LABOUR REQUIREMENTS ON WHEAT FARMS IN THE NORTH WESTERN SLOPE OF NEW SOUTH WALES

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1. INTRODUCTION

It is a common lament amongst agricultural economists that there is a lack of suitable data on input-output relationships in farming, for use in comparative analysis, budgeting, programme planning, linear programming and other planning techniques. However, this does not deter some from inventing the data so that they can use the more sophisticated techniques to reach much-publicized but probably spurious conclusions.

Sometimes resort is made to data obtained from experimental farms and there is a lot to be said for this approach. The management factor, which so often bedevils analysis of data obtained from farm surveys, is presumably constant and certain other factors which vary from farm to farm can be kept constant or their variation accounted for in proper experimental design. Thus results can be obtained for input-output relationships (though often at only one or two discrete levels) under stated conditions and with a given farming technique. There is, unfortunately, the problem of translating the experimental results into those that could

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be expected under commercial farming conditions. Davidson,[1] working on crop yields for wheat, sugar, cotton and tobacco has shown that, on average, commercial yields can be anything from 55 per cent to 75 per cent of experimental yields in the same area. It is well, then, to know just what levels of performance are being obtained by farmers under commercial conditions. Moreover, for some inputs, e.g., labour, it is not possible to obtain information any other way than by a farm survey. A combination of the two methods is almost certainly the best approach. For these reasons a farm survey was considered necessary for the purpose of a study which is briefly described below.

The purpose of the study was twofold:

(1) to obtain input-output data for various enterprises and methods of production found on wheat farms in the North Western Slope.

(2) to use the information to determine optimum farm plans under various conditions in the area. It was also hoped that the information would be helpful in any comparative analysis and budgeting studies carried out later by research and extension workers.

This article describes two aspects of the first phase of the study. Firstly, certain characteristics of the sample are compared with those of the population in order to assess the reliability of general conclusions inferred from the sample. Secondly, information on the particular input "labour" is singled out for examination, as little has been hitherto published in this field and it is felt that there is likely to be interest in this aspect by itself.

2. THE SAMPLE AND ITS RELIABILITY

Selection

It was originally hoped to have a sample of wheat farmers that would be identical with that drawn by McFarlane[2] ten years previously, so that changes in farm organization since the previous survey could be studied. It was thought that this would have been of interest by itself and in connection with the second phase of the study. The original sample was drawn at random from a list of farmers whose names appeared both in the electoral rolls for the Shires of Peel, Liverpool Plains, Macintyre and Yallaroi, and also in the electoral roll of wheatgrowers compiled under the Wheat Industry Stabilization Act, 1948. As far as possible this original sample was used but due to difficulties of locating some of these farms a supplementary list drawn at random was also used. The total size of the eventual sample was sixty-six farmers and due to the usual reasons, especially because of substitution of additional farmers for those not co-operating, it was expected that it would be a somewhat biased sample. The extent to which the sample can be said to be representative of the population we are interested in, i.e., wheat farms in the North Western Slope Division, is now tested by examining those characteristics of the sample and population for which information is available.

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[1] B. R. Davidson, "Crop Yields in Experiments and On Farms", *Nature*, Vol. 194, No. 4827 (May 5, 1962) and Private Communication.

[2] G. C. McFarlane, "Soil Management Practices on North-Western Wheat Farms", this *Review*, Vol. 20, No. 3 (September, 1952).

Examination of Major Characteristics

(1) *Size Distribution.* One point here that must be appreciated is that separate "Agricultural and Pastoral" returns must be made by a farmer who possesses or works more than one holding, except where the holdings are *adjacent and worked as one,* in which case one return is sufficient. Thus a farmer who has two holdings which are worked as one (in that labour, machinery or stock may move from one to the other and are under his one management) but which may be a few miles apart should make a return for each holding separately. In the survey certain details of separate holdings such as size and tenure were noted but were combined into the one unit "the farm".

To allow comparison to be made, the survey farms have been broken down into their constituent "holdings", using the definition adopted by the Commonwealth Statistician. Their size distribution and that of the population is shown in Table 1. The chi-square test showed that at the 95 per cent level the distributions did not differ significantly from each other. It is interesting to note the wide dispersion of size of holding. The distribution by size of *farm* is virtually the same and one can certainly not claim that there is a "typical" farm size for wheatgrowing in the North West.

TABLE 1

Holdings Classified According to Size of Holding

Size Group (Acres)	Sample, 1961–62		N.W. Slope, 1959–60	
	Number of Holdings	Per cent	Number of Holdings	Per cent
1-49	..	..	31	1.1
50–99	..	..	32	1.2
100–149	..	..	36	1.3
150-199	1	1.4	36	1.3
200–299	3	4.2	76	2.8
300–399	2	2.8	120	4.4
400–499	4	5.6	185	6.7
500–599	3	4.2	123	4.5
600-699	6	8.5	138	5.0
700–799	2	2.8	98	3.5
800-899	3	4.2	120	4.4
900-999	3	4.2	119	4.3
1,000–1,399	17	24.0	562	20.4
1,400–1,999	8	11.3	346	12.6
2,000–2,999	9	12.7	314	11.4
3,000–3,999	4	5.6	169	6.1
4,000–4,999	2	2.8	101	3.6
5,000–9,999	3	4.2	119	4.3
10,000–	1	1.4	29	1.1
Total	71	100.0	2,754	100.0

$\chi^2 = 6.03$

Source:—Classification of Rural Holdings by Size and Type of Activity, **1959-60,** Bulletin No. 1, New South Wales, Bureau of Census and Statistics, Canberra, 1962.

(2) *Acreage of Wheat.* Details of cropping and stocking, etc., were collected on a per farm basis and not for separate holdings, so that a comparison as in (1) cannot be made for the acreage of wheat grown. In Table 2, however, a comparison is made, with the sample on a *per farm* basis and the population on a *per holding* basis. The distributions differ significantly from each other, which is hardly surprising.

TABLE 2

Frequency Distribution of Acreage of Wheat for Grain

Size Group (Acres)	Sample, 1961–62		N.W. Slope, 1959–60	
	Number of Farms	Per cent	Number of Holdings	Per cent
1–49	4	6.3	405	14.7
50–99	6	9.5	407	14.8
100–149	9	14.3	417	15.2
150–199	9	14.3	314	11.4
200–299	10	15.9	453	16.5
300–499	16	25.4	496	18.0
500-699	4	6.3	147	5.3
700–999	2	3.2	67	2.4
1,000-1,999	3	4.8	45	1.6
2,000–	..	..	3	0.1
Total	63	100.0	2,754	100.0

$\chi^2 = 10.93$

N.B. Three farms omitted because no wheat for grain grown in 1961-62.

Source:—Classification of Rural Holdings by Size and Type of Activity, 1959-60, Bulletin No. 1, New South Wales, Bureau of Census and Statistics, Canberra, 1962.

The median acreage in the sample falls in the 200-299 group and the median acreage in the population falls in the 150-199 group.

(3) *Size of Sheep Flock.* As in (2) it is only possible to compare the sample on a per farm basis and the population on a per holding basis. (Table 3). Again, as is to be expected, the distributions differ significantly from each other. The median size of flock falls in the 1,000-1,399 group for the sample and the population. The fact that 6.7 per cent of the population had no sheep does not mean that this percentage of *farms* in the North West do not own any sheep at all. Though there certainly are farms which do not carry any sheep, it could be partly explained by the situation where at March 31, the sheep on two or three of the holdings under the control of one farmer have been brought together on one holding for shearing, for example.

TABLE 3

Frequency Distribution of Size of Sheep Flock (including Lambs)

Size of Flock (Numbers)	Sample at March, 1962		N.W. Slope at March 31, 1960	
	Number of Farms	Per cent	Number of Holdings	Per cent
None	..	..	184	6.7
1-49	..	..	40	1.5
50-99	..	..	26	0.9
100-199	1	1.5	63	2.3
200-299	1	1.5	91	3.3
300-399	1	1.5	115	4.2
400-499	3	4.5	119	4.3
500-699	8	12.1	303	11.0
700-999	9	13.7	357	13.0
1,000-1,399	17	25.8	440	16.0
1,400-1,999	11	16.7	394	14.3
2,000-2,999	8	12.1	315	11.5
3,000-4,999	3	4.5	208	7.5
5,000-9,999	4	6.1	81	2.9
10,000-	..	..	18	0.6
Total	66	100.0	2,754	100.0

$\chi^2 = 15.5$

Source:—*Classification of Rural Holdings by Size and Type of Activity*, 1959-60, Bulletin No. 1, New South Wales, Bureau of Census and Statistics, Canberra, 1962.

(4) *Wheat Yield.* Farmers' estimates of their wheat yields for the 1961-62 season averaged 16.2 bushels per acre for the sample. (Standard error 0.90 bushels.) The average yield for the North Western Slope over the ten years 1952-53 to 1961-62 was 17.5 bushels per acre but for 1961-62 averaged only 15.0. The probability of getting such a difference between the sample and the population, i.e., 1.2 bushels, purely by chance is nearly 20 per cent. The conclusion is therefore that there is no significant difference between the average yield of the sample and population.

(5) *Breed of Sheep and Lambing Percentage.* Apart from size of sheep flock on wheat growing holdings no other statistic is available in connection with sheep in the population. However, it is interesting to compare the sample with *all* sheep in the North Western Slope, in regard to the proportion of various breeds of sheep and lambing percentage.

In the North Western Slope, approximately 84 per cent of the total sheep are Merinos, 8 per cent Crossbreds and 8 per cent all other breeds. In the sample, the figures were respectively 71.5 per cent, 19.8 per cent and 8.7 per cent. The distribution of these proportions differed very significantly. This is to be expected, as in the North Western Slope, sheep farms with no wheat cropping would be expected to be located on either side of the wheat-sheep belt, i.e. bordering the North Central Plain or Northern Tableland, where Merinos are predominant.

Because of the higher proportion of Crossbreds in the sample compared to the whole North Western Slope, it would be of no value to directly compare their overall lambing ratios, as Crossbreds have a higher lambing percentage than Merinos. However, a comparison can be made if the frequency distribution of lambing percentage in the sample is weighted according to the proportions of the breeds found in the North Western Slope. On this basis the overall lambing percentage for the sample would be 72.2 per cent, with a standard error of 1.99 per cent. The average lambing percentage for the North Western Slope over the ten year period 1952-53 to 1961-62 was 67.3 per cent. The probability of getting such a difference purely by chance is less than 5 per cent. The conclusion could be either that the sample was biased towards farms with higher lambing ratios, or that the farmers' estimates were overstated or that, with a given breed of sheep, higher lambing ratios are achieved on wheat-sheep farms than on other sheep farms. It could be a combination of all three. Without other evidence it is impossible to say which of the conclusions is the most likely to be correct.

The conclusion to be drawn from this discussion of certain characteristics of the sample and population is that even if the sample is biased (for example towards farms with slightly higher lambing percentages), this bias is not very serious. There is certainly no bias towards farms of larger size, which is an important point, as research has shown that many important characteristics of the farm business are associated with farm size. It would therefore be reasonable to say that as regards the results obtained later, general conclusions for the population can be inferred from the sample.

Other Characteristics

Certain other characteristics of the sample concerning the organization of the farms are now briefly described. It will not be possible to make comparisons of the sample and the population, as no statistics are available for the latter.

(1) *Labour Force.* Twenty-eight farmers (42 per cent of the total) employed no regular full-time workers, carrying out all farm work with family labour plus the occasional help of casual or contract labour, mostly at shearing time and, to a lesser extent, at wheat harvesting. Table 4 shows

TABLE 4

Frequency Distribution of Number of "Regular" Workers

Number of Workers	Number of Farms
Less than 1	.. ..
1	.. 14
1 plus 1 part time ..	.. 7
2	.. 29
2 plus 1 part time ..	.. 3
3	.. 6
3 plus 1 part time ..	.. 1
4	.. 4
More than 4	.. 2
TOTAL	.. 66

the frequency distribution of the number of full-time workers and part-time workers, excluding casual workers. The category part-time workers covers those persons (the farmer himself, sharefarmers and employees) working for at least a third of the year but not for the whole year.

The median number of workers is 2 and this is also the modal group. Typically, this is either the farmer and his son or the farmer and one hired regular worker.

(2) *Tractor Force.* Most of the tractors in the sample were wheeled tractors, only 14 per cent. being crawlers. Their frequency distribution is shown in Table 5.

TABLE 5

Frequency Distribution of Number of Tractors

Number of Tractors	Number of Farms
None	2
1	24
2	25
3	8
4	3
5 or more	4
TOTAL	66

The median number of tractors is two and, as would be expected, there is a close association between the number of workers and number of tractors.

(3) *Plant and Equipment*—Frequency distributions of the size and type of various implements on the survey farms are given in Appendix 1.

Suffice it here to give the median size of the major items of equipment and plant. They are as follows:—

Disc plough	7 ft.
Scarifier	8 ft.
Diamond harrows	24 ft.
Combine drill	9 ft. 6 in.—10 ft. (16 run)
Header	10 ft. P.T.O.
Mower	7 ft.
Grain storage	1,000—2,000 bushels (silos and sheds)

3. LABOUR REQUIREMENTS FOR FARM OPERATIONS

Method of Enquiry

It was originally hoped to have the co-operation of a large number of farmers in their keeping daily records of the use of labour on the various farm operations. A preliminary small-scale survey indicated that only a fraction of the 66 farmers would be willing to carry this out, which is

certainly a rather demanding task. It was decided that obtaining estimates from 66 farmers by the survey method would be preferable to having detailed records from only about ten farmers, though there is no known research publication comparing the errors to be expected by the two methods in Australia.

An alternative to these two methods, viz. a field observation study, was ruled out because of the large number of operations for both crops and livestock, spread throughout the year, for which it was desired to obtain estimates of labour use. This method can be very useful when adopting a detailed "work-study" approach and has much to recommend it. It allows a "synthetic" approach to be adopted, i.e., given the time requirements for various jobs or processes these can then be used in building up labour and equipment requirements and rates of performance for different methods of operation, some of which may never have been actually used in practice. It is thus possible to compare different methods or systems, e.g., using sown bags as against bulk handling in wheat harvesting, whilst keeping other factors, such as soil, farm size, management, etc., constant. However, it has two main drawbacks. Firstly, as with the labour record approach, only a small number of farms can be covered and it is often dangerous to argue from the results derived from particular farms to general conclusions. Secondly, it is well-known that the presence of observers is likely to bias the estimates of the time taken to perform various operations, as workers may work much harder than normal to impress or "put up a show". Probably the ideal would be a combination of the two approaches, in which a field work study would be made of certain farms identified as average, above average and below average in rates of performance, from the results of a previous survey. Some of the operational and organizational factors leading to the observed differences between farms could then be identified by the detailed work study.

With the survey method the expectation is that, though the figures from each farm may be subject to error, the average obtained from the survey will be reasonably representative of the sample average, and, by inference, will be an unbiased estimate of the population average. This expectation is based on the assumption of a random distribution of the errors of observation (errors associated with measurement, farmer's memory, interviewer recording incorrectly, etc.) but this will not be so if there is some systematic bias in the errors, for example if most farmers are optimistic about their rates of performance, etc. As far as possible during the survey interviews, recourse was had to farmers' diaries, where the number of days actually taken for a certain operation and a given acreage or a given number of livestock could be ascertained. In other cases, a farmer's estimate of rates of performance was all that was available. The possibility of bias in these estimates is an important consideration and in the sections that follow various comparisons have been made as some check on their reliability.

It should also be noted that the unit of time measurement in the survey was the "day", which is open to a certain amount of flexibility in interpretation and could probably have accounted for a certain amount of the apparent differences in rates of performance amongst farms, where one farmer's "day" was one of six hours and another's one of ten hours. However, an important advantage of using the day instead of the hour as unit with the survey method is that time spent in getting to a job, idle

time and time lost due to breakdowns, etc., during the day are included. It is also the unit which farmers are more accustomed to think in.

Crop Operations

The labour requirements for crop operations covered by the survey are given in Table 6. In several cases the number of observations for a certain operation is small and thus care should be exercised in the interpretation of these particular figures. It was thought that there might be "economies of scale" in labour use for crop operations, i.e., that labour requirements per acre would decrease with increasing acreage. This would be expected because of the "overhead" element of labour required for coupling an implement to a tractor and setting the implement and also, assuming larger paddock sizes were associated with larger crop acreages, because of the smaller proportion of time spent in turning on the headland with larger paddocks. Molnar,[3] in a study in the Mallee area of Victoria, calculated an efficiency measure, which was the ratio of observed performance in acres per hour of tractor and implement to theoretical performance, based on the width of the implement and the speed of the tractor. Efficiency was found to be positively correlated with acreage, for working a fallow, sowing and harvesting and with length of run for disc ploughing.

Because practical experience suggested that there would be a "fixed" and a "variable" element in labour requirements for crop operations, it was hypothesized that the appropriate mathematical relationship between acreage and total labour requirement would be of the form:—

$$y = a + bx$$

where y = total labour requirement in man days for a given size of implement.

x = acreage.

Labour requirement per acre would then be given by:—

$$\frac{y}{x} = \frac{a}{x} + b$$

showing that labour requirement per acre declines with increasing acreage, i.e., "economies of scale" in labour use.

Straight line regressions of the form $y = a + bx$ were therefore fitted to the North West survey data for those operations where there were sufficient observations. Extrapolation of the line gave positive intercepts on the Y-axis for the operations of ploughing, scarifying and bulk harvesting with a 12 ft. header. This would indicate economies of scale in labour use for these operations. However, for sowing and harvesting into unsown bags with a 12 ft. header, there were negative intercepts on the Y-axis, which would indicate that labour requirement per acre *increased* with acreage. The inconsistency of the results from the regression equations invites the question whether such relationships for the sample could have arisen purely by chance. The reliability of the regression lines as estimates of the "true" regressions was therefore tested. The origin lay inside the 95 per cent probability zone in all cases (well inside in most cases) and

[3] I. Molnar, "Utilization of Machinery and Labour in Wheat and Sheep Farming", this *Review*, Vol. 28. No. 3 (September, 1960).

this means that the true regression line for the operations studied could well be one passing through the Origin. The conclusion is therefore that *over the range of acreage studied* there is no statistically strong evidence that labour requirements per acre vary with acreage. The sample mean has therefore been taken as an estimate of the per acre labour requirement for each operation. A number of comparisons are now made to serve as checks on the reliability of these figures.

The first comparison is with a "rule of thumb" method of estimating labour requirements. This is based on the width of the implement and an assumption about the overall speed of operation. In Molnar's study the theoretical speed was 5.0 m.p.h. for ploughing, working the fallow and sowing and the efficiency ratios ranged, according to acreage and length of run, from 55 per cent to 85 per cent, 50 per cent to 71 per cent and 53 per cent to 67 per cent respectively. Taking average figures of 70 per cent, 65 per cent and 65 per cent for ploughing, cultivating and sowing respectively and an arbitrary 70 per cent for harrowing, overall speeds of work of 3.5, 3.25, 3.25 and 3.5 m.p.h. respectively are obtained. By using the formula—

$$D = \frac{1.03}{VW}$$

Where D = time taken, in days per acre.

V = overall speed of operation in m.p.h.

W = width of implement in feet.

and assuming an 8 hour day for one man in each case, the labour requirements are calculated and appear in the last column of Table 6.

It will be noticed that as regards ploughing and scarifying, the survey figures are greater than the rule of thumb method for the smallest size of implement but are the reverse for the largest size of implement. Many reasons could be adduced for this. The farmers with the smaller sizes of implements are probably working smaller paddocks; they could be less "efficient"; their working day could be less than that of farmers with larger implements or their tractors could be moving more slowly than the farmers with larger implements. In regard to the last point, there was evidence that the power of the tractors on the farms was positively associated with size of implements, as is to be expected. However, as Molnar stated in his study, the exact horsepower of many types of tractors is often difficult to establish on a uniform basis even by consulting the manufacturers. With increased tractor power but increased size of implement, one might expect a similar speed of operation and this is the assumption implicit in the "rule of thumb" method. It is difficult therefore to be at all categorical about the reasons for the differences in the figures for varying sized implements. However, at the 10 per cent level there is no significant difference between the two sets of estimates.

Comparison is also made with Molnar's average figures for certain operations, converted to a day per acre basis assuming an 8 hour day. His harvesting figures were purely for the operation of the header with one man and emptying into unsown bags, but assuming that the second man takes about the same time to empty the unsown bags into the bulk body

TABLE 6—*Comparison of Labour Requirements for Crop Operations Estimated from Various Sources*

Operation	N.W. Survey			Molnar's Study			"Rule of Thumb" Method	
	Man Days per Acre		Number of Observations	Man Days per Acre		Number of Observations	Man-days per Acre	
	Mean	Standard Error		Mean	Standard Error			
Ploughing—5-ft. Disc Plough	.065	.0105	7	..	..	..	.059	
6-ft. Disc Plough	.047	.0030	13	.048	.0027	12	.049	
7-ft. Disc Plough	.046	.0077	15	.048	.0020	11	.042	
8-ft. Disc Plough	.031	.0045	5	..	..	..	.037	
Scarifying— 7-ft. Disc Plough	.053	.0120	7	..	..	..	.045	
8-ft. Disc Plough	.042	.0050	4	..	..	..	.039	
9-ft. Disc Plough	.029	.0029	2	..	..	..	.035	
10-ft. Disc Plough	.023	.0003	2	..	..	..	.031	
Harrowing—18-ft. Diamond Harrows	.022	.0047	4	..	..	..	.016	
24-ft. Diamond Harrows	.018	.0042	4	..	..	..	.012	
Sowing— 9 ft. 6 in.–10 ft. Combine Drill	.029	.0024	14	.037	.0067	4	.031	
11 ft. 6 in.–12 ft. Combine Drill	.024	.0014	10	..	..	..	.026	
Hay Making—								
Mowing—7-ft. cut	.050	.0095	6	..	..	..	....	
Raking	.040	.0160	4	..	..	..	....	
Baling (per ton)	.130	.0130	7	..	..	..	....	
							Baxter and Willis' Study	
							Man-days per Acre	
Wheat Harvesting—							Mean	Standard Error
Bags—2 men, 10-ft. Header	.140	.0042	4	..	..	..	.073	.0064
2 men, 12-ft. Header	.090	.0070	2	..	..	..		
3 men, 10-ft. Header	.167	.0140	3	..	..	..	.096	.0084
3 men, 12 ft. Header	.150	.0420	3	..	..	..		
Bag to Bulk—2 men, 10-ft. Header	.100	.0066	4	.086	.0106	12	.064	.0056
2 men, 12-ft. Header	.078	.0040	8	.056	.0064	3		
Bulk—2 men, 12-ft. Header	.059	.0038	7	..	..	..	.052	.0048
2 men, 15-ft. Header	.044	.0064	3	..	..	..	..	..

and drive to and from the silo, then the labour requirement is twice the figure of days per acre. The survey figures are less than Molnar's for sowing but greater for harvesting and very similar for ploughing (see Table 6).

It is noteworthy that the figures for ploughing are almost identical, as the soils that Molnar was concerned with were mostly sandy, whereas those in the North West vary from light to very heavy, so that a difference might have been expected. However, an examination of the rates of performance for identical implements over different soil types found on the North West farms showed no significant differences between soil types. Molnar, in discussing a comparison of his own figures with those taken from a Canadian study[4] where soil texture in different regions varied from relatively heavy to relatively light, said that "the variation in the hour-per-acre figures was usually negligible for identical operations with identical implements in the different regions".

It is difficult to explain the differences found between the figures for sowing and for harvesting; many technical reasons could be adduced. However, the small size of the samples and the variation found in them are sufficient explanation, as at the 10 per cent level there is no significant difference between the sample means.

A third comparison is one confined to the wheat harvesting operation and is a field study reported by Baxter and Willis.[5] Eleven farms, all but one being located in the North Western Slope, were studied during the 1958 harvest. Detailed observation was made of the time taken for various stages of the wheat harvesting operation; e.g., heading, emptying grain into bags or bulk trucks, sowing bags, loading trucks, etc. The requirements of equipment and labour and the rates of performance for different systems of wheat handling were then synthesized from the basic data. This was also the approach of Candler[6] and in fact, Baxter and Willis remark that the junior author and Candler on occasions "found themselves making simultaneous observations, from their respective viewpoints, on the paddocks of co-operating farmers". The comparison here is made with their study rather than with Candler's. This has been done as the present writer was able to obtain their individual observations, thus enabling statistical tests of significance to be made between their results and those of the North Western Sample.

In calculating the labour requirements in man-days per acre from their data (see Table 6), an important assumption has been made in connection with the time taken for the truck to travel to and from the silo at the rail siding. Though no observations were made, Baxter and Willis assumed an average time of 80 minutes, including time spent queuing up at the silo. Examination of the utilization of the harvesting team for each system shows that with such an assumption and with average rates of heading, the other members of the team are always ahead of the header

[4] S. W. Garland and L. M. Johnson, *Crop Production Requirements in Manitoba,* Economics Division, Department of Agriculture, Ottawa, 1958.

[5] R. I. Baxter and A. H. Willis, *The Management of Wheat Handling Systems on Farms,* Institute of Rural Technology, University of New South Wales. May, 1961.

[6] W. Candler, "A Study of the Economics of Bulk Handling of Wheat on Farms", this *Review.* Vol. 27, No. 2 (June, 1959).

driver and are thus not fully occupied through the day. Baxter and Willis, in calculating labour costs for the various systems, assumed that such labour could be available for some other farm operation and did not charge it to the harvesting operation. However, there is notorious uncertainty about the time that might be spent at the silo and a prolonged wait could mean that the rest of the harvesting team were *behind* the header driver. This writer has therefore made the assumption that the other members of the team are fully occupied on the harvesting operation. A further assumption in the calculation was that the average yield of the farms studied was 19.5 bushels per acre (the average for the North Western Slope in 1958-59) as no figures were recorded by Baxter and Willis.

It will be seen from Table 6 that the North West survey figures are greater than Baxter and Willis' figures for all systems. At the 10 per cent level, only the following systems do not differ significantly from each other:—

	N.W. Survey	*Baxter and Willis*
Bags 2 men	12 ft. header	10 ft. and 12 ft. headers.
Bulk 2 men	12 ft. header	12 ft. header.

There are several possible explanations for the observed differences between the two sets of figures. An obvious one is that Baxter and Willis' figures are *net* figures, in that they exclude time spent on preparation of equipment, getting to the paddocks, repairs during harvesting and idle time. In this connection it is worth noting that Molnar's efficiency ratios, relating actual to theoretical performance, for the operation of heading and emptying into unsown bags were as low as 54 to 68 per cent. It is quite feasible, then, and in fact to be expected, that even had the *same* farms been studied, the two methods (survey and work study) would have produced significantly different results.

Another possible reason is that the small number of farms in Baxter and Willis' study were "above average", in rates of performance and/or in crop yields. If their yields in 1958 were greater than 19.5 bushels per acre, estimated labour requirements per acre would have been correspondingly higher.

However, there is a third possibility for the differences between the two sets of figures. That is, that the sight of Mr. Baxter and Dr. Candler with stop watch in one hand and note-book in the other critically observing operations from the corner of the paddock, spurred these particular farmers and their workers on to give the spectators their finest performance, which has not been equalled before or since!

Livestock Operations

Estimated labour requirements for certain livestock operations are shown in Table 7. As with the crop operations, a linear regression of total man days on the number of livestock was made and these are the estimates which appear in the table. The data for all operations except that for "general" operations was obtained from the farmers' replies to the field questionnaire. However, that for "general", which covers such tasks as marketing, moving sheep from one paddock to another, inspection at lambing, etc., was estimated by a method which is more appropriately described in a later section. It will be noticed that all except "general" operations have a positive intercept on the Y-axis.

The reliability of the regression lines as estimates of the "true" regressions in the population was tested by setting 95 per cent probability limits. This is illustrated in Figure 1 for the operation of marking calves. It will be noticed that the Origin is *just* included within the 95 per cent probability zone.

TABLE 7

Labour Requirements for Certain Livestock Operations

Operation	Regression Equation Man-days	Standard Error of Estimate Man-days	Number of Observations	Correlation Coefficient
Sheep (X = No. of Sheep)—				
Crutching ..	3.7 + 0.004 X (0.0009)	6.0	49	0.52***
Shearing	8.5 + 0.021 X (0.003)	21.5	54	0.67***
Marking Lambs ..	0.6 + 0.005 X (0.0008)	2.5	49	0.68***
Dipping	0.4 + 0.0026 (0.0005)	5.8	48	0.61***
Drenching ..	0.9 + 0.0012 X (0.0004)	1.7	28	0.54**
General	0.08 X (0.013)	37.6	16	0.77***
Cattle (X = No. of Beef Cows)—				
Marking Calves ..	1.5 + 0.023 X (0.0057)	2.5	18	0.73***

** Significant at 1 per cent.

*** Significant at 0.1 per cent.

However, with 94.5 per cent probability limits the origin lies *outside* the zone. If one is prepared to accept a 5.5 per cent chance of being wrong, it could be concluded that the true regression line makes a positive intercept on the Y-axis and that therefore there are economies of scale in labour use for the operation of marking calves. With a 5 per cent chance of being wrong the same conclusion can be made about the operations of shearing and crutching.

An alternative explanation, of course, for the observed positive intercept on the Y-axis is that the farmers with smaller flocks or herds are "less efficient" than those with bigger flocks or herds. This could be a possible explanation for the observed decrease in labour use per head with increasing flock and herd size. However, it is known that in many operations there are certain jobs which do not vary directly with the size of flock, e.g., bringing a mob of sheep to the shearing shed, preparation of dipping materials, etc. They are almost in the category of "overheads" and their presence is sufficient to explain most, if not all, of the observed differences in labour requirements per head with flocks of differing sizes. If the farmers with smaller flocks were "less efficient", perhaps in the sense that

they had poorer labour organization and managerial ability, one might expect this to be reflected in other ways, for example by having lower lambing percentages. However, there was no correlation between flock size and lambing percentage. It is therefore suggested that the conclusion that there are economies of scale in labour use for the operations of crutching, shearing and marking calves is a reasonable one. Practical experience suggests that there are economies of scale for the other livestock operations, but the evidence for this is not statistically significant.

However, there is a consistency in the equations for livestock operations (which was not the case with the crop operations), in that none gave a negative intercept on the Y-axis. Therefore, the regression equations in Table 7, rather than the sample averages, have been used in estimating labour requirements in later sections.

There were three main techniques used for sheep dipping, viz. the use of the spray dip, plunge dip and jetting machine. No significant difference in labour requirements could be discerned between these three techniques, though this is not to conclude that there are no differences between them. However, any differences would have been masked by the large variation in labour use for any one technique.

The Timing of Livestock Operations

Information was also collected on the usual time of year that the various operations were carried out. There was considerable variation between farms in this respect, part of which could be explained by the differences in farm organization. However, the variation seems to suggest that there is no generally agreed "best" time of the year for many livestock operations. Each farmer either has his own idea of when is the best time for, for example, lambing or operations are fitted in wherever possible in the farm organization. Experimental evidence, however, would be the best source of information on the effects of timing of operations on input-output relationships in both crop and livestock enterprises.

For those farms where there was controlled mating, in Yallaroi Shire the majority of flocks lambed in September and about half those in Macintyre Shire lambed in September/October, i.e. Spring lambing. In Liverpool Plains and Peel Shires, however, the majority of flocks lambed between March and July, i.e. autumn and winter lambing. There were, however, some farms where there was no controlled mating and where flocks lambed throughout the year. Marking lambs was universally carried out between four and six weeks after lambing.

There seemed to be no relation between time of mating and crutching as had been expected. The majority of farmers carried out the operation of crutching between October and March, the most important factor probably being the incidence of fly-strike in the summer months.

Sixty-nine per cent of the farms carried out shearing in August and September which is identical with the figure for the North Western Slope in 1955-56.[7]

There appeared to be more spread in the timing of shearing in Yallaroi and Liverpool Plains Shires than in the other Shires.

[7] Commonwealth Statistician.

Dipping universally followed shearing by four to six weeks. Drenching was carried out at any time whenever the need arose. The frequency of drenching through the year also varied considerably. Some farmers never drenched at all, some drenched once, twice, three times in the year and there were a few who regularly used the practice, e.g. every month or two months.

The time of marketing fat lambs varied generally from four to six months after they were born. Where farmers were not able to get their lambs away fat before prices dropped they often kept them back to sell later as hoggets.

4. ENTERPRISE LABOUR REQUIREMENTS

In this section annual labour requirements for certain enterprises are synthesized by the aggregation of labour requirements for operations included in each enterprise. It will be realized at once that there can be no one figure of average labour requirements for a crop enterprise due to the differences resulting from use of varying size and capacity of implements and to the varying frequency of operations. For example, assuming the same number of operations of ploughing, scarifying, harrowing, etc., for wheat growing, a small-scale farmer using a 5 ft. disc plough, 7 ft. scarifier, 18 ft. diamond harrows, a 7 ft. combine drill and a 10 ft. P.T.O. header, with the sown-bags method, would have about twice the labour requirement per acre of a farmer with a more powerful tractor and using a 10 ft. disc, 12 ft. scarifier, 36 ft. harrows, 14 ft. drill and 15 ft. self-propelled header emptying into bulk trucks. With livestock enterprises, mainly because of the small extent of mechanization and because there is little variation in capacity of the equipment and tools used, an average figure for the enterprise can be more easily specified.

The total requirement for the year is, however, not the only important consideration in farm planning. Often more important is the *distribution* of the labour requirement through the year, because of the possibility of different enterprises having peak demands for labour at the same time, e.g. sorghum harvesting and wheat sowing. For most crops there is little latitude in the timing of operations such as sowing and harvesting, unless a farmer is prepared to accept lower yields (this may, of course, be a "rational" choice in certain circumstances). However, with livestock it has already been noted that considerable latitude seems to exist in the timing of many operations, if the practice of farmers in the survey is anything to go by. The above remarks must therefore be borne in mind in the following examples of average labour requirements.

Wheat

Typically, cultural operations for wheat crops after a summer fallow in the North West include two disc ploughings, two scarifyings and two harrowings (see Appendix II), though there is great variation in this pattern from farm to farm and from year to year. Taking a farm situation with the median sizes of equipment described previously (page 79) and a bag-to-bulk method of harvesting, the annual labour requirement would be approximately 0.34 man-days per acre. The distribution of the labour requirement through the year for a 250 acre crop is given in Figure 2 (b).

Sheep

The annual labour requirement in man-days for a ewe flock selling fat lambs and purchasing its replacements, with all ewes mated annually and with a lambing percentage of 70 per cent. is approximately

$$17 + 0.174 \text{ x}$$

where x = number of ewes.

Thus a flock of 1,000 ewes would require about 191 man-days per year.

In the above calculation the timing of operations was assumed to be as in Figure 2 (a), so that lambs were sold before being dipped and had a couple of drenchings, whilst ewes were drenched four times in the year.

It is interesting to estimate the size of the ewe flock that could be handled on average by one man, *if he did nothing else but look after sheep.* Assuming that half of the labour required at shearing would be supplied by outside labour, the labour requirement in man-days would be

$$12.6 + 0.163 \text{ x}.$$

Taking 275 man-days as the labour available from one man (this takes into account weekends, holidays, sickness, etc.) the size of flock that could be handled by one man is 1,600 ewes. In practice, of course, it is more likely that there would be two men handling twice the size of flock, because of the greater ease of carrying out certain operations, such as lamb-marking, with an extra man. Alternatively, if casual help was available for such operations one man could look after more than 1,600 ewes.

It had been hoped to be able to compare this estimate with figures of "sheep per labour unit" obtained from the Australian Sheep Industry Survey.[8] For example, in the New South Wales Wheat-Sheep Zone, the average for "Sheep Only" properties for 1957-58 to 1959-60 was 948 sheep per labour unit. However the figures are not comparable because in the figure estimated in the North West study, no allowance is made for general "overhead" labour, which can be anything from 36 per cent to 45 per cent of the total labour available (see below), and for labour required for pastures, feed crops, fodder conservation, etc. However, when allowance is made for the labour requirements of other enterprises, a comparison can be made, and this is done in the next section.

5. REQUIREMENTS FOR ENTERPRISE COMBINATIONS

The purpose of this section is to estimate annual labour requirements for certain combinations or aggregations of enterprises so that comparisons can be made with figures for the labour actually used, as far as this can be ascertained. It is hoped thereby to provide some further check on the validity of the labour requirement figures estimated in this study.

The Sample Farms

The first check was that provided by the sample itself. Using sixteen farms for which full information on all operations was available, the estimated total labour requirements in man-days for each farm was plotted against the total labour available, including casual and contract labour, assuming 275 man-days for a full-time worker. The estimated requirement

[8] *The Australian Sheep Industry Survey,* 1957-58 *to* 1959-60, *New South Wales,* Bureau of Agricultural Economics, Canberra. October, 1962.

was based on (*a*) the farmer's own performance figures for each operation and (*b*) the regression estimate or sample average for those operations. The correlation coefficient was (*a*) 0.76 and (*b*) 0.77, both being significant at 0.1 per cent level. Though the relationship was reasonably good there was still a large amount of unexplained difference between the figures of required and available labour. The difference was found to be correlated [9] with the number of sheep. This was to be expected, as no information had been collected (and would have been difficult to collect by the survey method) on labour requirements for such "general" sheep work as marketing, moving sheep about, inspection, etc. The regression coefficient for the relationship was 0.08 and this was therefore taken as an estimate of the labour requirement per sheep for general sheep work, appearing in Table 7. As the acreage of native pasture was also related to sheep numbers, the above estimate probably unavoidably includes the labour requirement for native pasture, e.g., for eradicating burrs, etc. However, the labour requirement for this is likely to be very small.

When the estimated labour requirement figures for the sixteen farms were adjusted for general sheep labour, the correlation between required and available labour was higher, giving a correlation coefficient of 0.91, significant at 0.1 per cent. The differences still remaining were not related to any other measurable factor and it was concluded that these differences on the average represented the "overhead" labour requirement on wheat-sheep farms. They were approximately 36 per cent of the total labour available on the two-man farms and 45 per cent on one-man farms. These figures seem exceptionally high but it is interesting to note that Molnar,[10] using labour records, had a figure of 43 per cent (repairs and maintenance to plant and machinery, clearing of dams and carting 18 per cent, fencing 6 per cent and miscellaneous tasks 19 per cent) on nine farms without any sharefarming, there being virtually no difference between one-man and two-men farms. Davidson,[11] also using labour records, reported an average figure of about 40 per cent for dairy, sheep and cattle and wheat farms in the Hunter Valley. It is, of course, difficult to assess how much of this "overhead" labour is strictly necessary for the maintenance of productivity on the farm and how much of it is connected with "finding jobs to do" in slack periods and when weather prevents the carrying out of more productive tasks.

Molnar found that on his "large" farms, which were mainly two-man farms, the operators were fully occupied through the year. However, he found that on his "small" farms, which were mainly one-man farms, there was inadequate work for the operator, even when combined with share-farming. It may, therefore, be that there is some under-employment. concealed in the "overhead" figure, on the one-man farms in the North West Survey. This would help to explain the difference between the 36 per cent and 45 per cent figures for two and one-man farms respectively. However, the difference could also be explained by postulating economies of scale in "overhead" labour requirements, as one moves from one to two-man farms.

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[9] $r = 0.77$ See Table 7 (page 86).

[10] *Op. cit.*

[11] Private communication.

TABLE 8

Calculation of Labour Requirements for Average Property in the New South Wales Wheat-Sheep Zone in 1959–60

				Man-days
Crops—				
Cereals harvested for grain			255 acres x .34	87
Cereals for hay, grazing, etc.—up to the point of harvesting			17 acres x .24	4
Improved pastures			520 acres x .07	36
Cereal and pasture hay			20 tons (est.) x .22	4½
Sheep—				
Average Number of Sheep carried	1,709			
Number of Sheep shorn	1,914			
Number of Lambs marked	629			
Crutching		1,600* (est.)		5
Shearing		1,914*		24
Lamb Marking		629*		3½
Dipping		1,914* (est.)		5½
Drenching	(x4)	1,350* (est.)		10
Drenching	(x2)	629* (est.)		3½
General		1,979* (est.)		158
				341

$$\frac{341}{175} = 1.95 \text{ full-time workers.}$$

This is an underestimate because no account is taken of unknown but small amount of labour required for beef cattle, pigs, poultry, etc.

* These are the values for X to be inserted in the regression equations in Table 7.

New South Wales Wheat-Sheep Zone

Another check on the reliability of the estimates of labour requirements was to use them in calculating the requirements for the average farm in the New South Wales Wheat-Sheep Zone sample of 105 farms[12] and compare this with the actual labour available. The calculation of the requirements is shown in Table 8. It was assumed that about half of the labour required for shearing and crutching was supplied by casual or contract labour. (This assumption is based on information from the North West Survey.) In this and similar calculations, it is assumed that 36 per cent of the labour available is required for work of an "overhead" nature, thus leaving 175 man-days per man as the labour available for direct crop and livestock work.

The average farm was a two-man farm, i.e. the operator plus one other worker (partner, family or hired employee) and the calculated figure agrees remarkably well with this.

North Western Slope Division

The final check on the reliability of the estimates was to use them in calculating the requirements for the whole of the North Western Slope. It would have been preferable to have confined attention to wheat farms or at least to farms with enterprises for which estimates had been made from the survey data. However, information on the labour available on farms is published only by Statistical Divisions and therefore the calculation of labour requirements was made for the whole North Western Slope Division. Labour requirements for poultry were calculated from the B.A.E's. survey in the Sydney area,[13] those for pigs from Molnar[14] and those for dairy cows from the Department of Agriculture's Dairy Farm Management Survey in the Nowra District of New South Wales. It was again assumed that half of the labour requirement for crutching and shearing was provided by casual and contract labour. The calculation of labour requirements is shown in Table 9. Most of the table is self explanatory. The calculation for sheep has been worked for the individual operations because of the different numbers of sheep involved in each operation.

Total labour requirements is estimated at 7,800 full time workers but this is an underestimate because no allowance has been made for labour requirements for the small acreage of fruit, tobacco, cotton and potatoes grown in the North West. There is no information on these enterprises but their labour requirements would probably amount to a hundred or so full-time workers. The number of persons permanently employed (owners, lessees, tenants, sharefarmers, relatives employed but not receiving wages, and employees working for wages) at March, 1962, in the North Western Slope is not available, but in 1958, the latest year for which information is available, it was 8,073. The number in 1962 would probably be somewhat less than this figure, so that there is a close resemblance between the estimated and actual number of full-time persons employed.

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[12] *Australian Sheep Industry Survey,* 1957-58 *to* 1959-60, *New South Wales,* Bureau of Agricultural Economics, Canberra. October, 1962.

[13] *Poultry Management Study in the Sydney Area of New South Wales,* 1961-62, Bureau of Agricultural Economics, Canberra. 1962.

[14] *Op. cit.*

TABLE 9

Calculation of Labour Requirements for All Farms in the North Western Slope Division of New South Wales, 1961-62

				Man-days
Crops—				
Wheat, Oats, Barley and Rye harvested for grain		719,826 acres x .34		244,600
Sorghum and Maize harvested for grain		48,109 acres x .39		18,700
Cereals and fodder crops for hay, grazing etc., up to point of harvesting		272,666 acres x .24		65,400
Lucerne		273,554 acres x .018		4,900
Sown grasses and clovers		245,718 acres x .07		17,200
Cereal and pasture hay		75,340 tons x .22		16,500
Long Fallow		178,693 acres x .18		32,200
Crops and pasture fertilized		230,109 acres x .03		6,900
Pigs—				
Number of Sows		5,708 x 3.		17,100
Poultry—				
Number of hens, cockerels, other adult birds		681,855 x 0.2		136,400
Dairy Cattle—				
Number of cows		20,316 x 6.		121,900
Beef Cattle—				
Number of beef herds (1959–60)		3,412 x 1.5		5,100
Number of beef cows		178,498 x .023		4,100
Sheep—				
Number of flocks (1959–60)	4,083			
Number of ewes, rams, wethers shorn	4,948,143			
Number of lambs shorn	716,790			
Number of lambs marked	1,421,303			
Crutching		4,948,143*		17,400
Shearing		5,664,933*		76,800
Lamb marking		1,421,303*		9,500
Dipping		5,664,933*		16,300
Drenching (x4)		4,948,143*		38,500
Drenching (x2)		1,421,303*		10,800
General		6,369,446*		510,000
				1,370,300

$$\frac{1,370,300}{175} = 7,830 \text{ full-time workers.}$$

* These are the values for X, to be inserted in the regression equations in Table 7. The constant term in the equations for each operation is multiplied by the number of flocks (4,083).

6. CONCLUSIONS

As stated in the Introduction, the purpose of this article was to provide information on labour requirements on wheat farms in the North Western Slope which could prove interesting or useful in itself. If they are to be accepted by research or extension workers as useful for farm planning or as the basis of other research work, an examination of the reliability of the various estimates was necessary.

The reliability of the survey results was tested, firstly, by testing the sample itself for bias and the general conclusion was that, even if there was some bias (for example, towards farms with slightly higher lambing percentages) this bias is likely to be small and it may even be absent. The validity of the estimates of labour requirements for the various crop and livestock operations was then tested in two main ways, by a comparison of labour requirements estimated from other sources for similar operations and by a comparison of estimated and actual labour use for various enterprise combinations. These tests seem to confirm that the figures generally are reasonably unbiased estimates of the "true" mean labour requirements for the various operations and enterprises on wheat farms in the North Western Slope. Perhaps, with not too much loss of accuracy, they may also be regarded as reasonable estimates for wheat growing and sheep production carried out under similar circumstances in other parts of South-east Australia.

APPENDIX I

Frequency Distributions of Types of Equipment and Plant on Sample Farms

Disc Ploughs

Approx. Width	Number
4 ft.	3
5 ft.	14
6 ft.	15
7 ft.	23
8 ft.	6
9 ft.	2
10 ft.	2
12 ft.	1
14 ft.	1
18 ft.	1
24 ft.	1
Unknown	6
	75

Scarifiers, Cultivators and Tillers

Approx. Width	Number
5 ft.	2
6 ft.	2
7 ft.	15
8 ft.	7
9 ft.	8
10 ft.	5
12 ft.	7
13 ft.	1
Unknown	10
	57

Chisel Ploughs

Approx. Width	Number
7 ft.	3
8 ft.	1
9 ft.	4
11 ft.	1
14 ft.	1
Unknown	3
	13

Mouldboard Ploughs

Approx. Width	Number
1 ft.	1
3 ft.	3
4 ft.	1
5 ft.	2
6 ft.	3
8 ft.	2
Unknown	1
	13

Diamond Harrows

Approx. Width	Number
12 ft.	3
18 ft.	16
24 ft.	11
27 ft.	1
30 ft.	11
36 ft.	5
Unknown	3
	50

Disc Harrows

Approx. Width	Number
7 ft.	2
8 ft.	2
9 ft.	2
10 ft.	5
12 ft.	1
18 ft.	1
Unknown	6
	19

Drills

Approx. Width	Number
5 ft.	1
6 ft.	2
7 ft.	1
8 ft.	6
9 ft.	9
10 ft.	14
11 ft.	1
12 ft.	15
14 ft.	2
24 ft.	1
Unknown	11
	63

Crop Sprayers

Approx. Width	Number
24 ft. boom	3
Unknown	1
	4

Headers P.T.O.

Approx. Width of Cut	Number
6 ft.	1
8 ft.	8
10 ft.	18
12 ft.	23
	50

APPENDIX I—(*continued*)

Headers, Auto and S.P.

Approx. Width of Cut	Number
10 ft.	1
12 ft.	4
14 ft.	2
15 ft.	3
18 ft.	1
	11

Mowers

Approx. Width of Cut	Number
6 ft.	7
7 ft.	15
9 ft.	1
Unknown	17
	40

Side Delivery Rakes

Number
30

Balers

Type	Number
Pick-Up	22
Stationary	8
	30

Dipping Plant

Type	Number
Spray	26
Plunge	18
Jetter	14
	58

Grain Storage Capacity
(Silos plus Sheds)

Bushels	Number of Farms
None	9
Up to 1,000	12
1,001-2,000	17
2,001-3,000	9
3,001-5,000	4
5,001-10,000	8
10,001-20,000	4
Over 20,000	3
	66

Hay Storage Capacity
(Sheds and Barns)

Tons	Number of Farms
None	5
Up to 50	14
51-100	14
101-200	12
201-500	9
Over 500	2
Unknown	10
	66

APPENDIX II

Assumptions Made About Cultural Operations for Crop Enterprises

Crop	Plough-ing	Scarify-ing	Harrow-ing	Drill-ing	Remarks
Wheat ..	2	2	2	1	
Barley ..					
Oats ..					
Sorghum ..					
Maize ..					
Rye ..					
Millet ..					
Lucerne ..	..	..	1 Annually		Assumed undersown
Grasses and Clovers	1	1	2	1	Establishment
	..	..	1 Annually	..	
Long Fallow	2	2	..	..	

	Mowing	Raking	Baling
Cereal and Pasture Hay	1	1	1

APPENDIX III

Frequency Distribution of Size of Beef, Pig and Poultry Enterprises

Number of Beef Cows	Number of Farms
None	10
1–19	23
20–49	17
50–99	10
100–199	2
200–499	4
Total	66

Number of Laying Hens	Number of Farms
Less than 100	57
100– 199	2
200– 499	4
500– 999	1
1,000–1,999	..
2,000–4,999	2
Total	66

Number of Sows	Number of Farms
None	52
1– 4	2
5– 9	8
10–14	1
15–19	..
20–29	1
30–39	..
40–49	2
Total	66

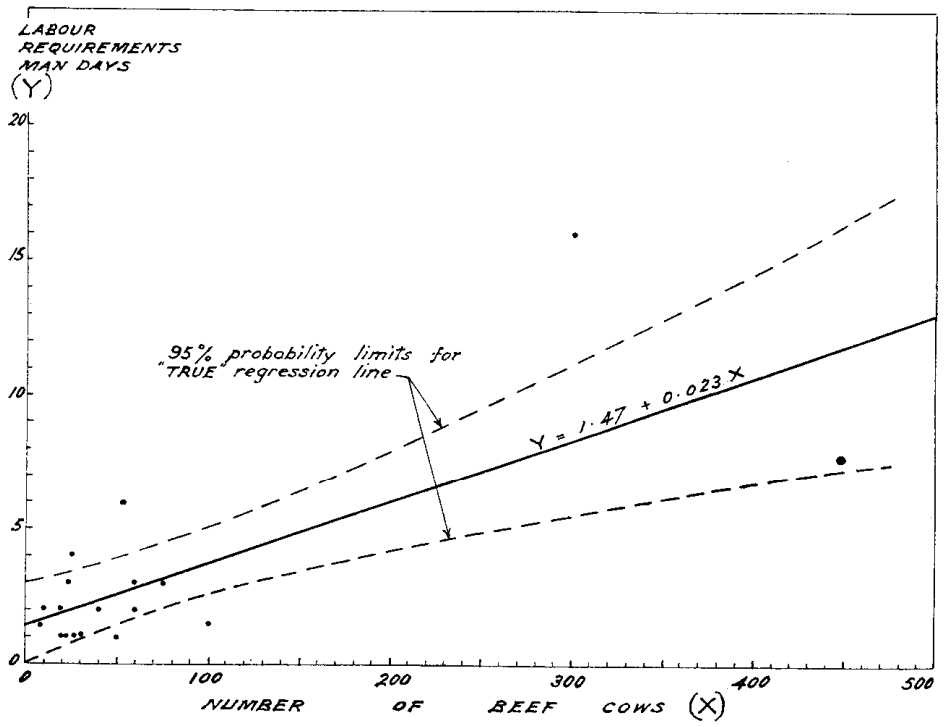

Fig. 1. Number of Beef Cows and Labour Required for Marking Calves

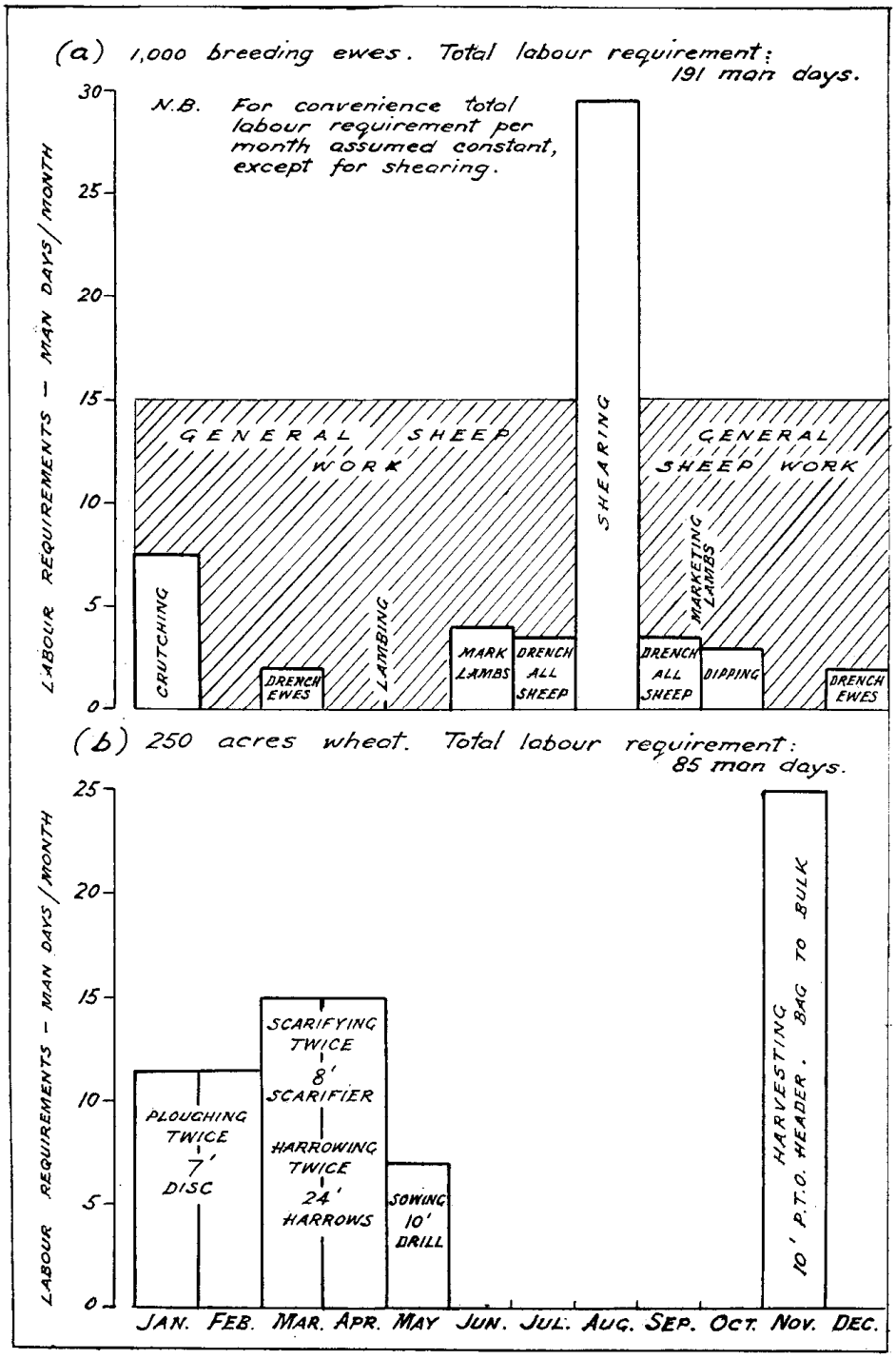

Fig. 2. Seasonal Labour Distribution for Sheep and Wheat Production