depreciation and Cash Costs of the Entire Farm for 1951-52.*

22 Sample Farms.

Farm No.	Employees Wages and Keep.	Water Rates.	Other Rates and Land Taxes.	Repairs.	Seeds, Fodder and Fertilizers.	Fuel and Oil.	Freight.	Depreciation.	Interest.	Insurance.	Rent.	Motor Registration.	Shearing.	Subscriptions, Stationary and Travel Expenses.	Miscellaneous.	Total Cash Costs.
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
3	305	198	31	863	594	302	...	584	86	142	15	42	...	12	48	3,222
6	33	337	60	121	435	87	142	146	129	...	...	2	60	14	...	1,566
7	1,560	274	59	1,713	950	289	238	258	10	93	...	62	...	68	8	5,582
8	111	94	58	313	174	145	75	89	100	...	...	9	...	1	5	1,174
10	282	91	30	472	263	329	112	131	80	15	110	7	...	42	65	2,029
12	270	150	38	407	1,578	104	35	270	...	1	...	...	81	15	35	2,984
14	702	212	90	138	430	137	38	296	100	10	10	...	...	59	63	2,285
15	294	205	6	900	802	362	127	206	813	69	...	44	127	66	63	4,084
16	88	183	55	527	986	292	108	206	95	26	104	19	...	41	103	2,833
17	504	176	91	127	144	187	200	52	53	18	104	28	14	2	19	1,719
19	10	668	111	780	192	441	165	181	265	36	...	...	185	51	60	3,145
20	688	114	189	450	320	121	...	411	66	53	...	38	18	35	10	2,513
26	12	129	57	468	324	102	33	63	...	17	...	17	105	9	7	1,343
27	...	94	26	99	181	173	37	215	41	22	...	18	...	11	4	921
28	526	192	106	520	283	161	12	263	79	147	...	38	65	26	85	2,503
30	190	74	26	812	227	378	37	278	95	38	129	...	16	27	28	2,355
34	208	50	9	544	545	33	21	59	21	...	...	...	...	1	12	1,503
36	264	68	59	526	261	196	10	183	23	1	196	14	...	26	24	1,851
38	711	155	65	652	519	193	39	377	...	60	...	24	207	29	129	3,160
40	82	85	61	330	535	144	1	240	162	2	...	25	146	8	12	1,833
42	186	60	36	111	85	113	45	98	315	5	...	...	...	13	26	1 093
43	10	50	47	372	10	106	...	136	95	14	...	...	35	15	29	919

* As shown in the relevant Income Tax returns with the exception of Depreciation which was calculated at normal rates only and does not include special allowances.

Appendix XI.

Gross Farm Income 1951-52* *Berriquin and Denimein Irrigation Districts.*

22 Sample Farms.

Farm No.	Butter.	Wool.	Gross Income Derived from the Sale of—							Gross Farm Income.	Butter Gross Income as a Percentage of Total Gross Income.	Dairy Gross Income as a Percentage of Total Gross Income.‡	Net Profit.§	Value of Farmers' Equity.‖	Net Return on Capital Invested.¶
			Wheat.	Oats.	Miscellaneous. †	Horses.	Pigs.	Cattle.	Sheep.						
	£	£	£	£	£	£	£	£	£	£	Per cent.	Per cent.	£	£	Per cent.
3	4,849	...	418	...	...	...	602	411	...	6,280	77	93	2,258	16,133	14.0
6	1,720	562	2,264	...	...	...	712	307	−181	5,384	32	51	3,018	12,600	24.0
7	5,215	...	299	...	...	...	1,635	1,780	34	8,963	58	96	2,581	28,533	9.0
8	2,404	...	...	...	44	...	229	42	−29	2,690	89	99	716	7,978	9.0
10	1,379	292	299	254	138	...	508	153	109	3,132	44	65	303	13,355	2.3
12	3,260	594	...	...	...	...	150	−30	393	4,367	75	77	583	21,067	2.8
14	3,673	...	...	...	...	...	995	1,401	...	6,069	60	100	2,984	13,178	22.6
15	2,143	...	4,686	803	...	− 4	303	318	131	8,380	26	33	3,496	19,022	18.4
16	1,527	179	41	1,581	129	−18	1,105	135	480	5,159	30	54	1,526	12,330	12.4
17	2,242	60	1,965	148	...	−69	189	302	115	4,961	45	55	2,442	21,689	11.3
19	2,031	2,041	849	...	11	...	39	66	460	5,497	37	39	1,552	34,311	4.5
20	1,452	261	1,543	...	6	...	261	434	94	4,051	36	53	738	12,844	5.7
26	2,387	999	638	...	...	...	...	258	199	4,481	53	59	2,338	16,422	14.2
27	985	31	469	131	...	...	273	363	−24	2,228	44	73	507	5,444	9.3
28	729	1,342	1,964	...	...	...	174	374	1,173	5,756	13	22	2,453	25,289	9.7
30	1,538	585	314	36	...	...	434	16	567	3,490	44	57	335	18,667	1.8
34	1,773	...	...	...	...	...	478	−155	...	2,096	85	100	−207	4,688	‡‡
36	1,864	131	96	...	33	...	202	219	232	2,777	67	82	126	21,444	0.6
38	1,177	1,660	2,477	823	...	...	97	31	166	6,431	18	20	2,471	21,778	11.3
40	466	1,373	408	...	...	...	291	−7	174	2,705	17	28	72	12,378	0.6
42	1,141	...	...	...	50	...	84	−47	70	1,298	88	91	−595	4,267	‡‡
43	751	827	14	...	...	...	8	325	147	2,072	36	52	353	17,133	2.1

* As shown in the relevant Income Tax returns.

† Includes Barley, Hay, Poultry and Show prizes.

‡ Dairy gross income is assumed equal to the sum of incomes derived from the sale of butter, pigs and cattle. (None of the 22 farms was selling beef stock.)

§ Calculated in each case by subtracting from the value of gross farm income the value of cash costs (see Appendix X) and £800 representing a wage and managerial allowance to the farm operator.

‖ Refers to the entire farm and not merely the assets used for dairying.
Equity was calculated, using the following values :—Land, buildings and machinery Flat rate of £25 per acre.
Mature cow, heifer or bull ... ... £25 per head.
Weaned young stock ... ... £15 per head.
Beef cattle ... ... £18 per head.
Sheep ... ... £3 per head.
Horses ... ... £10 per head.
Brood sows ... ... £25 per head.
Other pigs... ... ... £7 per head.

Farm debt was determined from interest paid as shown in Appendix X.

‡‡ For these farms, costs and allowances exceeded gross income.

¶ Net profit expressed as a percentage of the value of farmer's equity.

Appendix XII.

An Estimate of Cost of Production per pound of Commercial Butter, 1951-52.

22 Sample Farms.

Farm Number.	Mixed Costs.		Butter Costs in Mixed Costs. †	Dairy Labour Costs. ‡	Total Butter Costs.	Commercial Butter Production 1951-52	Cost per lb. of Butter.
	Interest on Farm Equity at 4.5 per cent.	Other Costs. *					
	£	£	£	£	£	lb.	Shillings.
3	726	2,917	2,812	1,426	4,238	27,713	3.1
6	567	1,533	670	672	1,342	9,826	2.7
7	1,284	4,022	3,088	1,512	4,600	29,799	3.1
8	359	1,063	1,271	882	2,153	13,737	3.1
10	601	1,747	1,033	1,008	2,041	7,893	5.2
12	948	2,714	2,732	1,306	4,038	18,629	4.3
14	593	1,583	1,316	720	2,036	20,989	1.9
15	856	3,790	1,189	817	2,006	12,247	3.3
16	555	2,745	977	882	1,859	8,729	4.3
17	976	1,391	1,070	869	1,939	12,813	3.0
19	1,544	3,135	1,726	949	2,675	11,604	4.6
20	578	1,825	860	505	1,365	8,297	3.3
26	739	1,331	1,103	339	1,442	13,640	4.2
27	245	921	515	590	1,105	5,626	3.9
28	1,138	1,977	396	417	813	4,167	3.9
30	840	2,165	1,325	523	1,848	8,787	4.2
34	211	1,295	1 274	664	1,938	10,134	3.8
36	965	1,587	1,712	630	2,342	10,651	4.4
38	980	2,449	627	288	915	6,723	2.7
40	557	1,751	397	498	895	2,697	6.6
42	192	907	966	756	1,722	6,522	5.3
43	771	909	608	464	1,072	4.291	5.0
Average	...	...	...	...	...	...	3.9

* Total cash costs of the entire farm minus cost of employees' wages and keep as shown in Appendix X.

† Calculated by making the assumption that all enterprises on the individual farm were equally profitable, hence the ratio of Butter Costs to Total Costs equals the ratio of Butter Gross Income to Total Gross Income.

‡ Calculated by paying dairy labour used in 1951-52 (as obtained from the questionnaire) the award wage rates for that year.