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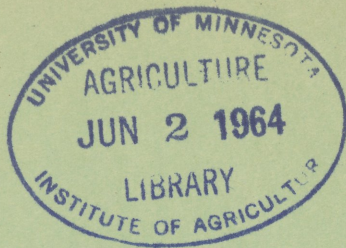
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Labour Planning of a Diversified Farm on the Transvaal Highveld

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INTRODUCTION

Efficiency and organisation in farm management is of fundamental importance to the prosperity of the future agricultural development of the Republic. In this technological age, the efficient farmer is the only one who in the long run is assured of a reasonable existence. Variable climatic conditions, and the low inherent production capacity of agricultural soil in South Africa, demand high standards from the successful farmer, and often impede the attainment of a high degree of efficiency.

After mechanisation, labour comprises the largest single cost item in mixed farming. Careful planning of labour, in order to obtain the highest degree of efficiency, is of vital importance - not only from the farm-management angle but also from the sociological point of view.

Calculation of the amount of labour required for a specific farm enterprise usually provides many problems; the main reason for this being the wide variation in labour requirements for farms with different combinations of enterprises and the limited number of standards available in connection with labour requirements of these enterprises. The first step in the planning of labour requirements of a specific farm is therefore to determine the physical labour standards for each branch of farming activity.

A. PHYSICAL LABOUR STANDARDS

With the assistance of a group of Transvaal Highveld farmers, who kept accurate farm records, first-hand information relating to labour requirements of the various farm enterprises had been obtained; these are reflected in Table 1.

Table 1 reflects the labour requirements of the most important enterprises calculated on the basis of working days of 10 hours each per morgen or per L.S.U.* According to Table 1, the labour requirements of the various enterprises vary from year to year, due chiefly to weather conditions and the size of the total crop to be harvested. The average working days necessary per morgen or per L.S.U., as indicated in the last column of Table 1, will be used to illustrate the methodology of labour planning. Casual labour comprises an average of 9.8 per cent of the total labour requirements for crops and livestock. For the purpose of calculation, the round figure of 10 per cent will be used.

*L.S.U. = 1 large stock unit = 1 large animal = 2 head of cattle under 2 years = 3 calves = 6 sheep = 5 pigs = 100 poultry.

TABLE 1 - Total annual labour requirements of certain farm enterprises on the Transvaal Highveld

Farm enterprise	1953/54 days	1954/55 days	1955/56 days	1956/57 days	1957/58 days
Maize (morgen)	10.2	10.0	9.2	12.2	10.4
Sunflowers (morgen)	-	14.6	12.8	5.0 ⁽¹⁾	10.8
Kaffircorn (morgen)	-	-	15.4	13.4	14.4
Potatoes (morgen)	-	-	110.6	-	110.6 ⁽²⁾
Other cash crops (morgen)	-	-	-	-	10.0 ⁽²⁾
Cowpeas (morgen)	8.2	8.8	11.7	12.2	10.2
Fodder crops (morgen)	6.4	9.8	8.3	8.9	8.4
Dairy (L.S.U.)	17.0	20.5	14.0	19.4	17.7
Other stock (L.S.U.)	3.7	4.2	6.8	9.4	6.0
Casual labour as a percentage of working days spent on crops and stock	7.0%	11.5%	8.7%	11.7%	9.8%

(1) Major portion of sunflower seed was harvested mechanically in 1956/57.

(2) Estimates.

With the assistance of these standards, the first steps in labour planning may now be taken, viz. to determine whether the farm employs at present too much or too little labour.

The standards mentioned are average standards and therefore give the requirements at an average level of efficiency. The aim of every farmer should be, however, to work at a higher level of efficiency than the average. It is well known that the average degree or efficiency on South African farms is still low. For this reason a rough method of calculating the labour and tractive-power requirements of a specific farm may be of great value to the farming community - and especially to those farmers who wish to find a standard of labour efficiency.

B. DIAGNOSIS OF LABOUR EFFICIENCY

The following method of calculating labour requirements of a farm provides a relatively simple, quick and fairly reliable gauge for the level of labour efficiency. The annual labour requirements of the various farm enterprises, as shown in Table 1, are used as the basis for calculation.

A Highveld farm consisting of 240 morgen of arable land and 160 morgen grazing is used as an example.

Particulars in respect of farming systems are reflected in the first two columns of Table 2.

TABLE 2 - Calculations of the labour requirements of a Highveld farm

Crop	Morgen or L.S.U.	Days required	
		Per unit	Total
Maize	120	10.4	1,248
Sunflowers	36	10.8	389
Kaffircorn	24	14.4	346
Other cash crops	12	10.0	120
Fodder crops	48	8.4	403
Dairy	60	17.7	1,062
Other livestock	50	6.0	300
Total	X	X	3,868
Casual labour (+ 10% of 3,450 days)			387
Total number of working days required			4,255
Total number of labour units required	(4,255 ÷ 300)		14.2

The labour requirements of each enterprise are then entered in the third column of Table 2 (from Table 1) and the total number of working days required for each enterprise are calculated in the last column. The 10 per cent casual labour is then added to the total of 3,868 days (see Table 1) to obtain an annual total of 4,255 working days for this specific farm.

The question of exactly how many labour units* are necessary in total, now arises. According to Table 2 14.2 labour units are required to perform this work.

According to available information casual labour comprises about 20 per cent of the total labour requirements on Highveld farms. The farm, therefore, is not compelled to employ 14.2 full-time labourers, but can manage with 11 full-time and 3.2 part-time labour units (i.e. casual labour).

After calculating the average labour requirements of a farm, these are compared with the actual labour used on the farm concerned. The total number of regular labourers used may usually be determined quite easily by asking a few questions. The number of casual labourers used may also be roughly determined. Suppose that the farm has 14 regular and two casual labour units. Therefore $16.0 - 14.2 = 1.8$ more labour units are used than the number required at an average level of efficiency. This, of course, means relatively inefficient use of labour.

On the other hand, if only 12 labour units were used, it indicates that the farm concerned uses 2.2 labour units less than the number required at an average level of efficiency.

*A labour unit is defined in terms of an adult labourer working 300 days.

In practice, this method of calculating the labour efficiency may be simplified by making the standard requirement (days per morgen or per L.S.U.) a round figure. The purpose of this calculation is by no means the precise calculation of labour requirements but rather to obtain a rough indication of labour requirements. It will in practice also be necessary to make certain adjustments. A farmer who, for instance, is combining his kaffircorn, will undoubtedly use less than 14.4 working days per morgen - say roughly 10.

Given standards are extremely difficult to obtain, and this limitation must be bridged by making the best possible use of the available standards with the aid of common sense and logical reasoning.

This quick method of calculating the labour efficiency at average standards has already been tested by the Division of Agricultural Economic Research for several years. This has proved to be a particularly useful and trustworthy method of ascertaining a quick, though reliable, calculation of labour efficiency.

C. PLANNING OF THE ANNUAL LABOUR REQUIREMENTS FOR THE HIGHEST EFFICIENCY ON THE TRANSVAAL HIGHVELD

The first step in the planning of labour requirements is to use some standard or other of efficiency. With the aid of this method, as explained in B above, it is possible to determine whether a farmer has too much or too little labour in terms of the average level of efficiency.

The following step that must be taken into account by the efficient and especially by the inefficient employer, is how to reorganise his labour in order to attain a higher level of efficiency.

The purpose of this analysis is to give guidance on how the farm organisation may be planned so that less labour per unit of production may be used. It is assumed that -

- (i) better supervision, wages or quality will not raise productivity further; and
- (ii) technological improvements, such as mechanisation of certain processes, are not possible.

It is therefore accepted that the planning of the farm organisation will have to take place within the present or relatively "fixed" framework of wage levels, labour management and technological growth.

Problem: As an example, we take a 400 morgen farm on the Transvaal Highveld with 240 morgen of arable land and 160 morgen of grazing. The present farm organisation is reflected in Table 4.

Methodology: In the first place the monthly and total annual labour requirements of the existing systems are calculated. The total annual labour requirements of certain enterprises are reflected in Table 1. Table 3 shows the monthly labour requirements of various enterprises on the Transvaal Highveld.

In the second place the monthly distribution of labour requirements are studied and a calculation is made of how many regular labourers should be taken into service to be productive throughout the year. Casual labourers will have to be hired to supplement the regular labour force during the months when the latter cannot satisfy the higher requirements.

TABLE 3 - Monthly labour requirements of various enterprises on the Transvaal Highveld, 1956/57 (expressed in terms of percentage of the total days required)

Month	Maize	Sun-flowers	Kaffir-corn	Cow-peas	Fodder crops	Live-stock	Casual labour %
Sept.	3	5	2	1	1	8	24
Oct.	6	6	4	1	1	8	16
Nov.	11	5	6	4	4	8	8
Dec.	18	8	16	6	3	8	4
Jan.	8	10	15	9	15	7	4
Feb.	6	3	2	17	19	8	8
March	5	2	2	25	16	8	9
April	2	28	1	35	27	9	4
May	8	24	33	2	12	9	5
June	18	1	12	0	0	10	3
July	14	1	1	0	1	8	4
Aug.	8	7	6	0	1	9	11
Total	100	100	100	100	100	100	100

In the third place the production of the farm with the existing farming organisation and production practices is analysed.

In the fourth place alternative farming systems are studied, both from the point of view of better farming practices and more efficient labour utilisation.

Lastly, the various alternatives are compared, graphically expressed and analysed in terms of efficiency factors.

Example: The example below may be worked out according to the above-mentioned method and the farming problem set.

(a) Alternative I: The existing farm organisation

The calculations of the total labour requirements and their monthly distribution are given in Table 4. In short, the method of calculation is as follows:

- (i) Draw up the table and fill in the size of the various farm enterprises.
- (ii) Calculate the "total number of days" required by multiplying the total annual labour requirements of a specific farm enterprise (from Table 1) by its size.
- (iii) Add 10% of the total labour requirements for crops plus stock to the latter total to obtain the total labour requirements for the year.
- (iv) Now divide the annual requirements of each enterprise on a monthly basis with the aid of the percentage distribution given in Table 3.
- (v) Obtain the total monthly and annual requirements.
- (vi) Calculate how many regular labourers may be productively used. It would appear that 13 labourers (@ 25 working days per month) are sufficient. Then the casual labour days required, days wasted, etc., may be calculated.

TABLE 4 - Calculation of the monthly and annual labour requirements on a Transvaal Highveld farm - Alternative I

Farm enterprise	Unit	Size of enter- prise	Sept. days	Oct. days	Nov. days	Dec. days	Jan. days	Feb. days	Mar. days	Apr. days	May days	Jun. days	Jul. days	Aug. days	Total days
Maize	Morgen	216	67	135	247	247	180	135	112	45	180	404	314	180	2,246
Cowpeas	"	12	1	1	5	7	11	21	31	43	2	0	0	0	122
Fodder crops	"	12	1	1	4	3	15	19	16	28	12	0	1	1	101
Dairy	L.S.U.	64	91	90	91	90	79	91	91	102	102	113	91	102	1,133
Other stock	L.S.U.	50	24	24	24	24	21	24	24	27	27	30	24	27	300
Total		X	184	251	371	371	306	290	274	245	323	547	430	310	3,902
Casual labour		X	94	62	31	16	16	31	35	16	19	11	16	43	390
Grand total		X	278	313	402	387	322	321	309	261	342	558	446	353	4,292
13 Labourers at 25 days per month			325	325	325	325	325	325	325	325	325	325	325	325	3,900
DIFFERENCE	X	X	+47	+12	-77	-62	+3	+4	+16	+64	-17	-233	-121	-28	-392

Days wasted (i.e. extra days per month) = 140. Labour is wasted if not cut down during the months when less labour is required than during the 325 available days. Casual labour is employed for these months when more labour is required than normally employed during the available 325 days. Casual working days = 538 days. Total days required (4,292 + wasted days) = 4,438. Percentage wasted days = 3.3 per cent. Percentage casual labour days = 12.1 per cent. Labour units necessary:

Regulated	13.0
Casual	1.8
	<hr/>
Total	14.8

TABLE 5 - Production of a Transvaal Highveld farm - Alternative I

Production	Gross income
	R
216 morgen of maize at 10 bags per morgen (R2. 83)	6,102
12 morgen of cowpeas at 13 tons per morgen	Feed for stock
12 morgen of fodder crops	Feed for stock
64 dairy L.S. U. @ R60 per A. U.	3,840
50 L.S. U. of other stock at R20 per L.S. U.	1,000
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Total production	10,942

The major problem involved in labour planning is, firstly, to have as little surplus regular labour as possible, and, secondly to make use of as little casual labour as possible. If 13 regular labourers are taken on, 146 days (3.3%) are wasted, and casual labour must be hired for 538 days (12.1%) of the total number of days required.

A total of 14.8 labour units, of which 1.8 units are casual labourers, is therefore required. At the accepted production levels and prices, as shown in Table 5, the total (gross) production of the farm amounts to R10,942.

The task now set is to try and change the farming composition in such a way as to reduce the amount of labour used for the farm as a whole, to use better production methods and to raise the income.

(b) Alternative II: Labour use after changing the crop and livestock enterprises

In Tables 6 and 7 an example of alternative plans are given. Only the relative sizes of the various farm enterprises have been changed. The same method of calculation was used as in alternative I.

(c) Comparison of the two alternative plans

The effect of the two alternative plans on the efficiency of labour at the level of production, may be clearly seen from Table 8.

TABLE 6 - Calculation of the monthly and annual labour requirements of a Highveld Farm - Alternative II

Farm enterprise	Unit	Size of branch	Sept. days	Oct. days	Nov. days	Dec. days	Jan. days	Feb. days	Mar. days	Apr. days	May days	June days	July days	Aug. days	Total days
Maize	Morgen	130	41	81	149	149	108	81	68	27	108	242	189	109	1,352
Sunflowers	"	20	11	13	11	17	22	6	5	60	52	2	2	15	216
Kaffircorn	"	20	6	12	17	46	43	6	6	3	95	34	3	17	288
Cowpeas	"	30	3	3	12	18	28	52	77	107	6	0	0	0	306
Fodder crops	"	40	4	3	14	10	50	64	54	91	40	0	3	3	336
Dairy	L.S.U.	100	142	141	142	142	124	141	142	159	159	177	142	159	1,770
Other stock	"	78	38	37	37	37	33	37	37	43	42	47	38	42	468
Total	X	X	245	290	382	419	408	387	389	490	502	502	377	345	4,736
Casual labour	X	X	114	76	38	19	19	38	43	19	23	14	19	52	474
Grand Total	X	X	359	366	420	438	427	425	432	509	525	516	396	397	5,210
16 labourers @ 25 days per month			400	400	400	400	400	400	400	400	400	400	400	400	4,800
DIFFERENCE			+41	+34	-20	-38	-27	-25	-32	-109	-125	-116	+4	+3	-410

Days wasted (i.e. extra days used)

82 days

Casual labour days required

492 days

Total number of days required (5,210 days plus days wasted)

5,292 days

Percentage of days wasted

1.5%

" " casual labour days

9.3%

Labour units required: Regular

16.0

Casual

1.6

TOTAL

17.6

TABLE 7 - Production of a Highveld farm - Alternative II

Production	Gross income
	R
130 morgen of maize @ 12 bags per morgen (R2.83)	4,407
20 morgen of sunflowers @ 15 bags per morgen (R2.00)	600
20 morgen of kaffircorn @ 12 bags per morgen (R3.00)	720
30 morgen of cowpeas @ 3 tons per morgen	Feed for stock
40 morgen of fodder crops	Feed for stock
100 dairy A.U. @ R70.00 per A.U.	7,000
78 A.U. of other stock at R20.00 per A.U.	1,560
Total production	14,287

Alternative I include only 5 per cent soil-improving crops in its rotation system, and 90 per cent cash crops. The latter consisted entirely of maize - there was no distribution of risk in that various cash crops were cultivated. In alternative I, 1.4 morgen of grazing was available per L.S.U. (in other words, light grazing - 1.0 morgen per L.S.U. is possible in practice). In addition 0.21 morgen of fodder crops was available per L.S.U. If the requirements of dairying are fixed at 0.5 morgen per L.S.U. and those of other stock at 0.25 morgen per L.S.U., an average of 0.38 morgen per L.S.U. of fodder crops is necessary for the herd composition of the first alternative.

Alternative I therefore falls short of the mark as far as the crop-rotation system and the feeding of the stock are concerned.

In the case of alternative II, soil-improving crops comprise 12.5 per cent of arable land and cash crops about 71 per cent. Furthermore, cash crops are now divided between maize, Kaffircorn and Sunflowers. The stock numbers are increased to 100 dairy L.S.U. and 78 other stock L.S.U. The veld utilisation now improves to 0.9 morgen per L.S.U. With proper fencing and good provision of feed, this veld utilisation is a practical possibility.

The provision of feed is also at a realistic level of 0.39 morgen of fodder crops per L.S.U. (The requirement is also 0.39 morgen per L.S.U. for this specific herd composition.)

As far as farm organisation is concerned, both field and animal husbandry are organised on a sound basis in alternative II. However, the question remains what the effect of this or any similar improved farm organisation would be on the amounts of labour used.

PRODUCTION

The production in terms of gross income obtainable from the various alternatives is shown in Table 8. In the case of the farming composition of alternative II, the gross value of the income has been raised to R14,287, an increase of 30.5 per cent above that of alternative I. Production per morgen per labour unit reflects a considerable increase. An increased intensity of production is therefor obtained by using alternative II.

TABLE 8 - Summary of the two alternatives

Item	Alternative	
	I	II
Size of farm (morgen)	400	400
Morgen of arable land	240	240
Morgen of grazing	160	160
<u>Crops:</u> Maize (morgen)	216	130
Sunflowers "	0	20
Kaffircorn "	0	20
Cowpeas "	12	30
Fodder crops "	12	40
<u>Stock:</u> Dairy (L.S. U.)	64	100
Other stock (L.S. U.)	50	78
<u>Farming organisation:</u>		
Percentage of cash crops	90	70.8
" of fodder crops	5.0	16.7
" of leguminous crops	5.0	12.5
Morgen of grazing per L.S. U.	1.4	0.9
" of fodder crops per L.S. U.	0.21	0.39
" of fodder crops required per L.S. U.	0.38	0.39
<u>Production:</u>	R	R
Total income	10,942	14,287
Income/morgen of farm surface are	27.4	35.6
Income/labour unit (+ casual labour)	739.4	811.6
Extra income/labour unit	-	72.2
Increase/decrease in income	-	3,345.0
Percentage increase/decrease	-	30.5%
<u>Labour:</u>		
Labour units required: Regular	13.0	16.0
Casual	1.8	1.6
Total	14.8	17.6
Percentage of days wasted	3.3	1.5
Percentage of casual labour days	12.1	9.3

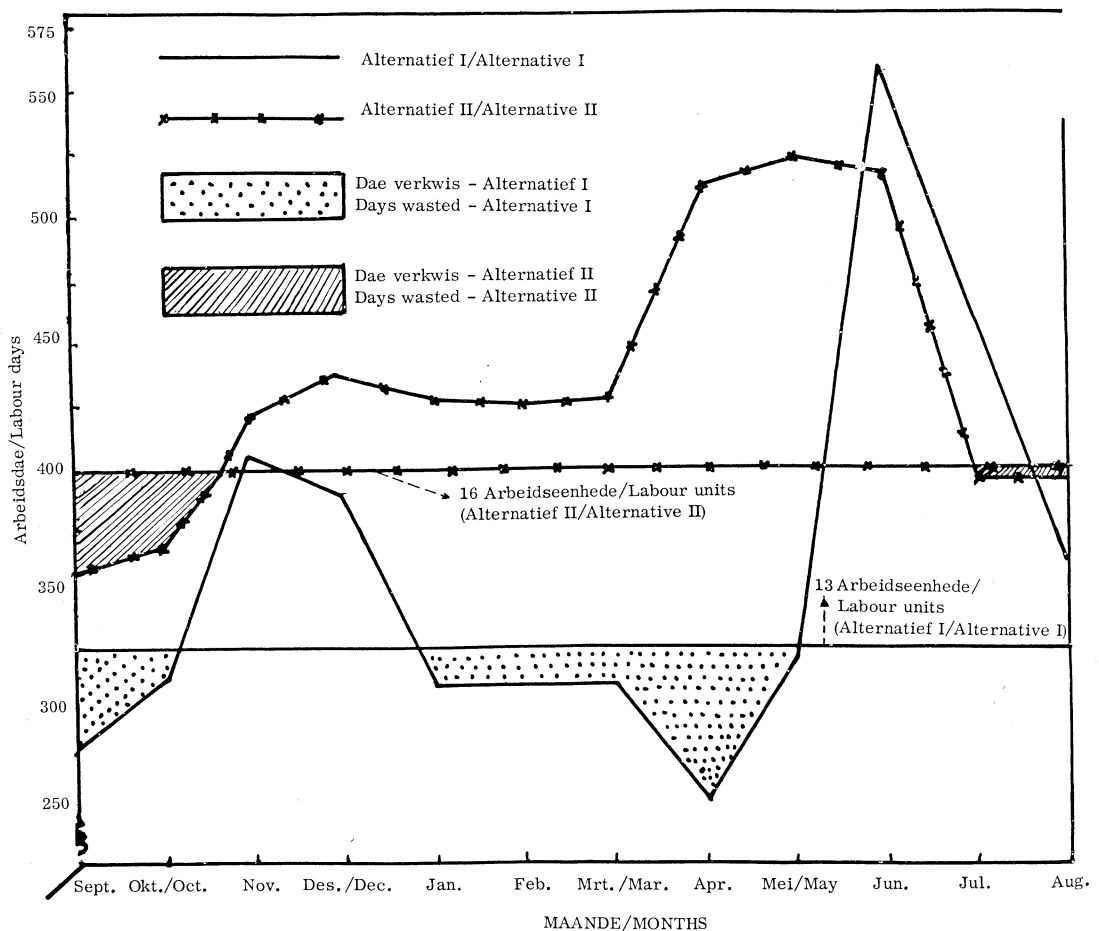
LABOUR

According to Table 8 the total labour requirements of the two alternatives increase from 14.8 labour units to 17.6 labour units. This would seem disturbing at first, because the basic aim is always a more efficient utilisation of labour.

This, however, is exactly what is obtained through the changed farm organisation. There were more shortcomings than just poor utilisation of labour - the farming practices and level of production also reveals serious discrepancies.

After the rectification of shortcomings in farm practices (e.g. rotational cropping and stock feeding), the following effect on labour efficiency is being obtained:

MONTHLY LABOUR REQUIREMENTS OF TWO ALTERNATIVE FARMING SYSTEMS ON THE TRANSVAAL HIGHVELD



- (i) The gross income per labour unit increases from R739.4 to R811.6 from the first to the second alternative.
- (ii) A better utilisation of labour is being obtained from the regular labourers - percentage of days wasted decrease from 3.3 per cent to 1.5 per cent.
- (iii) The percentage of casual labour days required, decrease from 12.1 per cent to 9.3 per cent.

The greater stability of labour utilisation, as a result of a more even distribution of labour throughout the year, is clearly shown in the graph. With alternative I major labour problems were experienced as a result of the extremely uneven labour distribution from month to month. The figures show clearly that harvest time in particular makes such high demands on labour that major problems have to occur. This means that the farmer's casual labour problem is much easier to solve, because -

- (a) he requires less casual labour at a specific moment; and
- (b) his casual labour requirements are relatively stable over a period of 4-5 months. He can therefore possibly hire a fulltime labourer for the period, which will undoubtedly simplify the problem of sufficient labour.

The second alternative, which of course, comprises a rational crop and stock programme, shows an even more equitable distribution of labour requirements. If 16 labour units are employed, only 1.5 per cent working days are wasted and 9.3 per cent casual labour days are required. According to the graph (alternative II) it will be possible in practice to employ an extra labourer on a full-time basis from November until the end of June (i.e. for eight months). The days wasted (1.5 per cent) then remain the same, while the casual labour days required drop to 7.0 per cent. (See graph for details.)

The number of casual labourers required may be further reduced by employing another extra labourer for the four months from March to June. The casual labour requirements then fall to 4.7 per cent of the total labour requirements, which is probably as low as practically possible on a mixed farm.

SUMMARY

The following improvements have been obtained by replanning the farm organisation:

- (i) Higher production per unit.
- (ii) Better farming practices (e.g. crop rotation).
- (iii) A more mixed and stable farm organisation.
- (iv) Labour is being more effectively utilised - production per labourer increases appreciably.
- (v) Less labour is being "wasted" through unproductive work.
- (vi) The farmer is less dependent on casual labour, which can often cause serious problems.
- (vii) Better use of capital has also been obtained - the farm (with its existing capital investments) now produces one-third more per year.

The effect of the replanning of the farm organisation was therefore beneficial in all respects.