ADJUSTMENT POSSIBILITIES AND MARGINALITY IN THE "BIG SCRUB"

W. F. MUSGRAVE*

J. G. BIRD†

1. INTRODUCTION

In discussing the problems of rehabilitating the low-income sectors of the Australian dairy industry, the Dairy Industry Committee of Enquiry recommended, *inter alia,* that "the development of suitable portions of holdings for complementary production—fruit, vegetables, crops, fat lambs, etc., should be encouraged".[1]

This recommendation suggests that the Committee felt that the breakdown of competitive forces and the failure of the price mechanism have been such that, in addition to the generally acknowledged decline of the industry, there is a further loss in social welfare due to sub-optimal combinations of enterprises on existing farms.

In an earlier issue of this *Review*, McCarthy[2] reported an analysis of the rôle of sidelines as a method of increasing dairyfarmers' net incomes. The study was based on a random sample survey conducted in Boonah Shire, Queensland. It was concluded that, although sidelines can be a means of increasing gross and net earnings, average non-sideline dairyfarmers cannot expect to earn such additional income as it appears that they possess fewer management skills and have more pronounced resource limitations.

In the study reported in this paper, a different approach is used in the analysis of the rôle of sideline enterprises on dairyfarms. This is the application of linear programming to determine the most profitable choice of enterprises.

---

* Senior Lecturer in Agricultural Economics, University of New England.

† Economics Research Officer, Wollongbar Agricultural Research Station, N.S.W. Department of Agriculture.

The authors would like to acknowledge the comments and assistance of their colleagues in the Faculties of Economics and Agricultural Economics at the University of New England and in the Department of Agriculture stationed at Lismore and Wollongbar Research Station. All errors of fact and logic are, however, their own.

[1] Commonwealth of Australia, *Report of the Dairy Industry Committee of Enquiry,* Commonwealth Government Printer, Canberra, August, 1960.

[2] W. O. McCarthy, "An Evaluation of Sidelines as a Method of Raising Net Incomes of Dairy Farmers", this *Review,* Vol. 33, No. 2 (June, 1965).

The area chosen is the well known "Big Scrub" district of the Far North Coast region of New South Wales.[3] While the analysis has been extended to include larger farm sizes, the major concern of the study is with a typical small farm. This typical farm, if it is devoted solely to dairying and if replacements are reared, has a production of 4,800 lb. of butterfat per annum. This is only 60 per cent of the standard established by the Committee of Enquiry as representing a satisfactory level.[4] It is therefore an example of the problem farms with which the Committee was concerned.

The next section of the article presents some brief details of the assumed farm situation ; Section 3 describes and discusses the results of analysis ; and the final section presents our conclusions. The appendices provide more complete details of our assumptions about the typical farm and the alternative enterprises.

The analysis avoids consideration of the implication for improvements in dairy productivity of the recent introduction of tropical pasture species to the area. If the results of local research and farm trials are any guide these species could profoundly alter farm technology. Therefore it must be emphasized that the present study applies only to farms producing under the old technology based on naturalized pasture species. This point will be pursued in the conclusion.

2. THE TYPICAL FARM

The farming situation was initially specified in terms of a 100-acre family farm with no employed labour. No more than 15 acres were to be cultivated in any one year. This restriction is discussed below. The resulting matrix is shown as Table I, Parts I and II. Following the usual conventions of linear programming models, the first two columns present, respectively, a list of the restraints and the level at which they are set in the initial matrix. The remaining columns specify the alternative activities. Comments on some aspects of the matrix which may need elucidation for the purposes of the casual reader follow. A more detailed description of the assumptions of the model are contained in the Appendix.

Restraints 18 to 29 specify a working capital profile which allows study of the impact of cash flows within the farm firm on the supply of working capital and the effect of shortages of such capital, if any, on farm organization. It must be noted that once a transaction takes place it is shown in every

[3] There are several reports on survey work in the Big Scrub area, see: A. M. Kingsland, "An Economic Survey of the Productivity of Dairy Farms on the Red Basaltic Soils of the Far North Coast of New South Wales", this *Review*, Vol. 18, No. 1 (March, 1950); W. F. Owen, "Dairy Farming on the Red Basaltic Soils of the Richmond-Tweed Region", *Ibid.*, Vol. 23, No. 1 (March, 1954); and L. Dillon, "Dairy Farm Tenure in the Big Scrub Area of the Richmond-Tweed Region", *Ibid.*, Vol. 23, No. 4 (December, 1954). Some comparisons have also been drawn between the area and other dairying areas, see, Anon., "The Cost Structure and Management Problems of the Dairy Industry in New South Wales", *Ibid.*, Vol. 23, No. 3 (September, 1955), also F. H. Gruen, "Incomes of Dairy Farmers in the Richmond-Tweed Region", *Ibid.* The latest of several surveys of the Far North Coast in general is reported in J. G. Bird, "The Dairying Industry on the Far North Coast of New South Wales", *Ibid.*, Vol. 32, No. 2 (March, 1962).

[4] Currently 12,000 lb. commercial butter or approximately 10,000 lb. butterfat is accepted as desirable in the application of the "build-up provision" of the Closer Settlement Act in New South Wales.

TABLE 1, PART 1

Linear Programming Model of Typical Farm Situation

	Unit	B	1 Dairy	2 Vealers	3 Pigs	4 Heifer Sell	5 Springer Rear	6 Cull Cow Buy	7 Cull Cow Sell	8 Springer Buy
Z—C	$	0	—70	—60.40	—216	—6.60	4	56	—50	70
1. Land	Acres	100	2.4	2.5	0	0	3	0	0	0
2. Arable Land	Acres	15	0	0	0	0	0	0	0	0
3. Sows	No.	5	0	0	1	0	0	0	0	0
4. Heifer Supply	No.	0	—.5	0	0	1	1	0	0	0
5. Springer Supply	No.	0	.25	0	0	0	—1	0	0	—1
6. Skim Supply	gals.	0	—333	0	6,000	0	210	0	0	0
7. Vealer Mother Supply	No.	0	—.1	0	0	0	0	0	1	0
8. Labour July	hrs.	195	2.3	1	6	0	1	0	0	0
9. Labour August	hrs.	195	3.0	1	6	0	1	0	0	0
10. Labour September	hrs.	195	3.0	1	6	0	1	0	0	0
11. Labour October	hrs.	195	3.0	1	6	0	1	0	0	0
12. Labour November	hrs.	195	3.0	1	6	0	1	0	0	0
13. Labour December	hrs.	195	3.0	1	6	0	1	0	0	0
14. Labour March	hrs.	195	3.0	1	6	0	1	0	0	0
15. Labour April	hrs.	195	2.3	1	6	0	1	0	0	0
16. Labour May	hrs.	195	2.3	1	6	0	1	0	0	0
17. Labour June	hrs.	195	2.3	1	6	0	1	0	0	0
18. Capital July	$	200	—1.88	0	—94	0	4	0	0	70
19. Capital August	$	200	—12.34	—69	—94	—6.60	4	0	—50	70
20. Capital September	$	200	—22.72	—69	—94	—6.60	4	0	—50	70
21. Capital October	$	200	—29.66	—69	—94	—6.60	4	0	—50	70
22. Capital November	$	200	—36.60	—69	—94	—6.60	4	56	—50	70
23. Capital December	$	200	—42.82	—69	—94	—6.60	4	56	—50	70
24. Capital January	$	200	—50.18	—69	—216	—6.60	4	56	—50	70
25. Capital February	$	200	—55.84	—69	—216	—6.60	4	56	—50	70
26. Capital March	$	200	—59.84	—69	—216	—6.60	4	56	—50	70
27. Capital April	$	200	—58.12	—64	—216	—6.60	4	56	—50	70
28. Capital May	$	200	—67.42	—60	—216	—6.60	4	56	—50	70
29. Capital June	$	200	—69.80	—60	—216	—6.60	4	56	—50	70
30. General Cash Max.	....	1	0	0	0	0	0	0	0	0
31. Vealer Mothers	No.	0	0	.33	0	0	0	—1	0	0

TABLE 1, PART II

Restraints	Unit	B	9 Sheep Vanners	10 Peas I	11 Peas II	12 Peanuts	13 Peas and Peanuts	14 Grain Buy	15 Gen. Cash Req'mts.	16 Vealer Mother Transfer	17 Cash Recir'ln
Z—C	$	**0**	—20	—119.30	—119.30	—134.84	—270.14	2.80	—999	0	0
1. Land	Acres	100	.2	1	1	1	1	0	0	0	0
2. Arable Land	Acres	15	0	1	1	1	1	0	0	0	0
3. Sows	No.	5	0	0	0	0	0	0	0	0	0
4. Heifer supply	No.	0	1	0	0	0	0	0	0	0	0
5. Springer supply	No.	0	0	0	0	0	0	0	0	0	0
6. Skim supply	gals.	0	210	0	0	0	0	—100	0	0	0
7. Vealer mother supply	No.	0	0	0	0	0	0	0	0	1	0
8. Labour July	hrs.	195	0	4.5	2	0	4.5	0	0	0	0
9. Labour August	hrs.	195	1	0	10.5	0	11.5	0	0	0	0
10. Labour September	hrs.	195	1	0	4.5	0	0	0	0	0	0
11. Labour October	hrs.	195	1	0	0	2	2	0	0	0	0
12. Labour November	hrs.	195	1	0	0	5	5	0	0	0	0
13. Labour December	hrs.	195	1	0	0	12	12	0	0	0	0
14. Labour March	hrs.	195	0	6.5	0	6	6	0	0	0	0
15. Labour April	hrs.	195	0	2	0	5	8.5	0	0	0	0
16. Labour May	hrs.	195	0	2	6.5	12	14	0	0	0	0
17. Labour June	hrs.	195	0	10.5	2.0	0	2	0	0	0	0
18. Capital July	$	200	0	33.20	1.50	0	33.20	2.80	210	0	—1
19. Capital August	$	200	0	—227.80	67.80	0	99.50	2.80	380	0	—1
20. Capital September	$	200	0	—227.80	101.00	.80	—153.50	2.80	570	0	—1
21. Capital October	$	200	0	—227.80	—160.00	1.60	—145.50	2.80	790	0	—1
22. Capital November	$	200	0	—227.80	—160.00	48.00	—113.50	2.80	990	0	—1
23. Capital December	$	200	0	—227.80	—160.00	51.00	—110.50	2.80	1,170	0	—1
24. Capital January	$	200	0	—227.80	—160.00	52.50	109.00	2.80	1,390	0	—1
25. Capital February	$	200	—20	—213.80	—160.00	54.00	—106.50	2.80	1,550	0	—1
26. Capital March	$	200	—20	—188.60	—160.00	54.00	—106.50	2.80	1,770	0	—1
27. Capital April	$	200	—20	—187.10	—146.00	74.76	—63.55	2.80	1,990	0	—1
28. Capital May	$	200	—20	—185.60	—120.80	117.25	—19.55	2.80	2,190	0	—1
29. Capital June	$	200	—20	—119.30	—119.30	134.83	—270.13	2.80	3,420	0	+1
30. Gen. Cash Max.	..	1	0	0	0	0	0	0	1	0	0
31. Vealer Mothers	No.	0	0	0	0	0	0	0	0	—1	0

subsequent month to the end of the year.[5] Thus, the operator starts the year with $200 working capital. The revenue generated and the capital required by the various enterprises will add to and subtract from this initial supply. Obviously, if the specified "typical" small scale dairyfarmer is short of working capital, farm organization will be sensitive to fluctuations in the flow of funds within the firm from month to month.

Of course, in order to ensure the realism of the model, it is necessary to allow for competition between the family and the firm for cash. Accordingly, activity (15) reflects the requirement of the farmer and his family for cash, other than variable costs of the firm, throughout the year. The derivation of these requirements is shown in Table 2. It is felt that most of the figures in this table are conservative. For example, the running costs are low, there is no provision for debt repayments, and there is no provision for insurance premium payments. It is difficult to decide whether $30 a week does represent a fair estimate of the "minimum" cash requirements of a farm family. While it is a figure below the November, 1963, basic wage[6] of $1,576, it seems that it could represent, in real terms, an income in excess of that figure.[7]

TABLE 2

A Schedule of Monthly Cash Commitments for General Farm Overheads and Household Expenses

	*Farm and Tractor	†Dairy Over-heads	‡ Car	§House and Personal	Total
	$	$	$	$	$
July	70	10	10	120	210
August	30	10	10	120	170
September	20	20	30	120	190
October	80	10	10	120	220
November	20	10	10	160**	200
December	20	20	20	120	180
January	80	10	10	120	220
February	30	10	10	110	160
March	20	10	70¶	120	220
April	80	10	10	120	220
May	20	10	10	160**	200
June	170‖	10	20	120	320
Total	640	140	220	1,510	2,510

* This permits general farm repairs and normal tractor operations and maintenance. Also electricity charges etc.

† These are fixed costs which must be met to keep the dairy operational. They are independent of the number of cows.

‡ The higher amounts in this column are provisions for repairs and servicing above the general operation expenses.

§ In general about $30 a week is provided here but see ** below.

‖ This figure included $140 as rates on 100 acres.

¶ Includes a charge for registration and insurance of car.

** This figure allows for telephone and some other small sundries.

[5] The technique employed is based on that developed by Stewart, see J. D. Stewart, "Farm Operating Capital as a Constraint—A Problem in the Application of Linear Programming", *The Farm Economist*, Vol. IX, No. 10, 1961.

[6] 1963 wage figures are taken for purposes of comparison with estimated farm income in this study.

[7] See below, p. 13.

It must be pointed out that the presence of activity (15) does not prevent the accumulation of income above this level which could be used for farm or household investment, or a higher level of consumption. Only the results of computation can tell if such a surplus will occur. A very high or "m" price is placed on the activity to force it into the basis. Of course, final income is calculated net of this price and restraint 30 ensures that the activity cannot enter the basis at more than unit level.

Activity (17) is a capital transfer activity which permits the recirculation of cash in the event of a surplus accumulating at the end of the financial year.[8] Should such recirculation not have been permitted, and should a June surplus have appeared, then the resulting plans would have been unrealistic, in the event of working capital shortages in other months. On the other hand, it would be unrealistic to assume that all of a June surplus would necessarily be available for use as working capital in the coming year. Not only must allowance be made for fixed cash requirements but also the need to meet depreciation and maintenance must be recognized. In an attempt to handle this, the June coefficient of activity (15) was expanded by the amounts shown for depreciation and other overheads (apart from interest) in Table 5. While this improves the position it must still be recognized that the specified situation does not allow for the choice confronting the farm family of using a June surplus either for working capital in the coming year, for new investment, or for expanded domestic consumption and investment.[9]

3. RESULTS[10]

Initially the optimum plan was computed for a farm of 100 acres with 15 per cent of the area arable. The revenue earning enterprises which appeared are shown in Table 3. Activity (15) is in the plan at unit level.

Table 4 shows the amounts of the resources (restraints) which are not used in the optimum plan.

One of the limitations of standard linear programming is its inability to accept restrictions which prevent activities appearing in the bases at non-integer levels. Often these inconsistencies are insignificant for operational purposes and rounding to the nearest integer is reasonable. This is true in much of this study though it is also true that serious difficulties could arise in a minority of cases such as with P5 and P8 in Table 3. However, rounding to integer levels is not carried out in this article as it is not necessary for the purposes of analysis.

Appraisal of these results suggests that the small farm which has been specified is not a "marginal" or "problem" one. Upon deducting from the net income of $5,284 the $3,420 required by activity (15) there is a surplus of $1,864. When this surplus is added to the amount of $1,430 allowed for domestic purposes in activity (15) the result is a family income of $3,294 which does not give rise to concern for family welfare.

---

[8] The authors are indebted to P. A. Rickards who insisted that this device would work.

[9] It should also be noted that a farm family would have greater flexibility in its use of cash than has been assumed. For example, payments do not always have to be made at the time of purchase and replacement. Furthermore maintenance and other overhead expenditures could vary greatly from year to year.

[10] The authors are indebted to P. A. Rickards, J. C. Flinn and R. C. Jensen for assistance in computing.

TABLE 3

Revenue Earning Enterprises in the Optimum Plan for the Typical 100 *Acre Farm (Cash Cropping Included)*

Activity	Unit	Level	Revenue Net of Variable Costs
			$
P. 1 Dairy	Cows	30·0	2,100.00
P. 3 Pigs	Sows	1·2	259.20
P. 7 Cull Cows-Sell	Cows	3·0	150.00
P. 4 Heifer-Sell	Heifers	2·3	15.20
P. 9 Sheep Vanners	Heifers	9·0	180.00
P. 13 Peanuts and Peas	Acres	7·1	1,918.00
P. 10 Peas I	Acres	7·9	942.40
P. 5 Springer Rear*	Springers	3·7	—14.80
P. 8 Springer Buy	Springers	3·8	—266.00
Total Revenue	$	....	5,284.00

* This activity requires the retention of heifer calves at a cost, or negative revenue, of $4 per unit.

TABLE 4

Unused Resources in the Optimum Plan for the Typical 100*-Acre Farm (Cash Cropping Included)*

Restraint (Resource)	Unit	Quantity not Used
R. 3 Sows	Sows	3·8
Labour:		
R. 8 July	Hours	47·5
R. 9 August	Hours	3·5
R. 10 September	Hours	85·0
R. 11 October	Hours	70·8
R. 12 November	Hours	49·6
R. 15 April	Hours	38·9
R. 17 June	Hours	17·6
Capital:		
R. 18 July	$	1,445.60
R. 19 August	$	1,291.00
R. 20 September	$	3,203.60
R. 21 October	$	3,135.20
R. 22 November	$	2,916.80
R. 23 December	$	2,902.20
R. 24 January	$	3,041.00
R. 25 February	$	3,102.20
R. 26 March	$	2,802.60
R. 27 April	$	2,215.20
R. 28 May	$	1,970.80
Capital recirculation	$	2,061.00

TABLE 5

Assumed Overhead Costs for Relevant Farm Sizes

	100-Acre Farm	127-Acre Farm
	$	$
Estimated Capital Values:		
Land and buildings* (excl. house)	13,000	16,250
Machinery and equipment†	2,200	2,200
Livestock‡	3,760	4,640
Total	18,960	23,090
Overhead Costs:		
Interest @ 6%	1,140 (—60)‖	1,386
Depreciation§	580	580
Maintenance*	330	330
	2,050 (—60)‖	2,296

* Based on figures reported in J. G. Bird, "The Dairy Industry on the Far North Coast of New South Wales", this *Review*. Vol. 30 No. 1 (March, 1962).

† Estimated depreciated value of equipment on typical small farm (excludes a tractor).

‡ Estimated for optimum plans assuming values of $80 per cow, $80 per sow and litter.

§ Depreciation is calculated by the straight-line method. It is assumed that machinery has a 10-year life with a 10 per cent salvage value at the end of its life. For buildings the corresponding assumptions are 20 years and 10 per cent.

‖ Less $60 when cropping is included.

On the other hand, questions of efficiency of resource use are not so readily answered. The family income of $3,294 mentioned in the previous paragraph is the residual available for labour, management, and capital after all other inputs have been awarded their opportunity cost. If the interest charge shown in Table 5 is subtracted, the imputed return to labour and management is $2,214. Comparison of this return with the opportunity cost of labour and management would enable a conclusion concerning efficiency of resource use. The problem is the determination of an appropriate opportunity cost figure.

It is quite usual in studies of this type to make a judgement on the appropriate opportunity cost for the farmer's labour and management. The above return compares more than favourably with most such judgments. In other words, if it were assumed that the income foregone by an individual remaining a dairyfarmer was no more than $2,200 per annum, and the indications are that many would assume this, then this farm organization represents an efficient allocation of resources or something not far from it.[11] In fact, the computed return is $238 greater than the average minimum wage rate in New South Wales during the year ending December, 1963. It was also $638 greater than the State basic wage in November of that year but was $386 less than average earnings per employed male unit over the year.

[11] It should be pointed out that inefficiencies due to the butter subsidy are ignored. In other words, the arguable stand is taken that the subsidized price represents the true social value of butter.

Of the three figures used in the above comparison it is likely that the last, average earnings per employed male unit, is the best estimate of the appropriate opportunity cost figure as it is the only figure which includes an allowance for average overtime earnings. On the other hand, as an estimate of farmer opportunity cost it is, if anything, biassed upwards as it covers salaried employees. However, adjustment of the computed cash income for differences in purchasing power of North Coast dairyfarmers and for income in kind[12] shows that the two figures are similar, the "real" income from a farm operated under the computed plan being estimated at $2,588. That is, the normatively estimated farm plan represents an efficient allocation of resources if the assumed opportunity costs of farm capital, labour, and management are accepted.

This initial analysis supports the Committee of Enquiry's hypothesis, at least to the extent that, of the various complementary enterprises included in the model, small crops use all the available arable land and the resulting farm income affords a family income which is well above poverty level and which suggests a seemingly efficient use of resources. Furthermore, the computed pattern of farm organization is not reflected in the observed behaviour of farms in the area. None of the surveys of the Far North Coast dairy industry have reported widespread cropping.

However, it would be naive to accept the implications of the Committee's recommendation as being true for this district on the basis of this evidence alone. To ignore the reaction of the majority of farmers in the area to the seeming attractions of the small crop markets, without further investigation, would be dangerous. In fact several considerations may be important in explaining why more farmers do not adopt small cropping:—

(*a*) Because demand for peas is relatively inelastic, and because both yields and total acreage of peas and peanuts are quite variable, the pea and peanut enterprise may be regarded as destabilizing influences on farm income.

(*b*) Frequent cropping has been considered important by some in the decline in fertility of the red soil. This could have resulted in some aversion to the practice.

(*c*) Some parts of the Big Scrub are totally unsuited to cropping because of topography or because of surface stone. Partly to accommodate this the original crop acreage was set at 15 acres. However, it must be recognized that some farms in the area have no cultivable soil at all.

(*d*) At the end of a cropping phase, reversion to pasture may be a slow process involving invasion by undesirable species. To the extent that this is true this analysis has ignored a cost associated with cropping which could be significant. On the other hand the

[12] These adjustments are based on the analysis of Mackay and are:—

(i) The purchasing power of money on the North Coast is 3 per cent less than in urban areas.

(ii) There is a $440 "income in kind" differential which favours dairyfarmers.

See D. J. Mackay, *Real Incomes of North Coast Dairyfarmers,* Agricultural and Economic Policy Thesis (unpublished), University of New England, 1964.

increasing importance of sown pasture and vetch could mean that this problem could be overcome by establishing such species following a cash crop.

(*e*) Finally, the managerial and labour requirements of these crops may be a deterrent to the small dairyfarmer, who is perhaps dulled by the drudgery of long hours for a low income.

It is possible to make an attempt at assessing the stability of the level of crop enterprises in farm organization as crop revenues fall. Unfortunately, the inter-relationships which exist between the various crops, and which have been built into the present specifications, make the use of orthodox variable price techniques impossible. While a specification appropriate to these techniques would have been possible, it was felt that the additional effort was unwarranted in view of the current poor understanding of the issues involved. In particular, it is suggested that variable-price programming may be misleading in that any detailed analysis of this problem would probably require explicit treatment of the issues of risk and risk aversion.

Further, any parametric programming involving objective function coefficients can only be done, in the present case, in a matrix from which the capital profile has been removed. This is necessary because the activity revenues are assumed to be virtually the only sources of working capital. This could be a dangerous oversimplification where working capital shortages do arise.

In view of the above considerations a rather crude but less time-consuming procedure was adopted. All crop activity revenues were decreased by 10 per cent steps until cropping all but left the farm plan. The capital profile was eliminated from the matrix used. The results indicated that cropping would be remarkably competitive with the livestock enterprises even at very low crop prices. The relevant results are contained in Table 6.

The implication of these results is that inelasticity of demand is not sufficient reason for the small amount of cropping actually engaged upon in the Big Scrub. Clearly the problem of income variance resulting from the inclusion of cropping, and farmer attitudes to risk, together with the other agronomic and managerial problems mentioned above, need to be studied further if the question of cropping in the area is to be answered satisfactorily.

Of the two complementary livestock enterprises, only pig production has entered this plan and even this is at a low level. Vealer production does not appear at all. However, the suggested role of these two enterprises could change should cropping not be considered. In addition one would expect the resulting plan to be closer to actual farm organization in the area.

Farm Organization Without Crops

The specification for this situation was readily achieved by setting the arable land restraint to zero. A comparison of the resulting farm plan with that contained in Table 3 is shown in Table 7, while Appendix Table 9 shows a comparison of the unused resources.

TABLE 6

Levels of Cropping in Optimum Farm Plans at Varying Crop Net Revenues

Crop	Net Revenue $	Size (Acres)	Total Crop Acreage (Acres)
Peas I	95.44—119.30	7·9	
Peas II	95.44—119.30	0	
Peanuts	107.88—134.84	0	
Peas and Peanuts	270.14	7·1	15·0
Peas I	59.64—83.56	7·8	
Peas II	59.64—83.56	0·3	
Peanuts	67.42—94.38	0	
Peas and Peanuts	189.14	6·8	14·9
Peas I	47.92	5·6	
Peas II	47.92	0·3	
Peanuts	53.94	0	
Peas and Peanuts	108.12	6·1	12·0
Peas I	36.00	3·9	
Peas II	36.00	0·2	
Peanuts	40.46	0	
Peas and Peanuts	81.12	4·2	8·3
Peas I	24.06	0	
Peas II	24.06	0	
Peanuts	26.96	0	
Peas and Peanuts	54.12	3·7	3·7

TABLE 7

A Comparison of Plans for the Typical 100*-Acre Farm When Cash Cropping is Included or Excluded*

Activity	Unit	With Cultivation		Without Cultivation	
		Level	Revenue Net of Variable Costs	Level	Revenue Net of Variable Costs
			$		$
P. 1 Dairy	Cows	30·0	2,100.00	41·7	2,919.00
P. 3 Pigs	Sows	1·2	259.20	5·0	1,080.00
P. 7 Cull Cow Sell	Cows	3·0	150.00	4·2	210.00
P. 4 Heifer Sell	Heifers	2·3	15.20	20·8	172.20
P. 9 Sheep Vanners	Heifers	9·0	180.00	....	....
P. 13 Peanuts and Peas	Acres	7·1	1,918.00	....	....
P. 10 Peas 1	Acres	7·9	942.40	....	....
P. 5 Springer Rear	Springers	3·7	—14.80	....	....
P. 8 Springer Buy	Springers	3·8	—266.00	10·4	—728.00
P. 14 Grain Buy	100 lb	....	....	161·3	—451.60
Total Revenue	$	....	5,284.00	....	3,201.60

The cost of excluding cash crops is high as there is a 39 per cent reduction in income net of cash costs in the new plan. Furthermore, activity (15), the general cash requirement activity, enters the plan at a level of .8047, well below the desired unit level. While a family is more than just sustained when cropping is possible, it seems that either family living levels, or maintenance and reinvestment, would have to suffer in the absence of cropping. If failure to fully satisfy the cash requirements of activity (15) is taken as an indication of a farm being marginal, or worse, then this farm falls into this category. In fact, it was found that, according to this "loose" criterion, the marginal farm is one of approximately 127 acres, milking 53 cows and with a revenue of $3,944 net of cash costs.[13] The relevant plan is contained in Table 8. As would be expected June and July are the months of cash shortage.

It must be remembered that this 127-acre unit is marginal only in a "welfare" sense in that, below this acreage, what are judged to be adequate living levels are not possible without disinvestment. The farm is still classed as submarginal in an efficiency sense even after the computed cash income is put into real terms. Although the real income of $1,828 is $252 above the state basic wage in November 1963 it is $148 below the minimum adult male wage rate for the year and $772 below the average earnings for an employed male unit.

TABLE 8

Organization of a Hypothetical "Marginal" Farm (Farm Area 127 Acres)

Activity	Unit	Level	Net Revenue
			$
Dairy	Cows	53·0	3,710.00
Pigs	Sows	5·0	1,080.00
Cull Cow Sell	Cows	5·3	265.00
Heifer Sell	Heifers	26·0	171.60
Sheep Vanners	Heifers	0·5	10.00
Springer Buy	Springers	13·2	—924.00
Grain Buy	100 lb	125·2	—350.60
Total Net Revenue	$		3,962.00

Clearly the 127-acre farm is submarginal in an efficiency sense according to our normative analysis. However it is difficult to determine just how far from the margin it is. It would be unwise to accept the minimum wage rate as the opportunity cost of farm labour and management as it includes no allowance for overtime. On the other hand, it is likely that average earnings would represent a definite upper limit due to the fact that, as mentioned above, it is probably biassed upwards because it includes salaries.

[13] It should be noted that a herd of 53 cows would, under our assumptions, produce only 7,950 lb. of butterfat. This is considerably below the 12,000 lb. called for by New South Wales dairy policy which would require a herd of 80 cows at the assumed per cow production.

All it is possible to say is that, according to this normative study, the marginal farm without crops, judged on efficiency grounds should be somewhat larger than 127 acres and if average earnings per employed male unit are taken as the opportunity cost of farm labour and management, then it is possibly larger than 150 acres.

It would seem that the margin to *efficient* dairying in the Big Scrub falls at considerably larger acreages than has been thought likely and that the implications for farm adjustment, if optimum resource allocation is the goal, could be rather forbidding.[14]

In comparing the situations with and without cropping it is clear that, not surprisingly, working capital shortages are not important when cropping is permitted. On the other hand it seems that cash shortages can become quite severe on small farms when, as it is usual in the Big Scrub, cropping is not contemplated. Just how severe these shortages may be in reality cannot be suggested on the basis of this analysis. However, it can be said that, to the extent that general cash commitments do in fact exceed the conservative estimates of activity (15), so the periods of cash shortage will become longer and more severe and will persist to larger sizes of farm. Activity (15) is conservative to the extent that, in particular, it ignores the possibility of principal and interest repayments on debt being necessary. Clearly, the level of debt carried will be a determinant of the size of farm which is marginal in so far as family living is concerned. Unfortunately knowledge of sources and use of credit on the part of Big Scrub farmers is such that nothing further can be said to elaborate this point.

It would seem that the presence or absence of cropping does have an influence on the possible role of one of the livestock alternatives, pigs. When cropping is permitted, pig production is at quite a low level with a cow:sow ratio of 25:1 as opposed to a value of 8.3:1 when cropping is excluded. This last value conforms with the modal value of such ratios as reported by Bird[15] but is probably well above the value which would have resulted had not sow numbers been restricted. This restriction was imposed on the assumption that accommodation was insufficient to house more than five sows and their progeny.

Farm organization in the absence of cropping is not very different from what would be observed on farms in the area with the exception that, as Bird shows, quite a large number of farms run no pigs at all and many farmers rear their own dairy herd replacements rather than purchase them. On the other hand both these activities are sensitive to size of farm and it was found that with increasing acreage both became less important till,

[14] On the other hand, the dimensions of the problem may be less. For example, as Professor Parish has suggested to us, some dairyfarmers may belong to that group of people which seems to be willing to sacrifice income in order to gain things of value to them such as independence. Many service station operators and small shop owners would fall into this class. In the case of North Coast dairyfarmers a pleasant environment in which to live must be counted on the credit side.

Gruen and Waring also showed that just under a third of their sample of small dairyfarmers may have been such that, due to their age, infirmity, or feminity they may have had low opportunity costs. F. H. Gruen and E. J. Waring, *op. cit.*, p. 15.

[15] Bird, *op. cit.*, p. 70.

at 163 acres, two-thirds of replacements are being reared and almost half the sows are not joined. The first of these outcomes merely reflects the declining scarcity of land, but the second reflects competition between pigs and other activities for labour. It could well be that labour hire would be justified,[16] and that expansion of pig production could then follow. There is also good reason to think that alternative forms of the pig enterprise could reduce this labour competition. However, it should be recognized that revenue from the pig enterprise can be highly variable and that the risk involved could make many farmers reluctant to expand that enterprise. Once again farmer reaction to risk could be important in determining the role of an enterprise in dairy farm adjustment.

Even in the absence of cropping vealer production fails to enter the plan. This is true even up to a farm size of 163 acres. However, at this acreage a $4 increase in vealer revenue would make non-zero output levels attractive. Despite this there is little evidence that vealer production will assist on marginal farms. In fact, even on a farm of 132 acres, which is not marginal according to our "loose" criterion, vealer revenue would have to rise by 20 per cent to justify its inclusion in the plan. One is forced to conclude that, with present prices and productivity, the vealer enterprise is only likely to have a place on larger farms with insufficient labour. Whenever land becomes scarce or labour sufficient dairying will displace vealers.

To this point, computations and discussion have assumed a constant dairy revenue. It would be interesting to see if there is any significant shift in recommended farm organization with changing dairy revenue.

The Sensitivity of Farm Organization to Changes in Dairy Revenue

Once again, to enable estimation of valid border prices, the capital profile had to be removed from the matrix, with the result that the impact of cash shortages on farm organization will not be detected. However, it is believed that the insights obtained justified persevering with the analysis. Dairy price was varied both with and without cultivation. The resulting arrays of plans are presented in Tables 9 and 10.

In both cases the vealer enterprise is important only at very low revenues per cow. When cropping is permitted vealers persist at higher dairy revenues than they do in the absence of cropping. In all probability this reflects the pressure on labour resources which occurs in the presence of cropping, particularly in May. Similarly it would seem that labour shortages keep pig production at a low level throughout.

On the other hand, no such labour shortages occur in any plan when cropping is not permitted, with the result that dairying competes more effectively with vealers at lower levels of dairy revenue and pig production is at its upper limit at all prices. In the presence of cropping, programming recommends quite low levels of pig production with cow to sow ratios in excess of 20.0 over a range of dairy prices which can be accepted as

[16] It should be mentioned that the presence of the artificially high "m" price on activity (15) means that conventional interpretations cannot be placed on shadow prices. While the appropriate adjustment can be made this would have necessitated "printing" of the final matrix from the computer and the effort was considered unwarranted.

TABLE 9

Optimum Plan as Dairy Revenue Varies: Cash Cropping Included

Activity	Plan at Dairy Revenue ($) of:									
	0— 37.30	37.30— 54.68	54.68— 55.46	55.46— 59.40	59.40— 67.82	67.82— 80.04	80.04— 115.64	115.64— 121.46	121.46— 126.80	126.80— 325.40
Cull Cow Buy	11·2	11·2	..	..	..	..	..	..	..	..
Peas I	4·1	4·1	6·8	7·3	7·7	7·9	7·8	5·7	5·6	5·6
Dairy	0	0	21·5	25·5	28·8	30·0	30·8	36·4	36·7	36·7
Pigs	0	0	0·8	1·0	1·1	1·2	1·3	2·0	2·0	2·0
Peas and Peanuts	10·9	10·9	8·2	7·7	7·3	7·1	6·8	6·1	6·1	6·1
Vealers	34·0	34·0	6·5	7·7	0	0	0	0	0	..
Sheep Vanners	..	0	5·4	12·1	9·8	9·0	9·9	..	..	..
Springer Rear	..	..	5·4	·7	4·6	3·7	3·0	0·2	..	..
Vealer Mother Transfer	0	0	2·1	2·6	..	..	..	..	..	..
Springer Buy	..	..	..	5·7	2·6	3·8	4·7	8·9	9·2	9·2
Cull Cow Sell	..	..	..	..	2·9	3·0	3·1	3·6	3·7	3·7
Heifer Sell	..	..	..	..	..	2·3	2·5	18·0	18·3	18·3
Peas II	..	..	..	..	..	..	0·3	0·3	0·3	0·3
Revenue Range $	4,860	4,860	4,860— 4,870	4,870— 4,986	4,986— 5,222	5,222— 5,586	5,586— 6,674	6,674— 6,892	6,892— 7,100	7,100— 14,388
Cow/Sow Ratios	..	..	26·9	25·5	26·2	23·1	23·7	18·2	18·3	18·3

TABLE 10

Optimum Plans as Dairy Revenue Varies: Cash Cropping Excluded

Activity	Plan at Dairy Revenue ($) of:				
	0 — 37.44	37.44 — 40.02	40.02 — 56.52	56.52 — 90.12	90.12 — 648.22
Cull Cow Buy	13.2	....	....	....	....
Grain Buy	300.0	230.0	208.8	208.8	161.3
Vealers	40.0	9.3	0	....	....
Springer Buy	0	7.7	10.0	10.0	10.4
Pigs	5.0	5.0	5.0	5.0	5.0
Sheep Vanners	0	15.3	20.0	20.0	....
Dairy	....	30.7	40.0	40.0	41.7
Cull Cow Sell	....	....	4.0	4.0	4.2
Heifer Sell	....	....	....	....	20.8
Revenue $	1,916	1,916— 1,994	1,994— 2,656	2,656— 4,000	4,000— 27,278

realistic. As would be expected this is a higher value than Bird found on all but six of his survey farms which ran pigs.[17] However, in the absence of cropping, sow numbers are pressing against their arbitrary upper limit at all levels of dairy revenue and the resulting cow to sow ratios are such that only three members of Bird's survey had ratios as low or lower. Clearly, had sow numbers not been restricted then the cow to sow ratio in the computed plans would have been lower still. For example, over the most relevant price range of $56.52 to $90.12 over nine sows could have been carried before the plan would have changed.

There certainly does seem to be disagreement between what the linear programme results recommend and what Big Scrub farmers actually do. According to the programme results, best farm organization should include cash crops and restricted pig production or, should cropping be excluded from consideration, levels of pig production high enough to justify quite substantial purchases of grain. In reality farmers do not crop, or grow pigs, to the extent the results recommend. It is suggested that this lack of agreement between farmer behaviour and the suggestions of the normative perfect competition model employed are due in the main to reactions by farmers to the variance of returns from the crop and pig enterprises.

Finally it is interesting to observe the resilience of farm income, when cultivation is possible, in the face of declining dairy revenue. While dairying dominates farm organization from revenues of $54.68 upward, income does not change markedly over a wide range of revenues. For example while dairy revenue increases from zero to $115.64, farm income only increases from $4,860 to $6,674. Admittedly this result could be misleading due to over-simplification of the problem resulting from the exclusion of the capital profile and because several prices are kept constant which could change in response to, or concurrently with, variation in dairy revenue.[18] However, it

[17] J. G. Bird, *op. cit.*, p. 70.

[18] This applies in particular to the prices of cull cows, springers and heifers, sheep vanners and pigs.

is tempting to conclude that this reluctance of income to fall in the face of falling dairy revenue is possible and that, perhaps some of the immobility of people on small farms is, to some extent, influenced by their feeling that the range of production possibilities open to them is such as to ensure a "sufficient" minimum income even in the event of disastrous declines in the price of their main product, butter.

4. SUMMARY AND CONCLUSIONS

In this study an attempt has been made to examine, for the Big Scrub area, the suggestion that the poverty problem in dairying could be alleviated, to some extent, by an expansion of certain sideline enterprises. Application of a static analysis has failed to show that the suggestion is unreasonable.

The steps of the analysis were: development of a linear programming model of a 100 acre dairy farm for which the alternative enterprise included vealers, pigs, sheep vanners, and several cash cropping activities; following solution of this programme the model was reformulated to exclude cash cropping in conformity with general practice and attention was also given to the effect of changes in dairy enterprise revenue on the optimum plans.

This analysis suggested that cropping should play a greater role than it does and pig production a lesser role or, should cropping be unacceptable, that pig production should play a more important role than it presently does in the area. In addition it would also seem that vealer production will be of little importance in any adjustment which may take place.

However, it has been pointed out that it would be naive to accept such a conclusion when repeated surveys in the area have shown that very little cropping is actually done and that pig numbers are considerably below those that the programming study would recommend in the absence of cropping. Rather than conclude that Big Scrub dairyfarmers are irrational the authors question the adequacy of the static, perfect competition model which has been used. If local opinion is any guide, the failure of north coast farmers to meet the norms suggested by this linear programming analysis is a reaction to the variability of returns from the pig and small crop enterprises. Further if the present study is any guide, the suggestion that inelastic demand for peas deters expansion of acreage in the area is not warranted. However an inelastic demand, when coupled with an elastic inter-year supply, could result in a divergent cobweb situation, market disturbances permitting, with resultant price instability. Should yields also be significantly variable then fear of the effect of the resulting income variance could well be a deterrent to significant plantings of the crop.

The current analysis has been such as to cause us to be dissatisfied with the present state of knowledge concerning the technology and markets of small crops and pig production. It would seem that research in these areas would considerably assist study of the impediments to dairy farm adjustment.

Several other possible areas of study have also been suggested by this work. Firstly, the appearance of the sheep vanner activity in several plans, and the importance of the purchase of dairy replacements on small farms, suggests that some investigation of the regional market for these livestock would be desirable.

Secondly, Mackay's work on the real income of dairy farmers shows that, if efficiency considerations are to determine the size of the marginal farm, then foregone cash incomes are not adequate indicators of the opportunity cost of farm labour and management. However, even after adjusting farm cash income to express it in real terms, it would seem that alternative income possibilities for dairyfarmers, outside the industry, would be such as to suggest a marginal farm acreage and an adjustment problem of greater magnitude than is commonly accepted. On the other hand, should a "loose" criterion of marginality, such as a minimum desirable income as in activity (15), be used then the problem assumes smaller dimensions with an estimated marginal acreage of approximately 127 acres, without crops.

However, even if marginality is defined according to such a loose criterion, the level of farm income needed to return the desired minimum family income will vary from situation to situation depending on levels of maintenance, reinvestment, and debt repayment obligations. In fact, while this study suggested that working capital shortages will only be important on marginal and sub-marginal farms it does seem that knowledge of month-by-month family cash flows, debt levels, and repayment and interest obligations needs to be improved if the extent of the marginal and sub-marginal farm problem is to be adequately defined.

In general it would seem that this work has indicated several directions which research into the problem of low income dairying in this area could take. However, the degree of abstraction involved in the model used is such that it would be optimistic to conclude that implementation of the changes in enterprise mix recommended by the analyses, particularly with regard to cropping, would resolve the adjustment problem. It is likely that, under the technology assumed herein, the main hope for adjustment still lies in the oft-advocated stratagems of farm enlargement and amalgamation and accelerated off-farm migration. However, it could well be that the introduction of a new technology based on sub-tropical legumes would alter this situation and the role of the various sidelines quite considerably. As yet it is not possible to determine with confidence suitable input-output coefficients for this changed situation.

APPENDIX

A detailed discussion of the construction and assumptions of the programming matrix follows:—

(i) Restraint 3 sets an arbitary (but probably realistic in terms of actual accommodation on farms) upper limit on the number of sows which can be carried, while restraints 4 and 5 are necessary for adequate specification of the choice which is possible in livestock replacement policies.

(ii) Retraint 6 allows the accumulation of skim milk for subsequent allocation between the various livestock which could profitably use it.

(iii) Restraint 7 records the availability of cast-for-age cows which are suitable to become vealer mothers.

(iv) Restraints 8 to 17 represent the upper limits on labour supply on a monthly basis. These entries are net of overhead labour requirement such as routine repairs and maintenance and dairy set-up and cleansing time and were arrived at, for a one-man labour force, by assuming that in a 30-day month there are 6.5 hours available for work on the alternative enterprises every day. A further 4 hours a day is employed on fixed chore work on 20 of these days.

(v) Restraint 31 allows for the provision of a herd of vealer mothers which have been purchased or have been made available as culls from the dairy herd. It should be noted here that restraint 7 merely records cows that could be retained, for this purpose, from the dairy herd culls. If it becomes profitable to join them to produce vealers, they would be transferred, via activity 16, down to restraint 31.

The Activities

(i) The dairy activity (1) is straightforward. The springer supply coefficient reflects the fact that cows are replaced at the end of four lactations. Subsequent activities allow a choice between rearing stock or purchasing them. The coefficient for vealer mothers is low because only a portion of the annual culling is suitable for this use. The remaining 0.15 "culls" are sold and the returns are included in general dairy revenue. The variation in labour requirements throughout the year for this activity allows for the general variation in the number of cows milked. The main lactation runs from August to March. The capital coefficients show the accumulation of funds from month to month. Of course, this flow of funds, if it is to be at all realistic, should reflect the typical situation on butter farms where, under the pooling system, monthly revenue is not solely a function of that month's butter production. Appendix Table 1 shows the derivation of the assumed pattern of payments which is based on the payments which occurred in 1963-64. This table also assumes a level of production of 150 lb. of butterfat per cow, as well as, on average, the sale of 0.5 of a "bobby-calf" and 0.15 of a cull cow. Variable costs of $0.40 per cow are incurred in each month while, in April, $5.00 is spent establishing one-third of an acre of vetch per cow for late-winter, early-spring feed.

(ii) The vealer activity (2) is even less complicated. It is assumed that a cow can produce three vealers before she has to be culled. Consequently the coefficient against restraint 31, vealer mothers, is set at 0.33. The area required per unit of activity is 2.5 acres which is slightly more than that required for one unit of the dairy activity. For a portion of the year, one-third of an acre of this land is under vetch for late-winter, early-spring grazing. Mating and calving are assumed to take place in March and November respectively, and the vealers are sold in August at nine months of age. Surplus cows are also sold at this time. The determination of net revenue from the vealer enterprise is as shown in Appendix Table 2.

(iii) For the pig enterprise (3) it is assumed that the weaner pigs weigh 40 lb. when they enter the fattening pens and that the pigs are turned off as porkers after gaining a further 60 lb. Experimental evidence suggests a food conversion ratio of 3.5 lb. of meal or gallons of skim milk per lb. liveweight gain. Accordingly, each animal would require 210 lb. of grain or 210 gallons of skim milk in order to make this weight gain. A budget for the annual feed

requirements of the pig herd per unit of a sow and progeny is shown in Appendix Table 3. Because of the inefficiencies which exist in commercial piggeries, this feed requirement has been increased to 6,000 gallons of skim or pounds of grain. Activity (14) permits purchase of grain to supplement skim milk, should this be profitable. It is assumed that porkers will fetch $16 and that the price of replacement sows and backfatters will cancel out. The resulting revenue, net of $8 miscellaneous charges, has been specified in the capital profile in the manner shown.

(iv) Activities (4) and (5) are self-explanatory. They represent the choice between selling all the heifers as "bobby calves" or retaining some to rear as replacement stock. Activity (8) is the dairy replacement activity which will enter the plan if all heifers are sold.

(v) Activities (6) and (7) allow, respectively, for the purchase of additional vealer mothers and for the sale of vealer mothers provided by the dairy herd, should vealer production be unattractive. The final livestock activity (9) represents the retention of heifers for six months before sale as "sheep vanners"; that is, heifers which are purchased as weaners for rearing in other areas of the State and must be small enough to be transported in railway sheep vans.

(vi) Of the possible cropping enterprises, only two "small" crops are included. It was considered that no other crop was worthy of inclusion. Banana growing was excluded because of that industry's low-income problem.[19] Consideration was given to sweet potato production, but it soon became apparent that this activity has very little potential for adding to dairyfarmers' incomes. Pineapple growing is an industry that probably should be included but its inclusion was precluded by lack of information on labour requirements for small areas grown in association with dairying. Two pea enterprises were included. They are identical in their resource requirements except that they are grown at different times of the year. Peas 1 are planted in March and Peas 2 in May. It was felt that this choice should be included because of possible pressure on labour at different times of the year. Each of the two enterprises generates the same net revenue. The schedule of labour requirements for peas is shown as the Appendix Table 4. Appendix Table 5 details the schedule of charges, from which the timetable of costs is constructed. In estimating net revenue per acre, a conservative price of 10 cents per lb. is assumed with a yield of 100 bushels per acre. For peanuts, the corresponding schedules of costs and labour requirements are shown as Appendix Tables 6 and 7. The yield of this crop is assumed to be 50 bags per acre (at 55 lb. a bag) at a price of 9 cents per lb.[20] Finally, for the cropping activities, it was decided that a sequence of peanuts followed by peas should be examined because of the possibilities of a reduction in labour requirements and cash costs associated with simplification of ground preparation for the pea crop. The time requirements for this combined operation are shown in Appendix Table 8 and can be derived from Appendix Tables 5 and 6, if account is taken of the elimination of part of the expenses and time required for seedbed preparation.

(vii) Of the remaining four activities, (14) allows for the purchase of grain to supplement skim milk for pig feeding. Activity (16) permit vealers mothers, which have been obtained as culls from the dairy herd, to be transferred to restraint 31. Should this transfer not take place, that is, if vealer production is not attractive, these cows are sold through activity (7).

19 See: Commonwealth Bureau of Agriciultural Economics, *The Australian Banana Industry*, Commonwealth Government Printer, Canberra, 1964.

20 Calculations were made originally in old currency, the actual figure here being 11d.

APPENDIX TABLE 1

Cash Flow Profile for a Unit of the Dairy Enterprise (Per Cow)

Month	Production	First Interim Payment	Equalization and Deferred Payment	Livestock Sales	Variable Costs	Net Revenue
	lb. butterfat	$	$	$	$	$
July	3·75	1.46	0.82	..	—0.40	1.88
August	15·00	5.88	1.48	3.50	—0.40	10.46
September	18·75	7.34	3.44	..	—0.40	10.38
October	18·75	7.34	..	..	—0.40	6.94
November	18·75	7.34	..	..	—0.40	6.94
December	16·88	6.62	..	..	—0.40	6.22
January	15·00	5.88	1.88	..	—0.40	7.36
February	13·13	5.14	0.92	..	—0.40	5.66
March	11·25	4.40	..	..	—0.40	4.00
April	9·38	3.68	..	..	—5.40	1.72
May	5·63	2.20	1.50	6.00	—0.40	9.30
June	3·75	1.46	1.32	..	—0.40	2.38
Total	150·00	58.74	11.36	9.50	—9.80	69.80

APPENDIX TABLE 2

Net Revenue from the Vealer Enterprise (Per Unit)

Item	Amount
	$
Income:	
One vealer	56.00
Average sale of 0·33 of a vealer mother	13.30
Total gross income	69.30
Variable Costs:	
Veterinary and miscellaneous	4.00
Vetch	5.00
Total variable costs	9.00
Net revenue	60.30

APPENDIX TABLE 3

Annual Feed Requirement for One Unit of the Pig Activity

(One Sow and Two Litters)

Class of Pig	No. of Weeks or Liveweight Gain	Gallons of Skim or Pounds of Grain	
		Daily Requirement or Requirement per lb. Liveweight Gain	Annual Requirement
	No.	No.	No.
Lactating sow ..	16 weeks	10 per day	1,120
Dry sow	32 weeks	5 per day	1,260
Porkers (14)	60 lb. liveweight gain	3.5 lb. per lb. gain ..	2,940
Total	.....	.....	5,320

APPENDIX TABLE 4

Schedule of Labour Requirements for Peas 1

Month	Operation	Time (Hours)
February	Rotary hoeing (twice)*	....
March	Plough (once), disc (twice), harrow (once), plant*	6.5
April	Scuffle (once)	2.0
May	Scuffle (once)	2.0
June	1st and 2nd picking	10.5
July	3rd picking	4.5

* The farmer is assumed to possess all the necessary equipment except a rotary hoe and a planter. Consequently these operations are done by contract. Picking is done by contract and farm labour.

APPENDIX TABLE 5

Per Acre Costs of Pea Production

Item	Cost per Acre
	$
Contract rotary hoeing—1st run	8.00
2nd run	6.00
Ploughing	2.00
Discing	0.50
Harrowing	0.50
Planting	20.70
Scuffling	0.75
Picking—pickers @ $1.00 per bushel bags @ $1.75 a dozen	
Total cost per picking .. .. (net of farm labour)	33.20

APPENDIX TABLE 6

Per Acre Costs of Peanut Production

Item	Cost per Acre
	$
Planting	29.50
Scuffling	1.50
Hilling	1.50
Root cutting	3.75
Stooking	18.00
Threshing @ 25 cents per bag with 50 bags yield	112.50
Cartage	6.40
Labour 4 men @ $1.00 per hour for 6 hours	24.00
Marketing—bags, stencil and string, and local freight	8.80

APPENDIX TABLE 7

Schedule of Labour Requirements for Peanuts

Month	Operation	Time (Hours)
September	Rotary hoeing (once)*	....
October	Rotary hoe* (once), plough (once)	2
November	Disc (twice), harrow (once), plant,* harrow (once)	5
December	Scuffle (twice), chip (once)	12
January	Hill (once), chip (once)	12
February	Hill (once), chip (once)	12
March	Chip (once)	6
April	Stooking*	5
May	Harvesting* (field and shed operations)	12

* The farmer is assumed to have all the necessary implements except for a rotary hoe, a planter, a cutter and a thresher. The services of these machines are supplied by contract.

APPENDIX TABLE 8

Schedule of Labour Requirements for Peanuts and Peas Grown Consecutively

Month	Operation	Time (Hours)
July	First pea picking	4.5
August	First and second pea picking, rotary hoe (new ground)	11.5
September	Nil	....
October	Rotary hoe, plough	2.0
November	Disc (twice), harrow, plant, harrow	5.0
December	Scuffle (twice), chip	12.0
January	Hill, chip	12.0
February	Hill, chip	12.0
March	Chip	6.0
April	Stook, disc, harrow, plant	8.5
May	Harvest, field to barn, scuffle	14.0
June	Scuffle	2.0

APPENDIX TABLE 9

A Comparison of Surplus Resources in Optimum Plans for the 100-Acre Farm With and Without Cropping

Restraint (Resource)	Unit	Quantity not Used with Cultivation	Quantity not Used without Cultivation
R 3 Sows	Sows	3·8	.....
Labour:			
R 8 July	Hours	47·5	69·2
R 9 August	Hours	3·5	40·0
R10 September	Hours	85·0	40·0
R11 October	Hours	70·8	40·0
R12 November	Hours	49·6	40·0
R13 December	Hours	.....	40·0
R14 March	Hours	.....	40·0
R15 April	Hours	38·9	69·2
R16 May	Hours	.....	69·2
R17 June	Hours	17·6	69·2
Capital:			
R18 July	$	1,445.60	.....
R19 August	$	1,291.00	43.60
R20 September	$	3,203.60	323.20
R21 October	$	3,135.20	435.20
R22 November	$	2,916.80	563.40
R23 December	$	2,902.20	677.80
R24 January	$	3,041.00	1,417.40
R25 February	$	3,102.20	1,524.60
R26 March	$	2,802.60	1,514.20
R27 April	$	2,215.20	1,265.40
R28 May	$	1,970.80	1,492.00
Cash recirculation	$	2,061.00	601.40