COST-SIZE AND REVENUE RELATIONSHIPS IN THE COTTON GROWING INDUSTRY OF SOUTH-WESTERN NEW SOUTH WALES

J. G. RYAN*

* Economics Research Officer, N.S.W. Department of Agriculture.

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1. SUMMARY

In broad terms the main aim of this study is to determine the conditions necessary for irrigated cotton to become a viable industry in south-western New South Wales. This is an important consideration for policy makers and farmers alike as there appears to be a number of other areas better suited to cotton growing within the State and in other parts of Australia. The Commonwealth Government cannot be expected to continue with the present level of subsidy indefinitely and the industry will no doubt have to be rationalized at some time in the future.[1] This paper attempts to answer important questions in relation to this.

At the same time the provision of detailed information on the cotton growing industry in this area occupies a major portion of the paper. The aim here is to assist extension officers, farmer advisers and all farmers who are seriously considering entering the industry. Input-output data including agronomic details of cotton grown in the area, together with their yields, quality, prices, costs, revenue and labour requirements are presented. With the aid of this information decisions regarding the feasibility of cotton growing in any particular situation should be facilitated.

A subsidiary aim was to evaluate the relative profitability of cotton and other major "large area" crops in the irrigation areas of the south-west. Unless cotton can compete successfully with these in terms of income per acre it will be destined to play a minor role in the economy of the region.

With the aid of input-output data on cotton supplied by nine cotton growers in 1962-63 and 1963-64, projected average costs curves related to size and yield are constructed. To ascertain the industry's viability, gross revenue lines are incorporated corresponding to the expected income levels with and without the bounty.

Gross margins for cotton at various yields are compared to those for a number of alternative irrigation crops assuming above average efficiency. The effect of the bounty on cotton's competitive position is also analysed to assist decision making in the future.

There are two main conclusions arising from the study. Briefly, the first is that in the absence of the Commonwealth Government's bounty on cotton, yields in excess of 500 lb. of lint per acre will be required to ensure a reasonable return to management and land when growing cotton is a *monoculture*. The second is that in the presence of the bounty, yields of at least 300 lb. of lint will be necessary. The latter is probably attainable with the present varieties and know-how, but it is less certain that average yields of 500 lb. will be achieved continuously without the development of new varieties.

A more detailed discussion of these and other subsidiary conclusions is to be found at the end of the paper.

[1] Annual bounty payments made by the Commonwealth Government for the five years ending June 30, 1964, were: £214,456; £373,487; £315,105; £287,077 and £473,447. In 1964-65 it is expected to be £1,100,000. Private communication, Department of Customs and Excise, Canberra.

2. INTRODUCTION

In the last few years, increasing interest has focused on the possibility of expanding the area of irrigated cotton in Australia. The emphasis is being placed on expanding the area of irrigated cotton only, as the crop requires a frequent and adequate supply of water to attain high yields. Reliance on natural rainfall alone is a risky venture in cotton with its high growing costs, and the provision of irrigation ensures increases in yield that more than pay for the additional cost involved. Ample evidence of this is found in Queensland. The New South Wales Department of Agriculture advises farmers not to grow cotton without irrigation.

The prime mover in the expansion of irrigated cotton production has been the prospect of replacing the present imports of raw cotton into Australia with home grown cotton. This is expected to bring about a saving of approximately £6m. in foreign exchange annually.

The real impetus has come from the Commonwealth Government bounty which is aimed at assisting the development of a viable industry in Australia. The present bounty, with its five-year term expiring on February 28, 1969, provides for a system of premiums over and above sales proceeds, based on the grades of cotton submitted to the ginneries by growers. Growers of the higher grades of cotton receive larger bounty premiums per lb. of ginned cotton (lint), which provides an incentive to grow higher quality cotton in line with the requirements of spinners. As irrigated cotton is usually of a higher grade than the rain grown product the bounty has favoured expansion in irrigated areas.

The object of this study is to evaluate the present and expected future performance of irrigated cotton crops in the south-western portion of New South Wales; more particularly, the area commonly referred to as the Murrumbidgee and Coleambally Irrigation Areas and associated Districts.

The financial records of three crops grown under irrigation in 1962-63 are drawn upon together with more detailed records of six crops grown in 1963-64. All nine crops were situated within a 120-mile radius of Leeton, a town in the Murrumbidgee Irrigation Area of New South Wales.

It should be pointed out that 1962-63 was the first year of substantial commercial cotton growing in this area. Only one of the three growers had had any experience with the crop prior to this year. Four of the six growers in 1963-64 could be classed as relatively experienced growers.

The effect of the bounty on net returns to management and land for the nine crops is examined and, with the aid of labour records kept by the six co-operating growers in 1963-64, the average labour requirements per month and per operation are presented. The relationship between the size of crop grown and the total costs per acre is established using estimates of machinery combinations and of expected cost levels in the future, with a view to determining if cotton growing in this area of the state is feasible in the absence of the Commonwealth Government bounty. The direct costs and revenue of other crops which can be grown in the area are also presented for purposes of comparison.

Another aspect studied is the costs of operating cotton pickers in relation to the ruling contract rates using information supplied by growers. Finally, the possibility of introducing cotton on large area irrigation farms in the Murrumbidgee and Coleambally Irrigation Areas of New South Wales is examined.

3. COTTON COSTS AND REVENUE IN THE AREA

Selection of Growers and Data Collection

To obtain the required information on costs and revenue for crops grown in 1962-63, approaches were made to all growers in the area subsequent to the picking of the crop. It was not possible to arrange for detailed records to be kept for this crop as the study was not commenced until early in 1963 which was midway through the growing season. Of the growers interviewed at this stage only three were able to adequately supply the required information.

Prior to preparations for the planting of the 1963-64 crop, nine growers were approached to seek their assistance in keeping detailed records of cotton production on prepared record sheets which were supplied to them in booklet form. Six of these were completed sufficiently well to enable the analyses which follow later in the article to be performed. The study therefore does not purport to be of a random sample of cotton growers in the south-western region of the State. Indeed at this early stage in the development of the industry in this area it is more desirable to acquire as many details about cotton growing from as many growers as possible so that a clear picture of the likely future trends can be painted.

The booklet in which growers kept their records consisted of two sections, one to enter a labour and tractor record and the other for the rates at which material inputs were applied. For the former the record was broken up into the various operations such as ploughing, grading, watering, planting, with provision made for entering details each day. The material input record was constructed in a similar manner, with division into categories such as fertilizer application, insecticide sprays, defoliant, weedicide sprays and provision for the date, the rates per acre and the acreage treated.

This system was found satisfactory and has the advantage that operations are classified for the analyser, with a resultant saving of time. It was preferred to a simple daily diary system as it readily shows the requirements for various operations as well as the total for the whole year.

Crop Details

Before presenting the financial details of the crops grown in this area the individual crop details need to be explained. Table 1 contains these characteristics for the three crops in 1962-63 and Table 2 for those in 1963-64.

Soils

The nine crops were grown on a wide variety of soil types and in paddocks with vastly different histories. It is difficult to discern whether

there is a relationship between soil type and yields, as the most significant variable is probably the ability and experience of the grower. However it does appear the loam soils generally yielded reasonable crops, whereas the heavier types were not as productive. This cannot of course be taken as a general indication of the best soils on which to grow cotton although the crop is said to be admirably suited to moderately fertile, deep loam and clay loam soils, possessing good structure and permeable sub-soils.

Varieties

Empire was the most commonly planted variety, with only one grower departing from this in planting Empire 289 for the production of pure seed. In the present season (1964-65) most growers have planted either Empire 289 or Delta-Pine Smoothleaf, the balance being Dixie King or Empire. Variety trials have been in progress for a number of years at the Department of Agriculture's Research Station at Yanco and to date it appears the most suitable varieties are Empire 289 and Delta-Pine Smoothleaf, followed by Empire. However, there is room for the development of varieties more suited to the area, with its relatively short season and marginal temperature regime during the spring months, where temperatures below 50°F. are likely to injure cotton seedlings. Basinski[2] states in this regard that: "It can only be concluded at this stage that while the temperature regime does not preclude cotton-growing, it presents problems which will have to be solved by evolving a suitable variety-method complex."

Cultural Details

The average quantity of water applied in 1962-63 to the three crops was 1.96 acre-feet, while in 1963-64 it was 1.50. In almost all cases a pre-irrigation was given prior to planting, followed by three irrigations in 1962-63, and from four to six in 1963-64.

Details of land preparation, planting and post-planting cultivations for the 1963-64 crops are contained in the section on labour requirements, whilst details of land preparations for 1962-63 crops are found in Table 1.

The average spraying routines for the farms studied were as follows:—

Spray	Average Number of Applications	
	1962-63	1963-64
D.D.T.	7	7
Endrin	4	5
Phosdrin	2	4

[2] J. J. Basinski, *Cotton Growing in Australia: An Agronomic Survey* (Commonwealth Scientific and Industrial Research Organization, 1963), P. 146.

TABLE 1

Individual Details of Cotton Crops Grown in 1962-63*

Item	Unit	Crop			
		1	2	3	Average of Three Farms
Area of Cotton Planted	acres	35	120	73	76·0
Yield of Lint per Sown Acre	lb. per acre	368	441	314	374
Yield of Cotton Seed per Sown Acre ..	lb. per acre	587	699	502	596
Variety Sown	..	Empire	Empire	Empire	..
Soil Type	..	Red Clay Loam	Black, self-mulching clay	Dark grey alluvial clay	..
Paddock History†	..	8IP-1.0	1B	5W	..
Land Preparation‡	..	3S-1D-2H-4G-1F-1D.R	1D-2S-2G-1F	1D-2G-3S	..
Spraying Details§	..	7DDT-6E-4P	9DDT-2E-1P	6DDT-4E	..
Average price received at Rail	pence per lb. of seed cotton	15.27	13.52	13.65	14.15
Water applied	acre-feet	2.08	1.80	2.0	1.96

* Many more details could be provided but these would occupy a full paper of their own, and for purposes of brevity are omitted.
† I.P. Improved Pasture, W—Wheat, O—Oats, B—Barley. Prefixes denote years.
‡ S—Scarifying, D—Disc Ploughing, H—Harrowing, G—Grading, F—Hilling or Furrowing, D.R.—" Precision " deep ripping of hills.
§ D.D.T.—Insecticide Spray, E—Endrin, P—Phosdrin, K—Kelthane, S—Sevin. D—Dieldrin.

TABLE 2

Individual Details of Cotton Crops Grown in 1963-64

Item	Unit	Crop							
		A	B	C	D	E	F	Average of Six Farms	Average for all Farms Served by ginnery.
Area of Cotton Planted ..	acres	60	130	150	53	275	84	125	139
Yield of Lint per sown acre	lb. per acre	464	336	212	146*	116†	574	308	223
Yield of Cotton Seed ..	lb. per acre	742	538	340	234	186	918	493	365
Variety Sown	....	Empire	Empire	Empire	Empire 289	Empire	Empire	....	....
Soil Type	....	Clay Loam	Mainly Red Loam	Sandy Loam	Black River Loam	Dark Grey Alluvial Clay	Red-Grey Loam	....	....
Paddock History‡	....	Virgin	3 0	Virgin	3NP—1F—1B —1P	7W	Virgin	....	....
Spraying Details—§ ..	....	8 DDT-3E-1P	7 DDT-3E-1P-1K	8 DDT-3E-3P-3S	9 DDT-7E-2P-2D	6 DDT-6E-1P	7 DDT-6E-3P	....	....
Average price Received for Cotton at Ginnery‖ ..	pence per lb. lint	48·72	49·20	46·56	56·74	48·44	50·51	50·02	48·15
Water Applied	Acre-feet	2·30	1·23	1·10	1·00	1·15	2·25	1·50	n.a.

* This was sown mainly for the production of pure seed at a rate of 15 lb. per acre which was extremely low due to an insufficient amount of seed available. This is one of the reasons for the low yield, the other being that it was planted about a month late.

† The apparent reason for the low yield was the heavy nature of the soil.

‡ NP—natural pasture. O—Oats. W—Wheat. F—Fallow. B—Barley. P—Peas. Prefixes denotes years.

§ See footnote § in Table 1.

‖ This includes returns from cotton seed and the cartage allowance.

In 1963-64 one grower applied a single spray of Kelthane, another applied three of Sevin and another put on two of Dieldrin. These were in addition to the above three sprays. All farms used boom sprays and usually combined ingredients resulting in about eight actual spraying operations.

Picking was done by mechanical pickers in all cases and the estimated costs of this for a number of crops are presented later in this article.

YIELDS, QUALITY AND PRICES

Yields averaged 374 lb. lint in 1962-63 and 308 lb. in 1963-64 for the crops studied. The average commercial yield of all the cotton grown in 1962-63 in the south-western part of the State was not available but in 1963-64 it was approximately 223 lb. of lint per acre from 1,700 harvested[3] acres.

The quality of the six 1963-64 cotton crops was quite variable, as shown in Table 3. The highest grade was Middling plus 1 1/32 in. and the lowest was Strict Low Middling Light Spotted 15/16 in. Forty-six per cent of the cotton was graded Middling, 44 per cent as Strict Low Middling and about ten per cent as Low Middling and Strict Low Middling Light Spotted. The comparable figures for the complete throughput at the Darlington Point Ginnery were:—

	per cent
Strict Middling	0.31
	per cent (approx.)
Middling	26
Strict Low Middling	50
Low Middling	22
Strict Low Middling (Light Spotted)	2

A breakdown into more grades is illustrated in Table 4, together with the actual proceeds from the sale of cotton to spinners in 1963-64, the bounty paid and the average total price paid to growers, excluding returns for seed and the cartage rebate. Comparison of the proportions in each grade shows that the six farms had a greater percentage in the Middling class than was the case with all cotton processed at the ginnery. The district average might therefore be expected to be slightly lower than those for the six farms studied.

Details of the prices, quality and yields of the three 1962-63 crops can be found in Table 5. Growers were paid on a seed cotton basis in this year whereas in 1963-64 prices were based on the yield of lint. There was a higher proportion of cotton in the Strict Middling and Strict Low Middling classes in 1962-63 compared to the crops in 1963-64. There was also less in the lower grades, indicating that the overall quality of the cotton did not improve in 1963-64.

[3] The areas and yields from experimental plots and crops which were eaten out by sheep have been excluded here. The total quantity of lint from commercial growers processed at the Ricegrowers Co-operative Mills ginnery at Darlington Point, New South Wales, was used to calculate average yield for the area. The fact that the industry is still in its infancy and the growers are relative newcomers to it probably accounts for the low yields to date. Indications are that the 1964-65 crops will generally yield better than those of the previous two years.

TABLE 3

Yields and Grades of Cotton—Six Crops 1963-64

(lb. Lint)

Grade	Crop						Total	Percentage of Total
	A	B	C	D	E	F		
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	
M + 1 1/32 in.	..	..	..	..	..	3,265	3,265	1·71
M + 1 in.	..	875	..	..	..	475	1,350	0·71
M 1 1/16 in.	475	..	..	..	400	..	875	0·46
M 1 1/32 in.	8,840	7,750	..	..	6,275	32,035	54,900	28·73
M 1 in.	3,590	22,600	..	..	..	1,805	27,995	14·65
S.L.M. + 1 1/16 in.	..	..	..	..	..	460	460	0·24
S.L.M. + 1 1/32 in.	2,330	1,940	410	..	4,865	3,370	12,915	6·76
S.L.M. + 1 in.	2,830	850	5,740	495	1,935	1,470	13,320	6·96
S.L.M. + 31/32 in.	..	..	1,960	..	..	..	1,960	1·03
S.L.M. 1 1/32	1,400	3,095	2,475	1,685	1,955	990	11,600	6·07
S.L.M. 1 in.	1,475	885	7,265	3,955	1,555	2,820	17,955	9·39
S.L.M. 31/32 in.	3,135	485	6,640	..	14,395	920	25,575	13·38
L.M. 1 in.	..	..	675	..	440	580	1,695	0·89
L.M. 31/32 in.	3,275	555	5,680	150	..	..	9,660	5·05
L.M. 15/16 in.	..	..	1,010	..	..	..	1,010	0·53
S.L.M. (light spot) 31/32 in.	470	3,660	..	..	..	..	4,130	2·16
S.L.M. (light spot) 15/16 in.	..	1,005	..	1,450	..	..	2,455	1·28
Total	27,820	43,700	31,855	7,735	31,820	48,190	191,120	100·00

TABLE 4

*Proceeds, Bounty and Average Total Prices of Raw Cotton (Lint) in 1963-64**

(Pence Per lb.)

Grade	Percentage of Ginned Cotton in each grade—Darlington Pt. Ginnery	Staple Length														
		1 1/16 in.			1 1/32 in.			1 in.			31/32 in.			15/16 in.		
		Proceeds	Bounty	Total Price	Proceeds	Bounty	Total Price	Proceeds	Bounty	Total Price	Proceeds	Bounty	Total Price	Proceeds	Bounty	Total Price
	Per cent	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence
Strict Middling	0·31	33·020	17·225	50·245	32·221	16·925	49·146	..	..	..	..	..	..	..	..	..
Middling Plus	2·22	..	..	..	32·318	16·650	48·968	31·638	16·325	47·963	..	..	..	..	..	..
Middling..	23·39	32·817	16·775	49·592	31·809	16·450	48·259	31·206	16·125	47·331	..	..	..	..	..	..
Strict Low Middling Plus	10·04	31·900	16·425	48·325	30·952	16·075	47·027	30·068	15·800	45·868	29·046	15·550	44·596	..	..	..
Strict Low Middling ..	40·40	..	..	..	29·813	15·800	45·613	29·636	15·525	45·161	28·310	15·275	43·585	27·701	15·000	42·701
Strict Low Middling (light spotted) ..	1·97	..	..	..	..	..	..	28·750	15·025	43·775	27·270	14·775	42·045	26·670	14·500	41·170
Low Middling ..	21·67	..	..	..	27·820	14·775	42·595	27·948	14·625	42·573	26·749	14·450	41·199	26·195	14·200	40·395
	100·00															

* The grades in this table are the range handled by the ginnery at Darlington Point. The prices exclude the return on seed and the cartage rebate allowed to growers.

In 1962-63 growers were paid under the *Cotton Bounty Act,* 1951-58, which guaranteed cotton producers a return of 14d. per lb. of seed cotton on all grades above Strict Good Ordinary. At this time all cotton was marketed through the Queensland Cotton Marketing Board, which sold to spinners at the Australian equivalent of world prices.[4] The Commonwealth bounty was paid to growers through the Board. The average price paid to the three growers for their cotton in 1962-63 was 14.15d. per lb. of seed cotton at their local rail sidings, net of ginning costs.

In the 1963-64 season growers operated under a different scheme, brought about by the introduction of a new system of guaranteed prices as set up in the *Raw Cotton Bounty Act,* 1964. This is to operate for a period of five years from January 1, 1964. A recent amendment has extended the Act to operate until February 28, 1969. The purpose of this was to cover the sale of ginned cotton from the 1967-68 crop which may not be sold till after December 31, 1968. Growers of cotton in 1968-69 will not be covered by the present Act.

The main difference between the *Raw Cotton Bounty Act* and the previous one is that the Commonwealth Government makes a bounty payment on each lb. of lint (ginned cotton) not lower than the grade Low Middling, and the higher the grade of cotton the larger is the bounty payable per lb. This now provides an incentive to grow higher quality cotton, whereas under the old system there was none.

The new guaranteed return is based on a *fixed bounty* which is paid at a rate of 16.125 pence per lb. for *raw* cotton of the grade Middling One Inch White, with appropriate premiums and discounts for other grades. This subsidy includes an allowance for freight and ginning expenses, formerly borne by the Commonwealth Government, but which will now be paid by the farmers themselves.

The prices at which lint is sold to Australian spinners is determined by the Liverpool "spot" price for Middling 1 inch White, as published in Liverpool each Friday. Cotton ginned during the previous week is sold on this basis. A scale of premiums and discounts for grades other than Middling One Inch White has been agreed between spinners, ginners and the Commonwealth Government.[5]

Financial Results

It was possible to obtain details of costs and revenue for all nine crops grown. However the 1963-64 records are probably a little more accurate than those for 1962-63 as they are based on day-to-day records kept by the growers, whereas the latter were derived from interviews towards the end of the season.

[4] For more details on this see: Bureau of Agricultural Economics, *Cotton Growing in Australia: An Economic Survey* (Canberra, 1963), pp. 9-13. The total payments made by the Board to growers for each grade and staple in 1962-63 can be found by adding 5.8d. to the prices shown in: Cotton Marketing Board, *Instructions to Growers: Season* 1963 (Brisbane, February, 1963), pp. 14-15.

[5] The scales of premiums and discounts for both the bounty and prices set for the sale of lint to spinners is contained in: Ricegrowers' Co-operative Mills Ltd., *Cotton for Profit in Southern and Western New South Wales* (Leeton, April, 1964), pp. 10-12.

TABLE 5

Prices, Grades and Yields of Seed Cotton—Three Crops 1962-63

Grade	Prices Paid per lb. Seed Cotton			Quantities of Seed Cotton in Each Grade			Total	Percentage of Total
	Proceeds	Bounty	Total Price	Crops 1	Crops 2	Crops 3		
	pence	pence	pence	lb.	lb.	lb.	lb.	per cent
Strict Middling 3+	8·92	6·93	15·85	11,148	19,567	....	30,715	11·6
Middling 3+	8·67	6·93	15·60	11,247	....	....	11,247	4·2
Middling 3	8·37	6·93	15·30	2,592	....	....	2,592	0·9
Middling 2+	8·32	6·93	15·25	....	....	14,024	14,024	5·2
Strict Low Middling 3	7·67	6·93	14·60	11,852	18,005	7	29,864	11·3
Strict Low Middling 2+	6·32	6·93	13·25	....	73,124	54,829	127,953	48·1
Strict Low Middling (light spot) 3	7·27	6·93	14·20	1,787	....	....	1,787	0·6
Low Middling 3	5·67	6·93	12·60	....	48,209	....	48,209	18·1
Total	....	....	....	38,626	158,905	68,860	266,391	100·0

Costs

The average "direct" costs in 1962-63 were £27.36 per acre, the average overhead costs £17.85 and the average total costs £45.21, all of which are shown in Table 6. These compare with the 1963-64 figures of £44.67, £9.83 and £54.50 respectively, as shown in Table 7. The reason for the relatively large difference in "direct" costs between the two years appears to be in increased use of fertilizers, (mainly nitrogenous) and the introduction of a deduction for ginning costs from growers returns in 1963-64. Under the former legislation the Commonwealth Government paid all ginning costs but the 1964 Act did away with this and included a contribution towards ginning costs in the bounty in its stead.

Overhead costs, made up of depreciation and interest on specialized cotton equipment, were lower in the second year, mainly due to the larger crops grown with a consequent lowering of these overheads per acre. Depreciation was charged at 10 per cent and interest at 6 per cent on the average value of cotton equipment.

Overall, the average total costs in 1963-64 showed about a £9 per acre increase over those in 1962-63. However, this may be a result of a larger proportion of higher cost farms among the six 1963-64 crops compared to 1962-63. The difference in costs therefore may be largely explained by this and not reflect a positive increase in the costs of growing cotton in 1963-64 over 1962-63.

Total cost per lb. of lint is the significant factor in determining the net return to management and land in cotton growing. Large per acre costs are of little consequence if they are accompanied by proportionately large yields as cotton is a crop that requires high per acre production costs in order to derive satisfactory returns. The average cost per lb. of lint produced from the three crops in 1962-63 was 29.01d. The six crops in 1963-64 averaged 42.47d. per lb. of lint, a difference of 13.46d. over the previous year, due to a lower average yield together with higher per acre costs. If growing costs remain at their present level, yields will have to be substantially increased for growers to achieve lower costs per lb. of lint. The extent to which they can do this will largely determine their ability to compete with other areas in the production of remunerative crops of cotton.

Revenue and Effect of the Bounty

As a result of the large variation in both yields and quality of crops, there was wide disparity in gross revenue per acre between farms. The highest of the nine crops was crop F with a total gross revenue of £120.72 per acre and the lowest was crop E with £23.32. However the average gross revenue of the six 1963-64 crops was very close to that of the three 1962-63 crops, the former being £64.60 per acre and the latter £66.15.

The net returns to management and land which are labelled as the "margin" are shown in Tables 8 and 9 for the nine crops. In 1962-63 all three crops had positive "margins" over their "direct" costs of production and the average was £20.94 per acre. In 1963-64 only three of the six

TABLE 6

Costs Per Sown Acre—1962-63 *Cotton Crops**

Items	Crop			Average of the Three Farms	
	1	2	3	Costs	Percentage of Total Cost
	£	£	£	£	per cent
" *Direct* " *Costs*—					
Seed	1·05	1·10	0.90	1·02	2·26
Fertilizer	0·55	1·95	1·70	1·40	3·10
Fuel, Oil, Grease	3·15	1·40	1·25	1·93	4·27
Water	1·55	1·80	0·80	1·38	3·05
Insecticide Materials	9·75	4·90	4·45	6·70	14·82
Repairs and Maintenance	1·50	1·20	0·50	1·07	2·37
Labour	9·15	12·20	8·95	10·10	22·34
Cartage	1·25	0·20	1·30	0·92	2·03
Defoliant	....	1·30	0·75	0·67	1·48
Miscellaneous	2·10	3·90	0·50	2·17	4·80
Total " Direct " Costs	30·05	29·95	22·10	27·36	60·52
Overhead Costs—					
Depreciation	17·70	7·00	16·80	13·83	30·59
Interest	5·25	2·12	4·67	4·02	8·89
Total Overhead Costs	22·95	9·12	21·47	17·85	39·48
Total Costs	53·00	39·07	43·57	45·21	100·00
Total Costs per lb. of Lint	34·57d.	21·26d.	33·30d.	29·01d.	....

* Overhead costs such as rent, rates, depreciation and interest on other farm equipment used on cotton have been excluded.

TABLE 7

*Costs Per Sown Acre—1963-64 Cotton Crops**

Items	Crop						Average of the Six Farms	
	A	B	C	D	E	F	Costs	Percentage of Total Cost
	£	£	£	£	£	£	£	per cent
"Direct" Costs—								
Seed	0·75	1·08	1·53	0·65	1·04	1·36	1·07	1·96
Fertilizer	6·65	3·20	5·04	2·55	1·43	7·22	4·35	7·98
Fuel, Oil and Grease	2·00	2·00	3·79	1·60	1·72	1·46	2·10	3·85
Water	2·30	0·98	1·44	1·00	0·93	1·80	1·41	2·59
Insecticide Materials	4·05	5·82	7·18	5·90	6·10	7·00	6·01	11·03
Repairs and Maintenance	2·00	1·64	1·04	1·45	2·04	0·71	1·48	2·72
Labour	6·50	5·20	15·87	6·65	6·39	8·90	8·25	15·14
Contract Harvesting	..	..	..	7·30	..	..	1·22	2·24
Ginning Charges	23·18	16·80	10·61	7·29	5·78	28·70	15·39	28·24
Cartage	1·50	0·13	1·10	0·46	0·07	1·28	0·76	1·39
Defoliant	0·80	..	..	0·80	0·07	..	0·28	0·51
Miscellaneous	0·50	0·23	1·86	0·50	0·22	2·80	1·02	1·87
Supervision	..	..	8·00†	..	..	..	1·33	2·44
Total "Direct" Costs	50·23	37·08	57·46	36·15	25·79	61·23	44·67	81·96
Overhead Costs‡—								
Depreciation	13·00	3·56	5·84	4·54	4·21	14·00	7·53	13·82
Interest	3·90	1·10	2·06	1·36	1·22	4·19	2·30	4·22
Total Overhead Costs	16·90	4·66	7·90	5·90	5·43	18·19	9·83	18·04
Total Costs	67·13	41·74	65·36	42·05	31·22	79·42	54·50	100·00
Total Costs per lb. of Lint	34·72d.	29·67d.	73·94d.	69·12d.	64·59d.	33·20d.	42·47d.	..

* See footnote under same symbol in Table 6.

† A cotton specialist was employed for part of the year on this crop.

‡ In many cases cotton machinery was borrowed and occasionally firms lent them to growers for testing. Where this has occurred the value of the item has been included in the growers plant for calculating depreciation and interest. The exception is crop C where a contract charge is used for picking instead of allowing for a picker in the plant.

crops managed to cover "direct" costs, resulting in an average "margin" of £10.10 per acre. This poorer result was due to two factors, namely:

(i) higher "direct" costs due largely to increased fertilizer use and the introduction of ginning costs;

(ii) lower gross revenue as a result of reduced yields, an increased amount of lower grade cotton and reduction of the bounty.

The bounty represented approximately 50 per cent of gross revenue in 1962-63, whereas in 1963-64 it fell to 31 per cent as a result of the new system of payment introduced by the Commonwealth Government. In the absence of the bounty all three crops in 1962-63 would have incurred a loss ranging from £17.14 to £2.69 per acre, the average loss being £11.48. Much the same picture would have been painted in 1963-64 without the bounty. Only two crops, B and F, would have covered costs and even then there would have been only a small residual to provide an adequate return to management and land. The overall position would have been much worse as the average "margin" for the six crops works out at minus £10.29 per acre without the bounty.

This illustrates the industry's present dependence on the bounty for its success. Yields and quality can be expected to improve over and above present levels and this may well enable the establishment of a viable industry in this part of the State, capable of competing on the free market without Government assistance. The extent to which yields will have to increase to achieve this viability is estimated in a later section of this article using projected average cost curves related to size.

4. LABOUR REQUIREMENTS

Cotton is a labour intensive crop requiring at least 10 months of attention from the time land preparation commences around August until picking is completed, normally around the end of May. As a result of the particularly wet late-autumn and winter in 1963 picking was not completed in some cases until September, which meant work on the 1962-63 crops was spread over 15 months. Labour requirements are of course higher in some months than others, as shown in Table 10.

October was the busiest month in 1963-64 which was when most of the cotton was planted. September, January and November were the next busiest but the labour used in each of these months was about 70 per cent of that for October. The spread of labour requirements is best illustrated by reference to Figure 1 which is derived from Table 10 and shows the average for the six farms by months.

If we assume the amount of cotton one man can handle is determined by the maximum working time available in the busiest month (October), the figure arrived at, using Table 10, is approximately 100 acres. This is calculated in the following manner:—

Number of days in October	31
Less average number of days lost through rainfall in excess of 30 points[6]	7
Gives days available for work	24

[6] This was estimated by tabulating the number of wet periods with rainfall in excess of 30 points at Leeton since 1953, and assigning a one day loss for falls of 30-40 points, two days for 40-50, three for 50-80, five for 80-150 and eight days for falls in excess of 150 points.

TABLE 8

Revenue Per Crop—1962-63

(£'*s per acre*)

Item	Crop			Average of Three Crops
	1	2	3	
	£	£	£	£
Proceeds from Seed Cotton	38·39	36·38	26·43	33·73
Bounty	31·84	38·21	27·22	32·42
Total Gross Revenue	70·23	74·59	53·65	66·15
Less—				
Total Costs	53·00	39·07	43·57	45·21
Gives—				
" Margin " (net return to management and land)	17·23	35·52	10·08	20·94
Bounty as percentage of Total Gross Revenue	45·34%	51·23%	50·74%	49·10%
" Margin " in absence of Bounty	— 14·61	— 2·69	— 17·14	— 11·48

TABLE 9

Revenue Per Crop—1963-64

(£'*s per acre*)

Item	Crop						
	A	B	C	D	E	F	Average of Six Crops
	£	£	£	£	£	£	£
Proceeds from Lint*	58·37	42·90	25·46	17·69	14·32	75·11	38·97
Bounty	30·59	22·36	13·54	9·36	7·57	38·94	20·39
Seed†	4·96	3·60	2·28	11·68	1·23	6·14	4·98
Cartage Rebate	0·41	0·28	0·03	0·16	0·20	0·53	0·26
Total Gross Revenue	94·33	69·14	41·31	38·89	23·32	120·72	64·60
Less—							
Total Costs	67·13	41·74	65·36	42·05	31·22	79·42	54·50
Gives—							
"Margin" (or net return to management and land)	27·20	27·40	— 24·05	— 3·16	— 7·90	41·30	10·10
Bounty as a percentage of Total Gross Revenue	32·4%	32·3%	32·7%	24·1%	32·4%	32·2%	31·0%
" Margin " in absence of the bounty	— 3·39	5·04	— 37·59	— 12·52	— 15·47	2·36	— 10·29

* Before Ginning costs are taken out.
† Estimated to be £15 per ton for all farms except D who grew pure seed at an estimated price of 12.0d. per lb.

Assuming a 10 hour working day:

Man-hours available for work in October ..	240
October labour requirements per acre	2.39
Maximum number of acres that can be handled by one man .. .. (assuming normal labour efficiency)	100

As growers become more efficient this figure can be expected to increase Furthermore individual growers with above average efficiency may well be able to handle more than 100 acres as the labour figure was calculated from the average of six crops. Farms A and B for instance could have handled 138 and 152 acres respectively using one man. It appears from this that about 150 acres is the absolute limit for one man.

Total labour required for the crops ranged from 10.42 man-hours per acre for crop B to 36.22 for C. Due to a number of circumstances the latter figure was exceptionally high and it is perhaps not a good indication of the likely future trends. For this reason no account was taken of the labour requirements of crop C in the cost projections presented later in the article. The average for the six crops was 16.58 man-hours per acre, which is about 2 man-days.

The average number of operations for crops A, B, D, E and F in 1963-64 to the nearest whole number were as follows:—

	Number of Times
Ploughing and Discing	3
Scarifying	2
Grading	2
Hilling or Furrowing	2
Watering	5
Planting	1
Fertilizing	2
Inter-row Cultivation	3
Spraying	8
Picking	2

No details of individual operations were available for Crop C. Table 11 shows the labour and tractor record for the above five crops by operations. Picking was by far the most labour intensive operation, requiring 1.14 man-hours per acre for each pick on the average. Generally the first pick took longer than the second as most of the cotton is taken off at this stage.

One farmer practised "precision" ripping along the hills before planting and the relevant details for this were:—

Man-hours per operation per acre	0.30
Tractor-hours per operation per acre	0.27

TABLE 10

Labour Utilization—Six Crops in 1963-64*

(Man-hours per acre)

Farm	1963											1964									
	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Total
A	0·26	0·93	..	..	..	..	..	0·08	1·88	1·75	1·18	1·30	1·30	0·76	0·20	1·66	..	1·66	..	..	12·96
B	..	..	..	..	..	..	1·12	1·71	0·34	0·72	1·41	1·47	1·05	0·15	0·45	1·08	0·46	0·46	..	..	10·42
C	..	..	..	..	..	..	3·49	3·45	4·95	3·79	1·58	1·69	3·16	1·50	1·40	2·08	1·49	2·02	2·81	2·81	36·22
D	..	..	..	..	..	..	..	2·13	2·78	1·89	1·20	2·68	1·43	0·38	0·15	0·30	1·02	..	0·45	..	14·41
E	..	..	..	..	..	..	..	1·18	2·87	1·54	1·20	1·28	1·03	0·27	0·05	0·35	0·37	0·09	0·44	..	10·67
F	..	..	..	..	..	..	1·58	2·03	1·57	0·86	1·26	2·19	1·81	0·65	..	1·88	1·01	..	..	..	14·84
Average	0·04	0·15	..	..	..	..	1·03	1·76	2·39	1·75	1·30	1·76	1·63	0·61	0·37	1·22	0·72	0·70	0·61	0·46	16·58

* This includes the owner-operator's labour used in direct production operations.

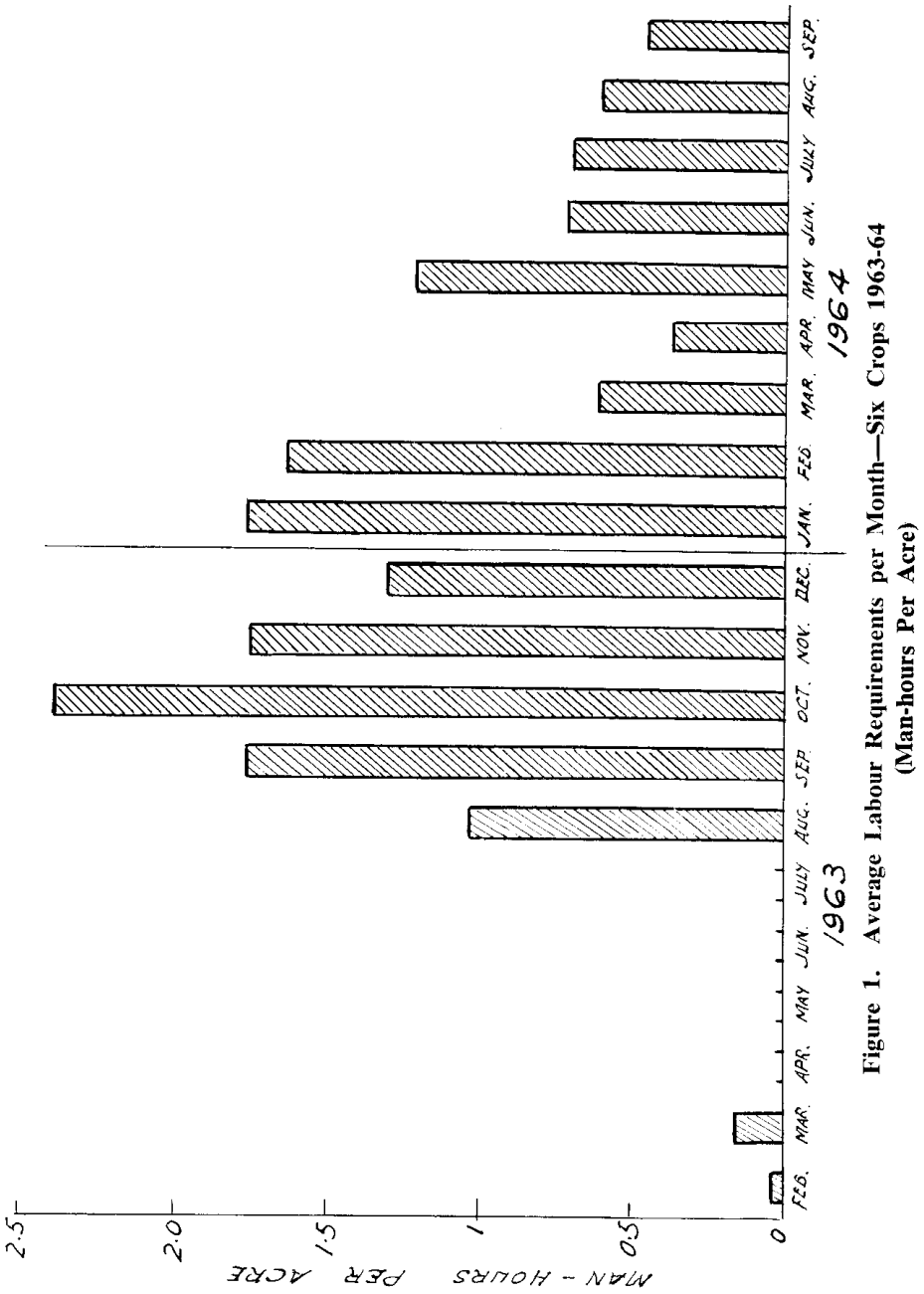

Figure 1. Average Labour Requirements per Month—Six Crops 1963-64 (Man-hours Per Acre)

This is only carried out normally in very hard clay soils to allow the tap root of the cotton plant to penetrate to a sufficient depth.

5. COSTS OF COTTON PICKING

Information was available on the costs of mechanical picking for crops A, B, D and E in 1963-64. Although the four pickers used were of different makes and the costs of picking vary because of this and with the yields, operator and lay-out, some indications of picking costs can be gleaned from the details obtained.

TABLE 11

Labour and Tractor Utilization per Unit Operation—Five Crops 1963-64*

Crop	Ploughing and Discing		Scarifying and Harrowing		Grading		Hilling or Furrowing		Watering	Fertilizing		Planting		Inter-row Cultivation		Spraying		Picking	
	Man-Hours per acre	Tractor Hours per acre	Man-Hours per acre	Tractor Hours per acre	Man-Hours per acre	Tractor Hours per acre	Man-Hours per acre	Tractor Hours per acre	Man-Hours per acre	Man-Hours per acre	Tractor Hours per acre	Man-Hours per acre	Tractor Hours per acre	Man-Hours per acre	Tractor Hours per acre	Man-Hours per acre	Tractor Hours per acre	Man-Hours per acre	Tractor Hours per acre
A	0·27	0·25	0·50	0·45	0·55	0·46	0·30	0·20	0·50	0·42	0·34	0·40	0·33	Done with Spraying		0·28	0·24	1·67	1·34
B	0·35	0·33	0·48	0·42	0·22	0·19	0·24	0·21	0·49	0·33	0·26	0·32	0·27	0·21	0·43	0·13	0·11	1·15	1·01
D†	0·83	0·76	0·92	0·81	0·47	0·41	0·70	0·60	0·86	Done with Furrowing		0·68	0·34	0·72	0·64	0·33	0·22	0·74	0·65
E	0·22	0·20	0·47	0·45	0·84	0·81	0·39	0·36	0·54			0·60	0·28	0·29	0·26	0·20	0·17	0·77‡	0·65
F	0·37	0·35	0·66	0·60	0·31	0·26	0·25	0·18	0·96	Done with Planting 0·29	0·23	0·45	0·40	0·20	0·18	0·27	0·18	1·35	0·93
Average	0·41	0·38	0·61	0·55	0·48	0·43	0·38	0·31	0·67	0·35	0·28	0·49	0·32	0·36	0·38	0·24	0·18	1·14	0·92

* Individual details for Crop C were not available.

† Crop D was grown by establishing the furrows between existing contour banks resulting in many short furrows involving more turns and hence time loss which accounts for the relatively high man and tractor-hours.

‡ Crop E was harvested with a two-row mechanical cotton picker. All others were harvested with a one-row picker.

Depreciation was charged at 10 per cent of the original value of the machine (excluding the prime mover where it can be used in other operations) and interest at six per cent of the average value of the machine over its life. Fuel, oil, grease and labour costs were obtained from the grower's records and repairs were as estimated by growers for the year. It is realized the repair costs so obtained are probably lower than the expected average over the life of the machine, however there are no accurate estimates of "average repairs" available for cotton pickers. The Queensland Cotton Marketing Board use a figure of £500 per annum for machines picking between 100 and 250 acres twice over per season, but it is felt this is a little high.[7]

Even allowing for the difference in pickers, it appears the variable costs of operation rise as yield per acre increases. This is illustrated in Table 12 and is what would be expected. Labour represents the largest item of variable or operating costs, details of which are to be found in Table 11. A charge of 12s. 0d. per hour was made for labour in the calculations and the estimates of picker costs would be significantly affected by any variation in this assumption.

TABLE 12
Costs of Mechanical Picking—1963-64

Item	Unit	Picker			
		A	B	D	E
Yield per acre	lb. lint	464	336	146	116
Number of Picks ..	..	2	2	2	1·5
Machinery New Value (Picker Unit Only) ..	£ (Total)	3,400	2,120	3,400	7,200*
Machine Type ..	..	Single-row high drum	Single-row low drum	Single-row high drum	Two-row low drum
Fixed Costs					
Depreciation	£'s (Total)	340	212	340	720
Interest	,,	102	64	102	216
Total Fixed Costs ..	,,	442	276	442	936
Variable Costs					
Fuel	£'s per acre	0·62	0·58	0·23	0·19
Oil	,,	0·07	0·05	0·02	0·07
Grease	,,	0·22	0·17	0·07	0·02
Labour	,,	2·00	1·38	0·88	0·69
Repairs	,,	0·40	0·12	0·38	0·40
Total Variable Costs ..	,,	3·31	2·30	1·58	1·37

* This includes the prime-mover which cannot be used for any other operations apart from picking.

[7] Private communication from the Queensland Cotton Marketing Board.

Table 13 shows the estimated average total costs of operating each picker for areas of cotton up to 300 acres, picked twice. Average cost curves for pickers A and B are presented in Figure 2. It is felt these two are more representative of the likely costs of picking cotton in the future as pickers D and E operated in relatively low yielding crops. Also included in the graph are the estimated costs of contract picking per acre, based on the current rate in Queensland of 4d. per lb. of seed cotton. To the writer's knowledge no contractors operated in this area last year but they may become available for growers of small crops with an expansion in cotton acreage. The Ricegrower's Co-operative Mills Limited may well follow the lead of the Queensland Cotton Marketing Board at a later date and set up a machine hiring service to cater for the smaller grower.

The break-even point between the costs of a grower-owned and operated single-row picker of the type used on Crop A and that of hiring a contractor for a crop yielding 464 lb. of lint per acre, is about 20 acres according to Figure 2. For a crop yielding 336 lb. lint using picker B, it is also about 20 acres. This does not agree with the Bureau of Agricultural Economics' contention that in general, as yield per acre rises so the minimum acreage of cotton required to justify the purchase of a mechanical picker falls.[8]

It should be pointed out that no allowance has been made for field waste or grade loss in the costs of operating the pickers in this study. The Bureau of Agricultural Economics has estimated picker costs taking these into account and the break even points for crops with the above yields work out to be approximately 15 and 40 acres respectively.[9] One of the reasons for the large difference between the two estimates for the crop yielding 336 lb. lint per acre appears to lie in the different depreciation rates used. Although it is not explicitly stated it seems the Bureau used depreciation rates which varied with the amount of annual use, whereas a flat rate was used in the present study. A cost for the prime mover, based on the proportion of annual use in cotton picking was also included in the Bureau's calculations. This was not done here as in both cases the prime mover was required for other cotton work.

Another cause of disparity lies in the fact that the Bureau assumed variable picker costs per acre were constant for all yields, which may not be realistic. Pickers A and D in the present study were of a similar make and tend to refute this assumption.

6. PROJECTED AVERAGE COSTS RELATED TO SIZE, YIELD AND REVENUE

This section aims to establish the expected future costs of growing cotton as a *monoculture* in the south-western portion of the State, and the extent to which costs are affected by size and yields. An attempt is made to determine the level of yield required for gross revenue to break-even with projected costs, both in the presence and absence of the bounty.

[8] Bureau of Agricultural Economics, *op. cit.*, p. 347.

[9] *Ibid.*, p. 347.

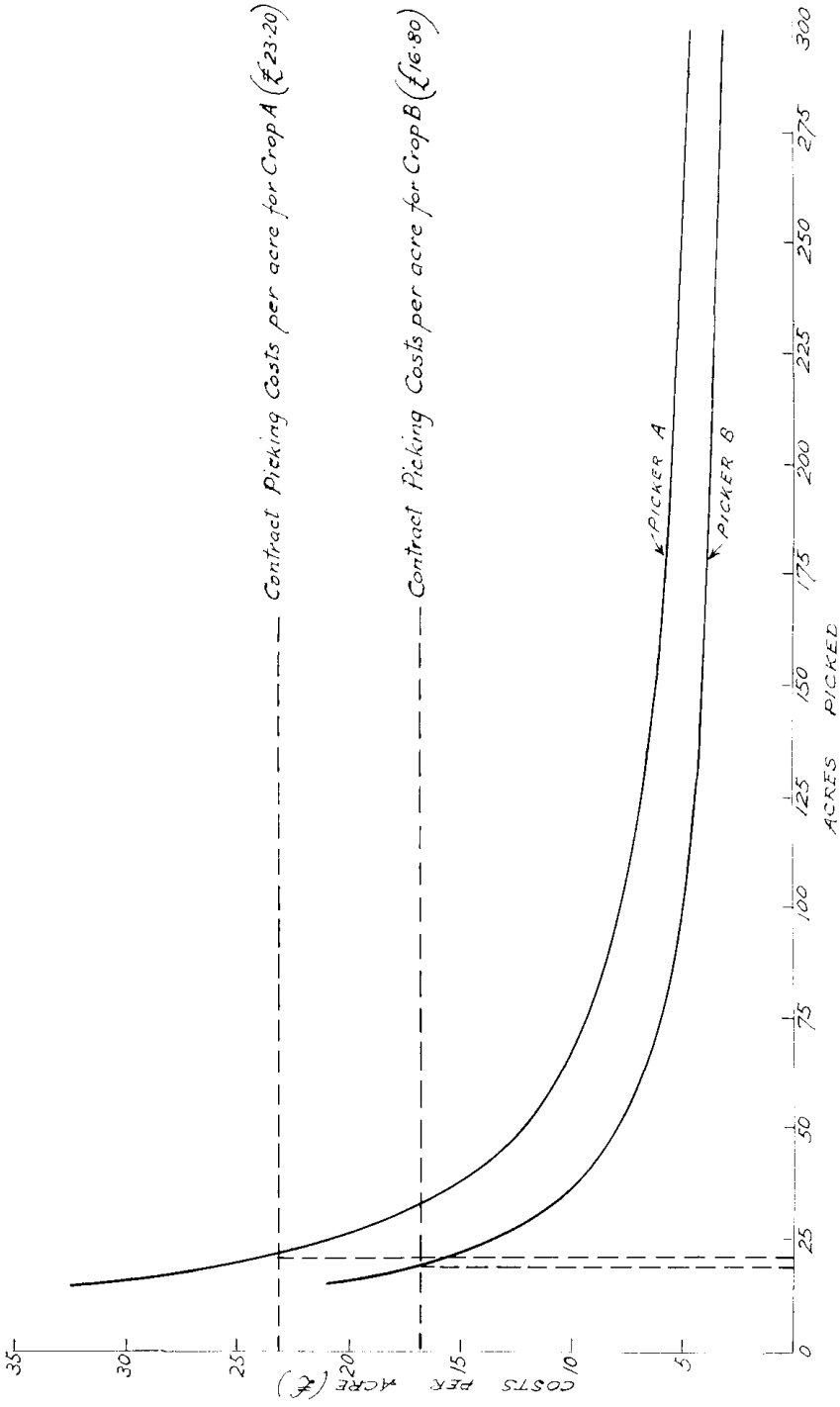

Figure 2. Average Total Cost Curves for Mechanical Cotton Picking

TABLE 13

Total Costs of Mechanical Picking per Acre—1963-64

Picker	Acres of Crop Picked												
	15	25	50	75	100	125	150	175	200	225	250	275	300
	£	£	£	£	£	£	£	£	£	£	£	£	£
A	32·78	20·99	12·15	9·20	7·73	6·85	6·26	5·84	5·52	5·27	5·08	4·92	4·78
B	20·70	13·34	7·82	5·98	5·06	4·51	4·14	3·88	3·68	3·53	3·40	3·30	3·22
D	31·05	19·26	10·42	7·47	6·00	5·12	4·53	4·11	3·79	3·54	3·35	3·19	3·05
E	63·77	38·81	20·09	13·85	10·73	8·86	7·61	6·72	6·05	5·53	5·11	4·77	4·49

Machinery was designated as the resource category which is fixed in the short-run and the combinations required for four acreage groups established. The least cost method of producing crops of various yields was then calculated using input information from the surveyed crops, modified where cost levels in the future are expected to vary. The capacity of each machine combination was determined by taking account of the equipment at present used by growers and the views of research personnel and machinery agents in the area.[10]

Individual growers may well be able to handle more than the specified acreages, although it is felt the assumptions are fairly representative of what can be expected in the future. Furthermore, where cotton is grown in conjunction with other enterprises as opposed to a monoculture, machinery overheads may be spread over more units of production hence lowering the costs of cotton production. This is particularly so for smaller acreages where additional cultivating and grading equipment may not have to be acquired to grow cotton.

Cost curves are compiled for areas of cotton up to 600 acres by dividing this into four acreage groups of 0-100, 100-200, 200-400 and 400-600 acres. This classification was chosen to correspond roughly with the estimated maximum acreage each equipment combination could handle. It was felt a set of two-row equipment could be used to a maximum of 100 acres and four-row units could handle up to 200 acres.

The yield levels considered are 300, 400, 500 and 667 lb. of lint per acre.

Cost Assumptions

"Direct" Costs Independent of Yield

There are a number of cost items coming under the heading of "direct" or production costs which can be considered as constant regardless of the yield of cotton. The assumptions regarding these are listed below for crops of up to 100 acres, using two-row equipment and employing a contractor to harvest the cotton:—

	Cost per Acre
	£
Seed: 30 lb. @ 10d. per lb.	1.25
Fertilizer:	
2½ cwt. Sulphate of Ammonia @ £1 14s. 4d. per cwt.	
2 cwt. Super @ 14s. 10d. per cwt.	5.77
Fuel, Oil, Grease: @ average in 1963-64	2.10
Water: 1.5 acre-feet @ £1	1.50
Insecticide Materials: @ average in 1963-64	6.01
Repairs and Maintenance	3.00

[10] A number of studies in the United States have been carried out along similar lines to this. For example see: Harold O. Carter and Gerald W. Dean, *Cost-Size Relationships for Cash Crop Farms in Imperial Valley, California* (California Agricultural Experiment Station, Giannini Foundation Research Report No. 253, May, 1962). An alternative technique for determining short and long-run average cost curves using the minimum cost methods of producing various levels of output can be found in: J. E. Faris and D. L. Armstrong, *Economies Associated with Size, Kern County Cash-Crop Farms* (California Agricultural Experiment Station, Giannini Foundation Research Report No. 269, December, 1963).

Labour:

3 ploughings @ 0.41 man-hours each	
2 scarifyings @ 0.61 man-hours each	
2 gradings @ 0.48 man-hours each	
2 hillings @ 0.76 man-hours each	
5 waterings @ 0.67 man-hours each	
1 planting @ 1.20 man-hours each	
1 fertilizing @ 0.84 man-hours each	
3 inter-row cult. @ 0.72 man-hours each	
8 sprayings @ 0.28 man-hours each	
Total 14.72 man-hours @ 12s. per hour	8.83
Defoliant: @ average in 1963-64	0.28
Miscellaneous: @ average in 1963-64	1.02
TOTAL	£29.76

The seed and fertilizer rates are the expected normal or average levels in the future, priced at farm in bags. Water is the average of that used on the six farms in 1963-64 and at the average price of £1 per acre-foot. Fuel, oil, grease, insecticide materials, defoliant and miscellaneous costs were also set at the average for the 1963-64 crops. The number of operations performed on the crop was determined by the average occurring in 1963-64 and the labour requirements for these were obtained from Table 11. Where row equipment was used in an operation, such as hilling, planting, fertilizing and inter-row cultivations, the average requirements from Table 11 were doubled to take account of the two-row equipment assumption for crops up to 100 acres in size. The figure for spraying requirements was taken from Crop A which used a four-row boom spray of the type specified for this acreage range. A basic repair cost of £3 per acre is assumed for all yields but where a grower-owned picker is used repair costs are increased accordingly. This is discussed in the next section.

For areas between 100 and 600 acres of cotton the only item which varies in the class of "yield independent" "direct" costs is labour, as a result of the introduction of four-row equipment. Consequently these costs are reduced by £2.10 per acre for 100 to 400 acres, as the labour requirements for hilling, planting, fertilizing and inter-row cultivation are all reduced by half and spraying by 0.08 man-hours per acre with the introduction of six-row boom sprays. Eight-row boom sprays reduce these costs by £2.29 per acre, for crops between 400 and 600 acres. Labour details for six-row boom sprays were taken from Crop E and eight-row equipment was assumed to take half the time of the four-row.

The total labour requirements up to picking were as follows:

	Man-Hours Per Acre
(i) 0-100 acres using two-row equipment	14.72
(ii) 100-400 acres using four-row equipment with six-row sprayer	11.22
(iii) 400-600 acres using four-row equipment with eight-row sprayer	10.90

Details of "yield independent" costs for the four acreage classes are to be found in Table 14.

"Direct" Costs Varying With Yield

As yield per acre increases so do the costs of fuel, repairs, maintenance and labour for the picking operation, as well as the costs of ginning and cartage to the ginnery.

For crops of up to 100 acres two methods of picking the cotton were considered, namely hiring a contractor and operating a grower-owned picker. Crops in excess of 100 acres were assumed to be picked by the latter method. Contract mechanical picking was charged at 4d. per lb. of seed cotton harvested, which is the established rate in Queensland. Although no facilities exist at present for growers to have their cotton picked by contract it was felt this alternative should still be considered as the situation may change in the future.

From crop details obtained for 1963-64 it was estimated that every increase in yield of 100 lb. of lint over the average yield of the six crops in 1963-64 (300 lb. approx.) increased picker operation by approximately 0.17 hours per acre. By assuming a fuel consumption of two gallons of diesel oil per hour at a cost of 2s. 4½d. per gallon, the additional cost of fuel for each additional 100 lb. of lint over the basic yield of 300 lb. was estimated to be £0.04 per acre. The total fuel cost of 300 lb. lint was assumed to be £2.10 per acre, which was the average of the six crops in 1963-64.

Repairs to pickers were assumed to increase by £0.34 for every 100 lb. lint over 300 lb., as a result of the greater throughput. The basic cost of all machinery repairs for a crop yield of 300 lb. was taken as £3.00 per acre which was included as an "independent" cost. This is about double the average repair bill in 1963-64, as most of the machinery was relatively new and repairs can be expected to increase with age.

Labour requirements for picking a crop yielding 300 lb. lint once were taken as the average of the five crops for which picking details were available in 1963-64. As shown in Table II this was 1.14 man-hours per unit operation per acre. The average requirement of crops A and B (1.41 man-hours per acre) was taken as that for crops yielding 400 lb. lint which meant an increase of 0.27 man-hours for every 100 lb. lint in excess of 300 lb. This was used to estimate labour costs for higher yielding crops. It was assumed the cotton was picked twice.

TABLE 14

"Direct" Costs Per Acre

Acres	Equipment Combination	Costs Independent of Yield	Costs That Vary with Yield			
			Yields of Lint per Acre			
			300 lb.	400 lb.	500 lb.	667 lb.
		£	£	£	£	£
0-100	I	29·76	24·78	33·05	41·30	55·08
0-100	II	29·76	11·13	15·08	19·01	25·58
100-400	III and IV	27·66	11·13	15·08	19·01	25·58
400-600	V	27·47	11·13	15·08	19·01	25·58

The charge for ginning in 1963-64 was 1s. 0d. per lb. lint, which is higher than the expected level when the ginnery is operating at full capacity. It is estimated the cost for ginning will be of the order of 7d. per lb. in the future and this has been used in the calculations.[11] As ginning is one of the major costs of cotton growing, any variation in charges will significantly affect the analysis which follows.

Cartage of cotton to the ginnery was charged at contract rates of £10 per load of four tons carted 30 miles.

A summary of all "direct" costs are to be found in Table 14. It should be emphasized that these costs are based on various assumptions, the most important of which is that cotton is grown as a monoculture, and individual growers may well perform differently. The most variable of these assumptions between farms are probably fertilizer, seed and cartage rates, followed by insecticide material costs, water application, labour costs and ginning charges.

Equipment Costs

Five equipment combinations were considered for the four acreage groups analysed. Two variations were included for crops of 0-100 acres in size, one with and one without a mechanical cotton picker. Two-row equipment was estimated to be practicable up to a maximum of 100 acres. Four-row equipment was used thereafter with a capacity of 200 acres per equipment combination.

The number and type of machinery items required for each acreage group is contained in Table 15 and the capital costs involved in purchasing these new are presented in Table 16. Capital costs may vary depending on the make preferred by individual growers. A typical make of equipment was used in all the cost projections so as to be consistent.

Annual overhead costs of all cotton equipment was computed using depreciation at 10 per cent of the present purchase price and charging interest at 6 per cent of the average value of the items over their life.

Total Costs

Having compiled the "direct" and overhead costs the total costs of growing cotton crops between 0 and 600 acres is shown in Table 17. The average total cost curves for growing crops yielding 300, 500 and 667 lb. of lint per acre as presented in the Table are shown in Figures 3, 4 and 5.

As can be seen from the Table the costs of using Equipment II (grower-owned picker and two-row equipment) on crops of up to 100 acres, is almost equal to the costs of using Equipment III (grower-owned picker and four-row equipment). For this reason the curve representing Equipment III has been drawn in instead of II for areas less than 100 acres until it intersects the curve for Equipment I.

The points at which it becomes more profitable to introduce either Equipment II or III in place of Equipment I, for crops up to 100 acres in size are as follows:

[11] See Ricegrower's Co-operative Mills Limited, *op. cit.*, p. 6

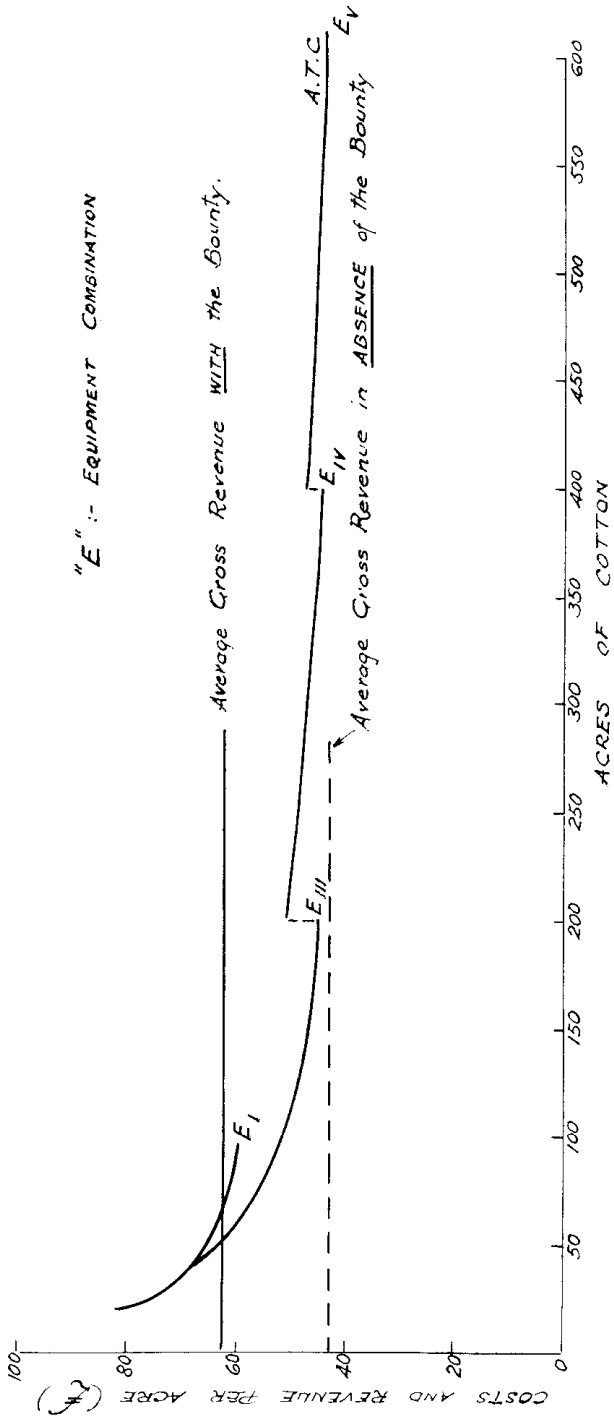

Figure 3. Projected Average Total Costs and Revenue for Cotton Yields of 300 lb. Lint Per Acre

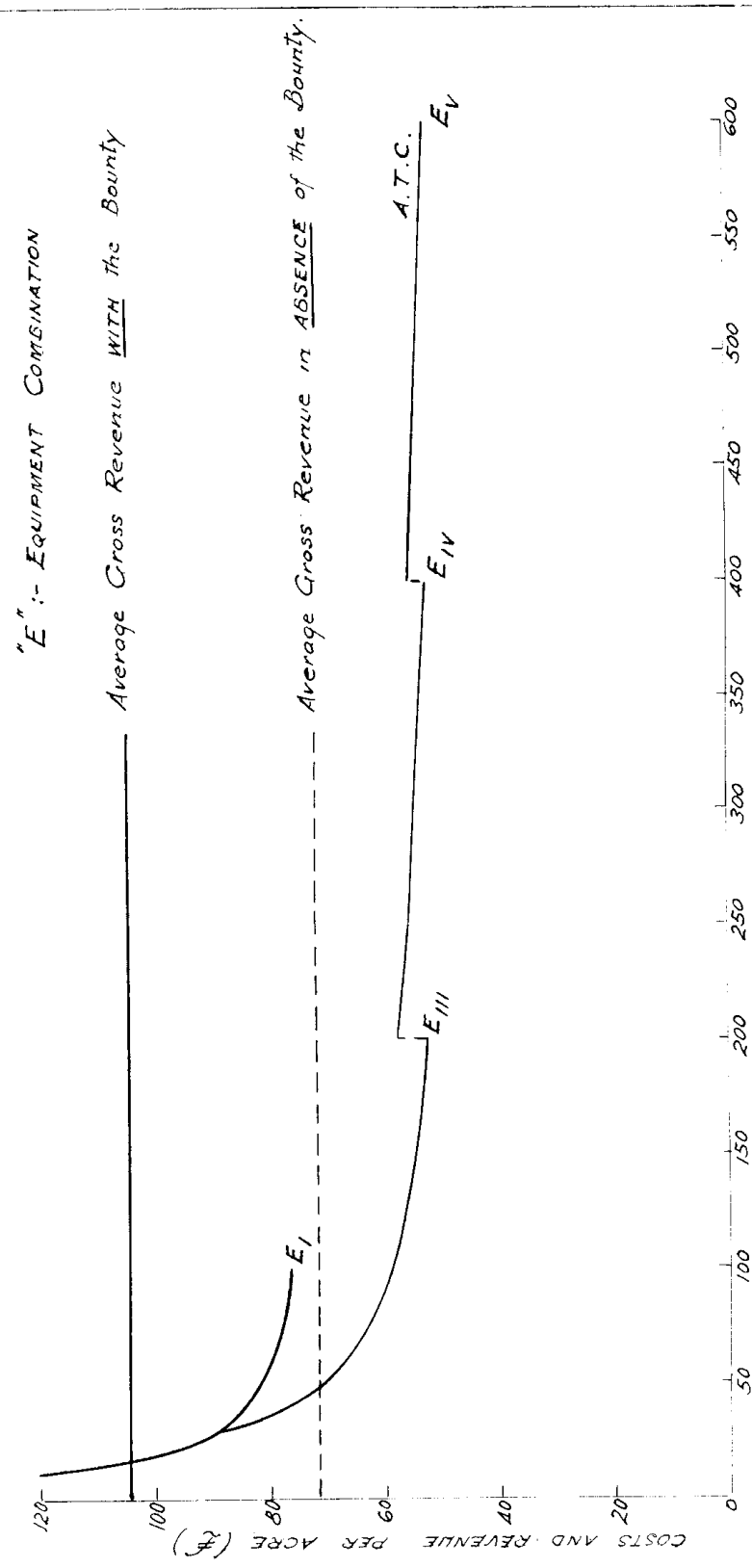

Figure 4. Projected Average Total Costs and Revenue for Cotton Yields of 500 lb. Lint Per Acre

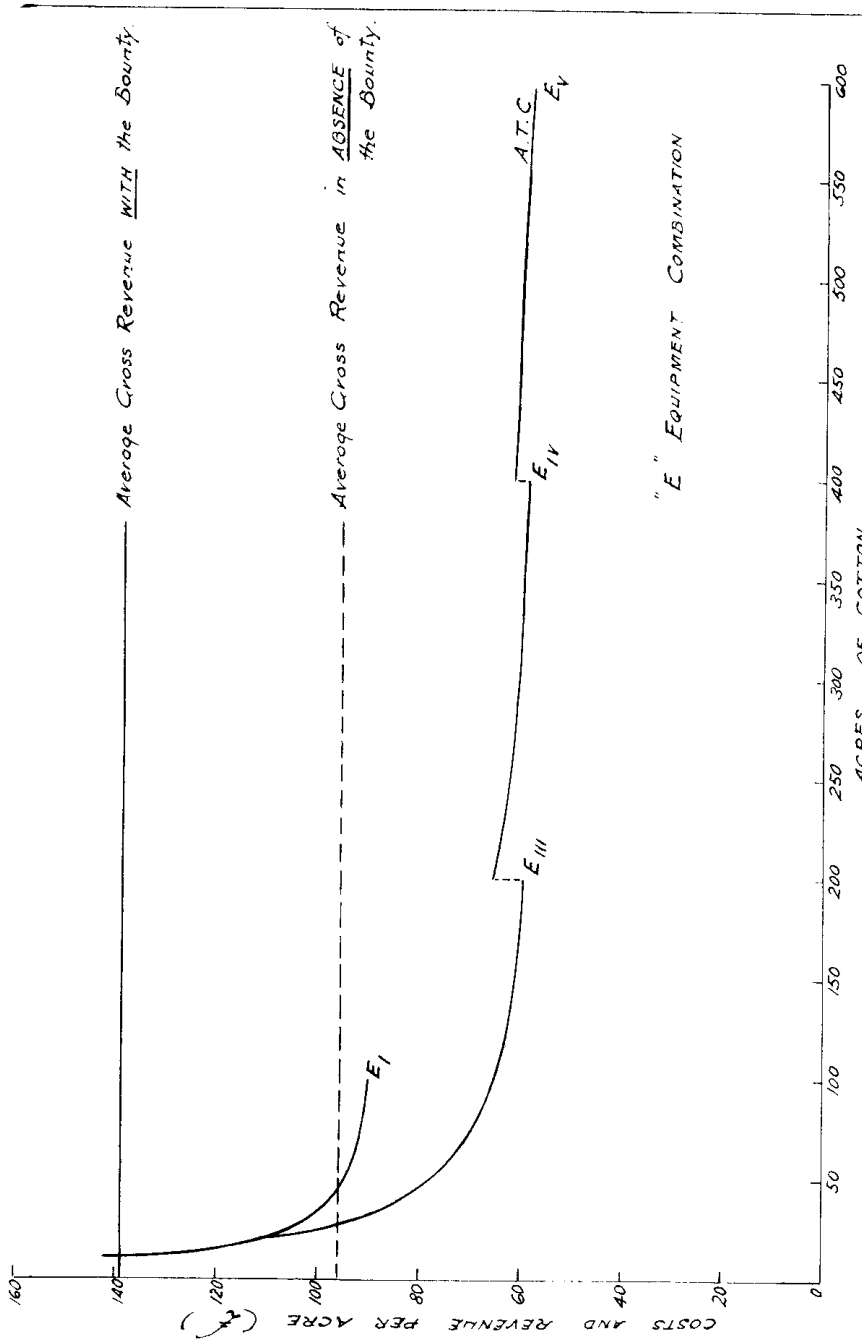

Figure 5. Projected Average Total Costs and Revenue for Cotton Yields of 667 lb. Lint Per Acre

TABLE 15

Equipment Required for Various Crop Sizes

Type of Equipment Required	Number Required			
	I* 0—100 Acres	III 100—200 Acres	IV 200—400 Acres	V 400—600 Acres
Tractor—55 B.H.P.	1	1	2	3
—second hand	..	..	1	1
Chisel Plough/Scarifier— 9 ft.	1	..	..	..
10 ft.	..	1	..	..
10 ft. 6 in.	..	..	2	3
Disc plough — 7 ft.	1	..	..	..
9 ft.	..	1	2	3
Land Leveller —auto 9 ft. × 23 ft.	1	..	..	..
—auto 9 ft. × 33 ft.	..	1	..	..
Land Plane —10 ft. × 60 ft.	..	..	1	2
Planter—single row, plus markers	2	4	8	12
Rear Toolbar & Shanks—Two-row	1	..	..	..
—Four-row	..	1	2	3
Fertilizer Units—Single Row, plus Mid-mounted Toolbar	2	4	8	12
Cultivators-mid-mounted—two-row	1	..	..	..
—four-row	..	1	2	3
Furrowers—Rear Mounted	3	5	10	15
Weeders—Rotary	4	8	16	24
—Knife	..	8	16	24
Gauge wheels—Set	..	1	2	3
Boom spray—Four-row	1	..	..	..
—Six-row	..	1	2	..
—Eight-row	..	..	..	2
Picker—Single-row, Low drum (Excluding Prime Mover)	..	1	2	3
Trailers—All Purpose	1	1	2	2

* Equipment II consists of all Equipment I plus a single-row mechanical cotton picker.

TABLE 16

Equipment Costs

Equipment	Equipment Costs for Various Crop Sizes			
	I* 0—100 Acres	III 100—200 Acres	IV 200—400 Acres	V 400—600 Acres
	£	£	£	£
Tractors	1,740	1,740	3,980	5,720
Chisel Ploughs/Scarifiers	400	430	920	1,290
Disc Ploughs	570	665	1,330	1,995
Graders or Levellers	406	486	910	1,800
Planters & Markers	240	480	960	1,440
Rear Toolbar	28	79	158	230
Fertilizer Units plus Mid-mounted Toolbar	80	160	320	480
Mid-mounted Cultivators	200	465	930	1,395
Furrowers	21	35	70	100
Weeders	80	188	376	558
Gauge Wheels	..	69	140	200
Boom Sprays	150	320	640	840
Pickers (excluding Prime Mover)	..	4,100	8,200	12,300
Trailers	50	50	100	100
Freight	50	70	110	140
TOTAL (less usual discount of 5 per cent. on multiple purchases)	4,015	9,337	18,187	27,159

* Equipment II consists of all Equipment I plus a Single-row Mechanical Cotton Picker, value £4,100. Total value of Equipment II is £8,115.

TABLE 17

Total Costs Per Acre at Various Yields

Acres of Cotton	Yield per Acre			
	300 lb.	400 lb.	500 lb.	667 lb.
	£	£	£	£
Using Equipment I				
20	80·64	88·91	97·16	110·94
40	67·59	75·86	84·11	97·89
60	63·24	71·51	79·76	93·54
80	61·07	69·34	77·59	91·37
100	59·76	68·03	76·28	90·06
Using Equipment II				
20	93·64	97·59	101·52	108·09
40	67·26	71·21	75·14	81·71
60	58·47	62·42	66·35	72·92
80	54·07	58·02	61·95	68·52
100	51·44	55·39	59·32	65·89
Using Equipment III				
20	99·49	103·44	107·37	113·94
40	69·14	73·09	77·02	83·59
60	59·02	62·97	66·84	73·47
80	53·97	57·92	61·85	68·42
100	50·93	54·88	58·81	65·38
120	48·91	52·86	56·79	63·36
140	47·46	51·41	55·34	61·91
160	46·38	50·33	54·26	60·83
180	45·53	49·48	53·41	59·98
200	44·86	48·81	52·74	59·31
Using Equipment IV				
200	50·61	54·56	58·49	65·06
240	48·64	52·59	56·52	63·09
280	47·23	51·18	55·11	61·68
320	46·18	50·13	54·06	60·63
360	45·36	49·31	53·24	59·81
400	44·70	48·65	52·58	59·15
Using Equipment V				
400	47·62	51·57	55·50	62·07
440	46·82	50·77	54·70	61·27
480	46·15	50·10	54·03	60·60
520	45·58	49·53	53·46	60·03
560	45·10	49·05	52·98	59·55
600	44·68	48·63	52·56	59·13

Crop Yield (lb. lint)	Break-even Point (acres)
300	40
500	30
667	20

The cost disadvantage in using Equipment I instead of II or III for areas in excess of these can be seen from the graphs.

Economies associated with size seem to disappear at around 200 acres. After this point there are only marginal economies to be gained by expansion of size. Ideally then, intending growers of cotton on a monocultural basis should aim at growing at least 200 acres per annum so as to derive maximum benefit from these size economies.

Revenue and Effect of the Bounty

In estimating the expected returns from the sale of lint to Australian spinners in the future, it is assumed that world parity prices (on which the above transactions are based) will remain the same as those reigning in 1963-64. The reason for this assumption is that the United States Department of Agriculture expects world cotton prices to rule steady at the existing moderate levels as a radical change in the relationship between world cotton consumption and production seems unlikely in the immediate future.[12] The average price at the ginnery to growers, including the bounty, is thus assumed to be 50.00d. per lb. of lint, which was the average price received by the six growers in 1963-64 and includes the cartage rebate and seed returns. This assumes the quality of cotton grown in this area will not improve, which may not in fact be the case. However any other estimate is largely a matter of conjecture. Should quality vastly improve in the future, the prices received from spinners should rise, as will the bounty payable on these higher grades. This would tend to lower the "break-even yields" which are calculated below.

In the absence of the Commonwealth Government bounty on cotton the average price received by the six growers in 1963-64 would have been 34.50 pence per lb. of lint. To gauge the effect of both this and a price of 50.00 pence per lb. of lint on the net returns to management and land, average gross revenue lines corresponding to each yield have been incorporated into Figures 3, 4 and 5. The details of these are shown in Table 18.

In the presence of the bounty Figure 3 illustrates that profitable cotton growing in south-western New South Wales is possible if yields of 300 lb. of lint per acre can be achieved, and providing areas of more than 50 acres

[12] *Financial Review*, January 7, 1965, p. 23.

are established. If areas of 200 acres or more are sown so as to derive maximum benefit from size economies, a "margin" of approximately £17 per acre can be expected. If yields of 500 lb. can be attained this could reach £51 per acre for crops of 200 acres with the present bounty in force and the break-even point between per acre costs and gross revenue would occur at 15 acres of cotton as shown in Figure 4. At yields of 667 lb. the "margin" would approach £80 per acre at 200 acres with a break-even point of 10 acres.

The position is somewhat different when the bounty is excluded from gross revenue as is also shown in the three diagrams. Payable crops would only be possible with yields of not less than 500 lb. of lint per acre, which is more than double the average yield of 223 lb. for all commercial crops in 1963-64. Only one of the nine crops studied exceeded 500 lb. The break-even point in this case would be 50 acres with a "margin" in the vicinity of £19 per acre for crops of 200 acres or more. Growers capable of achieving yields of 667 lb. lint per acre could expect a "margin" of approximately £35 per acre for crops of this size with 25 acres being the break-even point. Yields in excess of 667 lb. would certainly render the cotton growing industry in south-western New South Wales viable in the absence of the bounty, with world prices at their present levels.

In the long-term average yields in excess of 500 lb. will no doubt be attained commercially. Growers and research workers in the area confidently expect yields to approach 1,000 lb. in the not too distant future. With yields at this level cotton would certainly find a permanent place as a lucrative crop in the Irrigation Areas and Districts of south-western New South Wales.

TABLE 18

Projected Gross Revenue Per Acre

Yield of Lint Per Acre	Average Gross Revenue Per Acre	
	With the Bounty	In Absence of the Bounty
lb.	£	£
300	62·50	43·13
400	83·33	57·50
500	104·20	71·90
667	138·96	95·88

7. COTTON AS AN IRRIGATION CROP

Alternative Irrigation Crops

In irrigated areas such as those in south-western New South Wales there are a wide range of crops which can be grown profitably with far less labour and management than is required with cotton. In most cases these

can all be produced with the same equipment and do not require any specialized machinery as does cotton. Furthermore, returns are more certain with these crops due to the fact that they have been grown for many years and their agronomic requirements are well known. Varieties suitable to the area have been developed in a number of cases and most have an assured market outlook, at least in the medium-term.

The crops referred to here are rice, wheat, oats, barley and grain sorghum. Of late there has been an interest in oil crops, mainly safflower and linseed. Results with these in 1964-65 were quite variable, although for most growers it was their first attempt. Until more experience is gained with oil crops under irrigation it is difficult to say what part they will play in the future. A further disadvantage at present is the uncertain market situation for linseed and safflower.

It is in this framework that the cotton industry has to establish itself. In 1959 the comment was made that ". . . even when appropriate varieties are selected and developed, (for cotton) and appropriate cultivation methods determined, due consideration must be given to costs and returns relative to those of alternative forms of farm production".[13] This still applies, and perhaps with more weight in irrigation areas which have such a large number of alternatives available.

To give an idea of the "gross margins" of some crops which are grown in the Murrumbidgee and associated Irrigation Areas, including Coleambally, typical enterprise budgets have been prepared and are set out in the Appendix. It is emphasized that these budgets are by no means the result of exhaustive investigations but have been compiled after discussions with Departmental officers and selected farmers. They assume a degree of management slightly above the average and take account of likely agronomic changes in the near future. No account has been taken of overhead machinery costs as it is assumed these are fixed resources on a typical large-area irrigation farm. The "gross margin" differs from the "margin" computed throughout the article for cotton, in that no allowance is made for the annual overhead costs of equipment with the former. Labour has been included as a "direct" cost although on most large area farms it may have close to zero opportunity cost. The "gross margins" could therefore be below the true figure for the majority of farms.

The "gross margins" for linseed and safflower are those of the most successful growers in a survey of oil crops grown in 1964-65. The survey was conducted by forwarding a mail questionnaire to 29 growers. To date 18 of these have been returned.

The "gross margins" for cotton *with the bounty* can be estimated from Tables 14 and 18 for yields ranging from 300 to 667 lb. of lint per acre. These are presented below, together with those from a number of alternative irrigation crops from the Appendix and for cotton with a yield of 1,000 lb. It is assumed Equipment II is used in cotton:

[13] "Cotton Growing in New South Wales", *Trends,* Rural Bank of New South Wales, Vol. 4, No. 7 (March, 1959) p. 16.

	Gross Margin Per Acre
	£
Cotton (with bounty)—	
Yield 300 lb. lint per acre	21.61
Yield 400 lb. lint per acre	38.49
Yield 500 lb. lint per acre	55.43
Yield 667 lb. lint per acre	83.62
Yield 1,000 lb. lint per acre	139.78
Rice	40.55
Wheat	7.14
Oats	4.18
Malting Barley	4.75
Grain Sorghum	13.64
Linseed	30.55
Safflower	14.31

The cost of purchasing Equipment II to grow cotton is £8,115 and this can be used for areas up to 100 acres, which is probably close to the maximum that could be grown on a "large area" irrigation farm each year.[14] The approximate cost of the equipment required to set up for rice and cereals is £7,000. This includes a 12-foot Auto Header in addition to a tractor, scarifier, disc plough, grader, combine, harrows and a trailer.

If yields approached 400 lb. lint per acre the "gross margin" from cotton with the government bounty would be almost equal to that for rice with a yield of 2.5 tons per acre, which is the average yield for the M.I.A. On farms with higher yields of rice, such as those in the Coleambally Irrigation Area, cotton yields would need to be well above 400 lb. lint to compete with rice. The per cent gross margin per unit of annual overhead equipment costs for the above yields is 3.65 for cotton and 4.46 per cent for rice. This is a rough indication of the relative returns to investment in the two crops. The latter is underestimated to an extent, as the equipment can also be used in other enterprises. For yields of 500 lb. cotton lint the per cent gross margin per unit of annual overhead equipment costs is 5.25, at 667 lb. lint 7.93 per cent and at 1,000 lb. it is 13.25. We can conclude from this that for cotton to be a more profitable investment than rice in the presence of the bounty, yields of approximately 500 lb. lint per acre would be required. Until this is achieved and with rice prices at present levels and the cotton bounty in force, it is doubtful if cotton will ever replace rice as the main source of income on large-area farms in ricegrowing areas.

It is difficult to foresee the growing of cotton in conjunction with rice on a large scale as they are both summer growers and have peak labour requirements at similar times. There would also be problems with the establishment of suitable rotations where they are grown jointly on one farm.

[14] The cotton picker could handle up to 200 acres per annum. The limiting factor with Equipment II is the planting and cultivating machinery which is based on a two-row combination.

It appears linseed can be a profitable crop under ideal conditions and proper management. Gross margins of up to £30 per acre could be expected although, like cotton, the crop has shown variable results in the past and complete losses have been experienced in some cases. Cotton yields of just under 400 lb. would be required in the presence of the bounty to compete with linseed. In addition linseed and safflower can be grown without the purchase of additional machinery on most irrigation farms whereas cotton requires row crop equipment.

In the *absence of the bounty* the "gross margins" for cotton would be as follows:

	Gross Margin Per Acre £
Cotton (without bounty)—	
Yield 300 lb. lint per acre	2.24
Yield 400 lb. lint per acre	12.66
Yield 500 lb. lint per acre	23.13
Yield 667 lb. lint per acre	40.54
Yield 1,000 lb. lint per acre	75.20

To compete with rice in the absence of bounty assistance cotton yields in excess of 667 lb. lint would have to be attained. This is three times the average yield for south-western New South Wales in 1963-64. With yields of 1,000 lb. cotton would be far more profitable than rice. A good linseed crop would be more remunerative than cotton for yields up to approximately 600 lb. To compete with grain sorghum and safflower average yields would need to increase by about 200 per cent.

Wheat, oats and barley returns are at present very much lower than the expected income from cotton in the presence of the bounty. However this is not the case in the absence of the bounty, for yields of cotton up to about 400 lb. lint per acre. Even though these are winter crops they can be considered as competing with cotton for land as it is extremely difficult to sow these immediately after the cotton is harvested in autumn. There is insufficient time to slash the cotton stubble and adequately prepare a seed bed. It may be possible to sod-seed these crops into the slashed stubble as is done with rice, but the chances of success are remote.

This list of crops in the Appendix is by no means exhaustive. Crops such as soybeans, millet and maize have been grown under irrigation in the area covered by the study but results to date have been extremely variable and the seven crops mentioned in the appendix have been by far the most popular.

Problems of Rotation and Layout

As mentioned previously, the introduction of cotton into the existing programme of large area irrigation farms would present a number of technical problems. Firstly, the average size of farms in these areas is between 400-500 irrigable acres and at least 100 acres of cotton is desirable to justify the investment in equipment. This means that cotton would have to be grown at least twice on the one piece of ground to allow a suitable pasture phase on the balance of the farm.

Opinion is that this is feasible and it may even be possible to grow it continuously for three years. For farms intending to grow cotton in conjunction with rice there would be a consequent shortening of the rotation, even if cotton is grown for three years on the same ground, with a resultant decline in fertility, crop yields and carrying capacity.

The second problem arises from the contour layout which is characteristic of large-area farms. As cotton is sown in furrows it either has to be grown between existing contour banks or these have to be knocked down, thus allowing longer furrows. The former method results in a substantial loss of land in banks and short furrows requiring excessive turning when tractor operations are being performed. Farm D used this method and lost approximately 7 acres in banks and substantially more time was required for field operations as shown in Table 11. The removal and consequent reconstruction of the contour banks is an expensive business and can present a drainage problem as obstructions tend to occur where the old banks were situated and this makes watering difficult. The problem is made even more acute where there are serious "gilgai" formations in the soil, which is the case on newly developed areas such as Coleambally.

In view of the foregoing remarks cotton growing may not be suitable for large scale introduction into the programmes of large area irrigation farms. Growers may find it necessary to lease land outside their own farms to overcome these problems. In areas where farm size is not limited to the same extent as it is in the irrigation areas and where the contour layout is not widely practised the above problems should not be as acute.

8. CONCLUSION

The main conclusion which arises from the study is that, using fairly optimistic cost assumptions for growing cotton as a *monoculture*, and applying the level of prices ruling for the various grades of lint grown by the six farmers in 1963-64, profitable cotton growing in south-western New South Wales appears unlikely in the absence of the Commonwealth Government's bounty, for yields less than 500 lb. of lint per acre. This is equivalent to a yield of approximately 1,500 lb. of seed cotton. The district average for 1963-64 was 223 lb. of lint per acre which is less than half the above figure. It is therefore evident that many growers will need to vastly improve on present yield levels to expect to survive in the absence of the present bounty system, which is due to expire on February 28, 1969. There is of course every possibility that the bounty will not be completely abolished on this date.

Should the quality of cotton grown in future vastly improve over that grown in 1964, this "break-even" yield figure would be lowered accordingly, as the average prices paid for lint by spinners would probably increase. However predictions about the expected quality improvements are largely a matter of conjecture, although the introduction of new varieties would no doubt lead to some improvement. To the extent that this is true the above statements may require qualification.

With lint prices and the bounty steady at their present levels however, and again with reasonably optimistic cost assumptions, yields of at least 300 lb. of lint per acre (900 lb. of seed cotton) would be required before an adequate return to management and land is forthcoming.

This is probably attainable with the present varieties and know-how, but it may be several years before the district average reaches this level. It is possible that it may not be achieved within the life of the present bounty system, as the industry is still in its infancy in this area, with new growers entering each year and still a lot to be learnt about the crop and its requirements.

From the assumptions used in this study it appears that all economies associated with size are exhausted at around 200 acres. The main factor limiting further economies is that, after this, machinery requirements double and the only savings that accrue are the usual quantity discounts on machinery purchases. There does not seen to be any reduction in labour requirements per acre or per operation with larger areas. However until there are more growers in these larger size groups who are able to provide the required labour details, and pending the accummulation of more experience by growers, this latter question will remain largely unanswered.

The growers of the six crops in 1963-64 reported in the study would, collectively, have *lost* about £10 per acre in the absence of the bounty. The most efficient grower would receive a return of only £5 per acre to management and land ("*margin*") in this situation. This illustrates the industry's present dependence on Government assistance for its success. The average "margin" with the inclusion of the bounty in revenue for the six crops was just over £10 per acre.

With yields and revenue at present levels it would not pay to grow crops of less than 50 acres, and the use of four-row equipment plus a grower-owned and operated picker has a distinct cost advantage over two-row equipment with contract picking under these circumstances. Should yields of 500 lb. lint be achieved with the present bounty assistance, profitable cotton growing should be possible with a minimum of 15 acres using two-row equipment and contract picking. Four-row equipment with a grower-owned and operated picker would be more economical for areas in excess of 30 acres. For crops yielding 667 lb. lint the corresponding figures are 10 and 20 acres respectively.

Based on the labour utilization in 1963-64 for six crops, it appears the maximum area that can be adequately handled by one man is from 100 to 150 acres per annum. The busiest months in cotton growing are October, September, January and November, in that order, and the crop requires about two man-days of labour per acre per season.

For cotton to be a more profitable investment than rice in the irrigation areas of south-western New South Wales in the presence of the bounty, yields of approximately 500 lb. lint per acre would be required. In the absence of subsidized cotton prices, cotton yields in excess of 667 lb. would be necessary.

APPENDIX

Gross Margins for Alternative Irrigation Crops

1. Rice on Prepared Seed Bed.

Direct Costs Per Acre

	£
Seed: 140 lb. @ 3d. per lb.	1.75
Fertilizer: 1 cwt. sulphate of ammonia @ £1.72 cwt.	1.72
Water: 6 acre-ft. @ £1 per acre-ft.	6.00
Fuel, Oil and Grease: 3 cultivations, 3 gradings, 1 sowing, 1 spraying, 1 harvesting	1.32
Cartage: @ 15s. 0d. per ton to local shed	1.88
Labour: 1.41 man-days per acre @ £5 per day[15]	7.05
Insurance: @ £3 per cent on 2.5 tons @ £20 insurable value	1.50
Repairs: Tractor—2.3 hours @ 2s. 8d. per hour Header—@ 6s. 0d. per acre	0.60
Pest Control: Blood worm—16 oz. D.D.T. per acre @ 2d.	0.13
Weed Control: Barn yard grass—Stam F34 1 gall. per acre @ £7 Algae—4 lb. Bluestone @ 2s. 6d.	7.50
Total "direct" costs	£29.45

Gross Revenue Per Acre

	£
2.5 tons @ £28 per ton	70.00
Total gross revenue	£70.00
Gross margin per acre	£40.55

2. Wheat on Prepared Seed Bed

Direct Costs Per Acre

	£
Seed: 70 lb. @ £1 per bushel	1.16
Fertilizer: 1.5 cwt. of 1:1 @ £1.34 per cwt.	2.01
Water: 1.25 acre-ft. @ £1 per acre-ft.	1.25
Fuel, Oil and Grease: 5 cultivation, 1 grading, 1 sowing, 1 harvesting	1.05
Cartage: to rail @ 7d. per bush.	0.88
Labour: 0.51 man-days per acre @ £5 per day[16]	2.55
Repairs: Tractor—1.6 hours @ 2s. 8d. per hour Header—@ 5s. 0d. per acre	0.45
Insurance: @ £3 per cent on 30 bush. @ 10s. 0d. per bush.	0.45
Pest Control: Army worm ¾ lb. D.D.T. @ 8s. 0d. per lb.	0.30
Total "direct" costs	£10.11

[15] *Riverina Continuous Farm Study* 1958-59, Bureau of Agricultural Economics, Canberra, p. 7.
[16] *Ibid.*, p. 7.

Gross Revenue Per Acre

	£
30 bush. @ 11s. 6d. per bush. at rail	17.25
Total gross revenue	£17.25
Gross margin per acre	£7.14

3. OATS ON PREPARED SEED BED

Direct Costs Per Acre

	£
Seed: 40 lb. @ £1 per bush.	1.00
Fertilizer: 1½ cwt. super @ 14s. 10d. per cwt.	1.11
Water: 1 acre-ft.	1.00
Fuel, Oil and Grease: as for wheat	1.05
Cartage: to rail @ 4d. per bush.	0.70
Labour: as for wheat	2.55
Repairs: as for wheat	0.46
Insurance: @ £3 per cent on 42 bush. @ 4s. 0d. per bush.	0.25
Pest Control: as for wheat	0.30
Total "direct" costs	£8.42

Gross Revenue Per Acre

	£
42 bush. @ 6s. 0d. per bush.	12.60
Total gross revenue	£12.60
Gross margin per acre	£4.18

Oats has considerable grazing value in late autumn and early winter in this are and no account has been taken of this in the above budget.

4. MALTING BARLEY ON PREPARED SEED BED

Direct Costs Per Acre

	£
Seed: 60 lb. @ 25s. 0d. per bush.	1.50
Fertilizer: as for oats	1.11
Water: as for oats	1.00
Fuel, Oil and Grease: as for wheat	1.05
Cartage: to Melbourne @ £5 per ton (bulk) contract	4.01
Labour: as for wheat	2.55
Repairs: as for wheat	0.46
Insurance: @ £3 per cent on 36 bush. @ 7s. 0d. per bush.	0.37
Pest Control: as for wheat	0.30
Total "direct" costs	£12.35

Gross Revenue Per Acre

	£
36 bush. @ 9s. 6d. per bush.	17.10
Total gross revenue	£17.10
Gross margin per acre	£4.75

5. Grain Sorghum on Prepared Seed Bed

Direct Costs Per Acre

	£
Seed: 10 lb. @ 2s. 3d. per lb.	1.13
Fertilizer: 2 cwt. 1:1 @ £1.34 per cwt.	2.68
Water: 3 acre-ft. @ £1	3.00
Fuel, Oil and Grease: 4 cultivations, 1 grading, 1 sowing, 1 harvesting	1.03
Cartage: @ 7d. per bushel to rail	1.63
Labour: 5.0 hours @ 12s. 6d. per hour	3.13
Insurance: @ £3 per cent on 1.5 tons @ £14	0.63
Repairs:	
Tractor—1.7 hours @ 2s. 8d.	
Header—@ 5s. 6d. per acre	0.50
Drying Costs: @ 10s. 0d. per ton	0.75
Total "direct" costs	£14.48

Gross Revenue Per Acre

	£
1.5 tons @ £18 15s. 0d. per ton	28.12
Total gross revenue	£28.12
Gross margin per acre	£13.64

6. Linseed on Prepared Seed Bed

Direct Costs Per Acre

	£
Seed: 34 lb. @ 8.5d. per lb	1.20
Fertilizer: 120 lb. 1:1 @ £1.30 per cwt.	1.39
Water: 1 acre-ft. @ £1	1.00
Fuel, Oil and Grease: 2 ploughings, 1 sowing	0.45
Cartage: To Melbourne by grower-owned truck (fuel, oil and labour)	1.50
Labour: 1.38 man-hours @ 12s. per hour (crop operations only)	0.83
Contract Harvesting: @ £2.50 per acre	2.50
Pest Control: 0.4 galls. D.D.T. @ £1.00 per acre (materials and aerial application) for Heliothus control	1.00
Repairs: 0.69 tractor-hrs. @ 2s. 8d. per hour	0.08
Total "direct" costs	£9.95

Gross Revenue Per Acre

	£
8 bags @ £67.50 per ton (bulk)	40.50
Total gross revenue	£40.50
Gross margin per acre	£30.55

7. SAFFLOWER ON PREPARED SEED BED

Direct Costs Per Acre

	£
Seed: 40 lb. @ 9d. per lb.	1.50
Fertilizer: 100 lb. of 18.18.0 @ £38 per ton	1.69
Water: Nil	
Fuel, Oil and Grease: 2 ploughings, 1 sowing, 1 harvesting	0.60
Cartage: To Melbourne @ £3 per ton (Contract)	1.24
Labour: 1.27 man-hours @ 12s. 0d. per hour	0.76
Repairs:	
0.90 tractor-hours @ 3s. 0d. per hour Header @ 7s. 0d. per acre	0.49
Total "direct" costs	£6.28

Gross Revenue Per Acre

	£
6.83 bags @ £50 per ton (bulk)	20.59
Total gross revenue	£20.59
Gross margin per acre	£14.31