



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

SOME ASPECTS OF THE EFFECT OF TAXATION ALLOWANCES AND CLEARING COSTS ON DEVELOPMENT PLANS AND THEIR CAPITAL REQUIREMENTS

ROBERT A. PEARSE*

1. INTRODUCTION
2. THE EFFECTS OF INCOME TAX ALLOWANCES
3. THE EFFECTS OF A NOMINAL CLEARING COST CHARGE
4. CONCLUSION AND SUMMARY

1. INTRODUCTION

A variable-capital parametric linear programming technique was used by the author to define the optimum combination of certain pasture establishment methods; prepared seedbed (PSB), combining (COM), aerial sown and topdressed (ATD) and combining, later ripped up and resown (RC).¹ Annual expenditure was varied from £0 to £1,000 for a 1,000-acre property. The optimum combination was computed as a function of wool price and capital and it was found that at no stage was any one method the only method selected.

In the present paper the study is extended to estimate both the effects of the incidence of income tax at two different rates, namely 5s. 0d. and 10s. 0d. in the pound, and the effects of adding a small clearing cost charge. A study of income tax effects is justified because it has been the policy of the Commonwealth Government for many years to stimulate agricultural production by means of special taxation concessions for capital expenditures by primary producers.²

These concessions are of particular importance in a study of pasture improvement because expenditures on seed, fertilizer, cultivation and clearing costs and water supplies are completely deductible in assessing taxable income in the year of expenditure while expenditures on machinery, buildings and fences have been subject to accelerated depreciation allowances of 20 per cent per annum since July 1951. Since the 1963 Budget there is also an initial investment allowance of 20 per cent in addition to the 20 per cent depreciation allowance; a subsidy of £3 per ton on superphosphate

* Lecturer in Farm Management, Department of Farm Management, University of New England. The author has pleasure in acknowledging the useful comments and criticism of a draft of this paper by W. F. Musgrave and E. J. Waring, and to Mr. R. Officer, who prepared the figures and tables.

¹ Robert A. Pearse, "Financial Returns and Capital Requirements for Optimum Pasture Improvement Plans", this *Review*, Vol. 31, No. 4 (December, 1963), hereafter referred to as "the previous report".

² *Income Tax for Farmers and Graziers*, Fifth Edition, Canberra: Government Printer, March, 1959. Foreword, pp. 22, 24.

was also introduced in this Budget. The results on which this paper is based were obtained prior to the announcement of these additional concessions.

The effect of adding clearing costs of £2 10s. 0d. per acre³ to all the ground methods of establishment is examined. In the previous report the comparison of methods was on the basis that all land was fully cleared, which is not usually the case. The area which is part cleared prior to pasture improvement would, by visual assessment, generally form the greater part of a property, and it might well be that these results are the ones most applicable to the area under study. The best development plan where extensive clearing would be necessary prior to ground sowing has not been studied.

2. THE EFFECTS OF INCOME TAX ALLOWANCES

In this section the modifications to the previously reported matrix are explained. Then the results of the programmes run with the adjusted matrices are reported and discussed.

THE BASIC DATA

The origin of the costs and stocking rates for the various methods of establishing pasture were detailed in the previous report.⁴ Originally the tables were compiled and the capital requirements calculated without regard to any taxation effects, with running costs and capital expenses being separated for some purposes but amalgamated when estimating the total funds required in a given year. The net capital requirement was the sum of capital, running, and interest costs less the gross income due to pasture improvement in a given year.

In 1959, when this study began, an increase in taxable income from £1,000 to £2,000 increased the income tax payable by £270 or roughly 5s. 0d. in the pound, whilst an increase from £4,000 to £5,000 increased tax liability by £505, or roughly 10s. 0d. in the pound of added income. Therefore it is argued that the real cost of a tax deductible expenditure at these levels of income, was only 15s. 0d. or 10s. 0d. in the pound respectively. That is, if £1,000 spent on pasture seed reduced taxable income from £5,000 to £4,000 the real cost is only £495 as otherwise £505 would have been paid out as income tax. In other words, only £495 of money available for expenditure on non-tax deductible items had to be sacrificed to obtain a £1,000 asset. The effect is not that of having one's cake and eating it but rather that of having more cake to eat! This argument suggests that the greater one's income, with a progressive income tax rate structure, the greater the benefit obtained for any given financial sacrifice

³ The cost of clearing up ringbarked, part-cleared land, of which there are considerable areas on the New England Tableland, was estimated at £2-3 per acre in a 1958 survey.

⁴ *Op cit.* pp. 175-191, Tables 1-9.

where the expenditure is a deductible item. If increasing income means an increasing ability to invest rather than consume this must be a highly significant factor in attracting investment in agriculture, especially in an economy in which there is no capital gains tax.

The capital requirements of the earlier study were adapted for this work by splitting the total expenditure into three parts: firstly, those items which were wholly deductible, secondly, those which were eligible for the special depreciation allowances and thirdly, those which were not deductible. These figures were used to calculate the total amount claimable as a taxation deduction in each year. This deduction could be greater than the total expenditure if the expenditure was wholly or largely deductible and special depreciation allowances were available from earlier years. To obtain the tax adjusted capital requirement for the year either a quarter or a half of the amount claimable was deducted from the previously calculated capital requirement, to give the capital requirement for a marginal rate of income tax of 5s. 0d. or 10s. 0d. respectively. In Table 2 is shown the amount allowable for taxation deduction⁵ in each year for both prepared seed bed and aurally sown pastures, and the capital requirements when tax is not considered or is at a marginal rate of either 5s. 0d. or 10s. 0d. per pound of additional income.

An example of the method is that of PSB where the £525 full cost of first year expenses is composed of seed £200, fencing and water £150, cultivation and sowing costs £96, fertilizer £74 and depreciation £5 per 100 acres. The seed, fertilizer and cultivation costs are fully deductible (£370) and 20 per cent depreciation allowance for the fencing is £30, to give a total of £400. The second year costs are £361 (sheep £240, fertilizer £82, sheep running costs £34, depreciation £5) less receipts of £25 to give a net expenditure of £336. Deductions claimed are depreciation £30, loss on livestock account £30, running expenses £34 and fertilizer £82, a total of £176. The loss on livestock account is due to depreciation of the additional sheep which were valued at the market selling price. In this manner the amounts allowable for taxation deductions were calculated for each year and method of sowing.

As in the previous report the sum of net income over a period of 20 years was used as the maximizing function. However, the net income was the net taxable income as defined for taxation purposes, and it was subjected to income tax at the rate of 5s. 0d. or 10s. 0d. A first year sowing of PSB with no tax would return £5,463 but at a marginal rate of 5s. 0d. it would be £3,908, slightly less than three-quarters of the former sum. Due to the greater deductions the net income in the early stages of the programme is reduced so that the difference increases as the time of sowing becomes later, e.g., PSB in the tenth year gives a return of 63 per cent of that previously reported. Taxable net income may be greater than the net income because the special depreciation allowances cease after five years, whilst previously depreciation was over 30 years.

⁵ The full details of expenditure are set out in the previous report. Tables 2-6, *op. cit.* and in the textual explanations of these tables, pp. 175-186.

Finally, the remaining coefficients in the matrix are unchanged, as was the manner of capital supply in that between year savings were permitted. Because of the limited memory capacity of the computer it was necessary to restrict the number of activities considered. Those selected were chosen by the previously reported technique of a trial solution with some restraints not being exercised.—See Table 1.

TABLE 1
Activities in the Matrix

Wool	No Tax	5s. 0d. Tax	10s. 0d. Tax
5s. 0d.	PSB 1, 2, 3, 5-10 COM 2, 8-10 ATD 1, 2, 9, 10 RC 1 ₈ -5 ₁₂ , 1 ₇ -6 ₁₂ 2 ₆ , 5 ₉	PSB 1-3, 5-10 COM 1-6, 8, ATD 1, 2, 3, RC 1 ₈ -5 ₁₂ , 1 ₇ -5 ₁₁	PSB 1-3, 5-10 COM 1, 2, 7, 8, ATD 1, 2, RC1 ₅ -5 ₉ , RC 1 ₈ -5 ₁₂ , 1 ₇ , 2 ₈ , 5 ₁₁ , 6 ₁₂
4s. 0d.	PSB 1-3, 5-10 COM 1-5, 7, 8 ATD 1, 2, 10, RC 1 ₈ -5 ₁₂ , 1 ₇ -5 ₁₁	PSB 1-3, 5-10 COM 1-9 ATD 7, 8, 9, RC 1 ₈ -5 ₁₂ , 1 ₇ , 2 ₈ , 3 ₉	PSB 1-3, 5-10 COM 1-7 ATD 1, 2, 3, 5, RC 1 ₈ , 2 ₉ , 3 ₁₀ , 5 ₁₂ , 1 ₇ , 2 ₈ 4 ₁₀ , 5 ₁₁ , 6 ₁₂

SOME IMPLICATIONS OF THESE ASSUMPTIONS

The most obvious difference in the coefficients between the tax and no-tax situations is the substantial reduction in the period before accumulated receipts exceed the accumulated costs (see Table 2). An average period of 12½ years being reduced to 9½ years with tax at 5s. 0d. and to 7 years with tax at 10s. 0d. and a wool price of 5s. 0d. per lb.⁶ Also, the extent of maximum indebtedness is considerably reduced, especially for those techniques where the increase in carrying capacity is slow. This reduction in the period of "indebtedness" would do much to change the picture in applying for an overdraft loan. Even for a moderate (£1,000 to £2,000) taxable income the period of indebtedness is reduced by three years while at higher levels it may be halved. This aspect of the economic effects of taxation deductions does not seem to have been considered by economists⁷ studying the economics of pasture improvement. One

⁶ Pearse, *ibid.* Table 7, p. 185.

⁷ For example—F. H. Gruen, "Financial Aspects of Pasture Improvement on Southern Wheat-Sheep Farms", this *Review*, Vol. 24, No. 4 (December, 1956); F. H. Gruen and R. A. Pearse, "Aerial Pasture Improvement in New South Wales", this *Review*, Vol. 26, No. 2 (June, 1958); Keith Campbell and Richard T. Shand, "An Economic Study of Pasture Improvement on Some Farms in New South Wales", Department of Agricultural Economics, University of Sydney, mimeo., Report No. 2 (1959); F. H. Gruen, "Pasture Improvement—The Farmers' Choice", *Australian Journal of Agricultural Economics*, Vol. 3, No. 2 (December, 1959); and C. D. Throsby, "Some Notes on 'Dynamic' Linear Programming", this *Review*, Vol. 30, No. 2 (June, 1962).

problem in studying the effect of taxation is that the rates will vary over the development period due to changes in the taxable income. It is not possible to take account of this because the income at any stage will depend upon the level of annual development expenditure, that is, in the seventh year of development additional income will be very much greater if the annual expenditure is £800 rather than £200. *Therefore, these coefficients only suggest the effects that income tax concessions may induce rather than a plan which should be strictly followed or applied.*

In the previous report it was suggested that the period of indebtedness would be considerably increased if a grazier decided to use some of the additional income to raise living standards. Consideration of these coefficients suggests that firstly there would be considerable inducement not to raise living standards because a pound spent on deductible items has a much higher purchasing power than if spent on non-deductible items and, secondly, that restraint will result in a more rapid development of the property. Due to the tax effect one would be investing for a shorter period so that the time before one can increase non-farm expenditures without both delaying the development programme and extending the period of expenses exceeding receipts would be much less.

Finally, the activities selected for inclusion in the final matrices vary to some extent, mainly in the ATD activities, both for the various wool prices and also for the two tax levels.

THE RESULTS AND DISCUSSION

The discussion covers the main points raised in the previous report and treats the following topics:—

- (i) How the level of capital availability affects—
 - (a) the time required to establish pasture on the whole property, at different levels of income tax incidence;
 - (b) the time before the programme is self financing;
 - (c) the years when capital, rather than other restraints, limits the development programme.
- (ii) The optimum method of sowing pastures, in relation to the restraints, and whether sowings are at regular or irregular intervals, when net income over 20 years is the goal.
- (iii) How the optimum plans alter with changes in income tax rates and wool price, and their stability in the face of small changes in annual investment.
- (iv) Changes in the marginal value products of the limiting resources as affected by the incidence of income tax.

(i) *The Effects of Varying the Capital Available*

Some of the most important effects of tax incidence in relation to investment and returns are shown in Figure 1 for both wool prices. For clarity in presentation it was necessary to standardize the returns, the 5s. 0d. tax figure being used for the calculation. In effect, the figures show the results in terms of a constant amount of physical product with tax considered at 5s. 0d., irrespective of the real level. If the returns had not been

standardized the no tax income line would be about 50 per cent higher, e.g. Plan 40 would be £41,454 not £27,222 as shown and the 10s. 0d. tax returns would be 45-50 per cent below the returns shown. Using the original data, at levels of investment up to about £380 the returns are greatest for the 10s. 0d. tax and lowest for no tax, but past this point the situation is reversed. In terms of constant or standardized returns, for a given wool price, the income is greatest for the high tax and lowest for the low tax at any level of investment.

Examination of the figure shows that in terms of physical production, expressed as income standardized at the 5s. 0d. tax rate, there are significant decreases in the financial sacrifice required for any given level of production due to the taxation deduction effect. In terms of income available after paying income tax the issue may not be so clear. Consider the following example for the 4s. 0d. wool price:—

		<i>No Tax.</i>	<i>5s. 0d.</i>	<i>10s. 0d.</i>
Annual Investment £	.. ..	400	419	391
Original Revenue £	.. ..	11,598	13,756	12,565
Constant Returns £	.. ..	6,432	13,756	18,895

We see that in terms of physical production (constant returns) we are able to secure nearly three times as much product at the high tax rate for a given sacrifice of income after paying tax! In terms of our residual returns after paying appropriate tax we see that there would be little more money available to us for private consumption purposes. We have greatly increased production with little extra financial return but of course an increased capital investment which would provide tax free gains if we decide to sell the property.

At high levels of annual investment the picture may be somewhat different. Consider the example:—

		<i>No Tax.</i>	<i>5s. 0d.</i>	<i>10s. 0d.</i>
Annual Investment £	.. ..	985	972	980
Original Revenue £	.. ..	27,348	22,485	15,971
Constant Returns £	.. ..	18,793	22,455	24,016

In this case we find that there is much less difference in terms of constant product, only about 30 per cent more at the highest tax rate compared with about 300 per cent in the previous example. However, in terms of income left after paying tax there is a very considerable change, the total return at the 10s. 0d. tax level being only 55 per cent of that where no tax was charged!

Figure 1 also shows that the marginal return to capital is very much higher, due to the deduction effect, at low rates of capital investment. However, as in the previous study they fall away, in this case even more rapidly, and at much lower levels of investment.

Wool price does not affect this as much as taxation does. In the previous report it was shown that this decrease may be artificial because discounted returns may still rise due to the sowings being completed earlier and because capital does not have to be supplied for so many years. In this study capital was limiting in the twelfth year for the first plan of each combination, but for both the 10s. 0d. tax at the 4s. 0d. wool price and for the

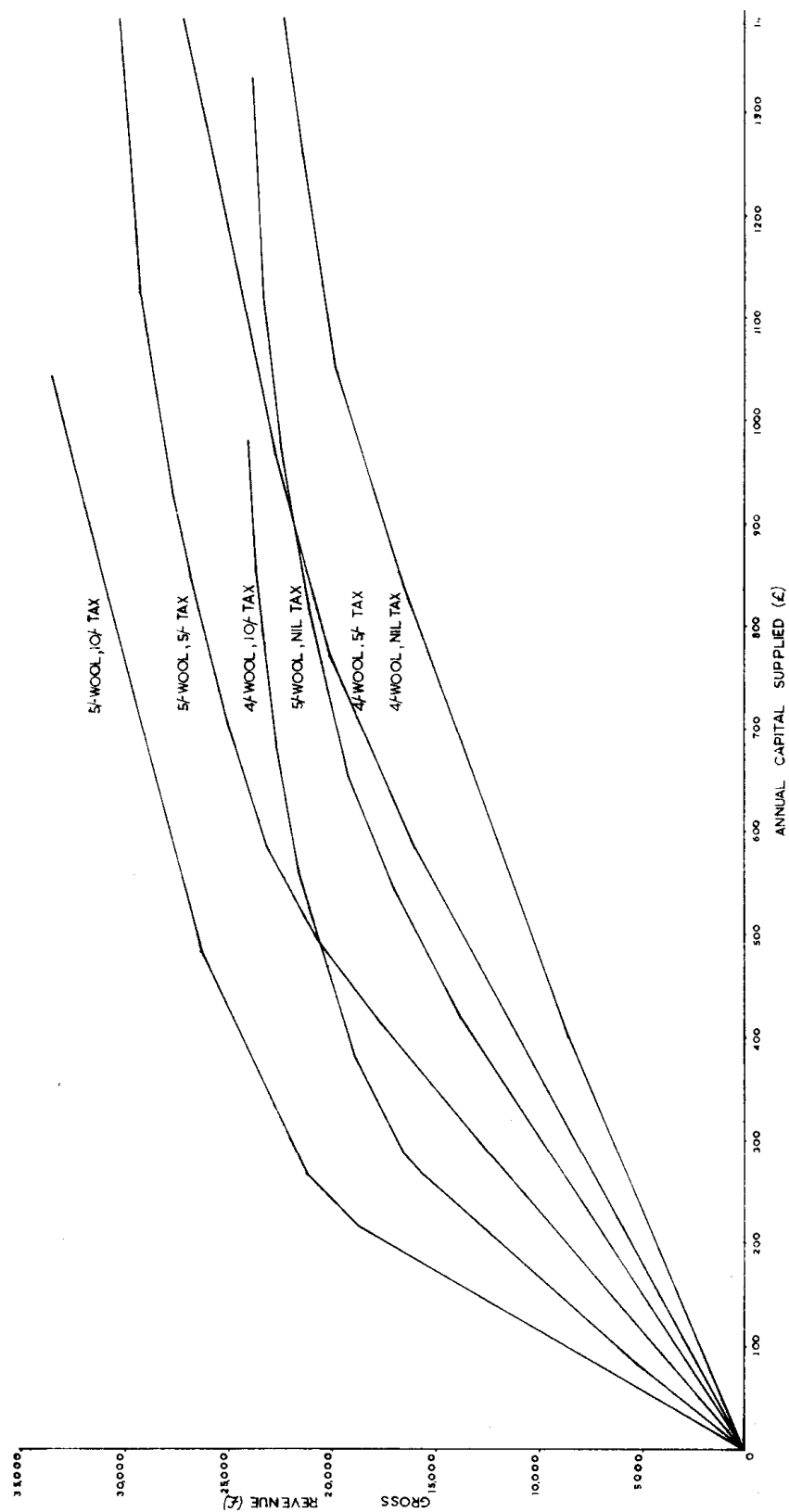


Fig. 1. Gross Revenue Calculated at a Standardized Value of Tax at 5s. 0d., for all Situations. (See Text)

TABLE 3

Some Optimum Plans for Varying Levels of Annual Savings
Wool Price 5s. 0d.; Tax 5s. 0d.; No Clearing Costs

	Plan Number						
	4	10	17	23	31	35	40
Net Revenue ..	14,011	20,780	23,333	25,117	27,827	29,400	30,450
Savings	321	490	585	698	929	1,126	1,411
Capital not limiting (years)	6, 7, 9, 12	9, 11, 12	6, 11, 12	1, 6, 10-12	1, 6, 6-12	1, 6, 8-12	1, 4, 6-12
Self Finance Year	12	12	11	11	9	9	8

Area Sown (Acres)

Year 1	71 PSB	109 PSB	130 PSB	150 PSB	150 PSB	150 PSB	200 RC 1; 100 RC 1 ₈
2	83 RC29	42 PSB 26 RC29	21 PSB 101 RC28	44 PSB	32 PSB 200 RC29	87 PSB 127 RC28	150 PSB
3 .. ..	..	..	..	59 PSB	59 PSB	61 PSB 126 RC39	150 PSB
4 .. ..	..	..	..	..	..	..	100 RC4 ₈
5	36 PSB 50 RC5 ₁₁	85 PSB 130 RC5 ₁₁	54 PSB 181 RC5 ₁₁	140 PSB 21 RC5 ₁₁	109 PSB	150 PSB	150 PSB
6	41 PSB	56 PSB	47 PSB	71 PSB	150 PSB	150 PSB	150 PSB
7 .. ..	..	19 PSB	92 PSB	150 PSB	150 PSB	150 PSB	200 RC1 ₇
8	300 COM	252 COM	74 PSB 101 RC2 ₈	150 PSB	150 PSB	127 RC2 ₈	100 RC7 ₈ 100 RC4 ₈
9	83 RC2 ₉	131 PSB 26 RC2 ₉	150 PSB	150 PSB	200 RC2 ₉	126 RC3 ₉	..
10	150 PSB	150 PSB	150 PSB	66 PSB	..	..	..
11	50 RC5 ₁₁	130 RC5 ₁₁	181 RC5 ₁₁	21 RC5 ₁₁	..	..	..
Time to Sow ..	..	10	10	10	8	7	6

TABLE 4

*Some Optimum Plans for Varying Levels of Annual Sowings
Wool 5s. 0d.; Tax 10s. 0d.; No Clearing Costs*

	Plan Number				
	13	26	44	51	63
Net Revenue	12,445	14,096	17,495	18,794	20,302
Savings	217	266	479	627	1,042
Capital not Limiting ..	5, 7, 11, 12	7, 8, 10-12	5, 6, 8-12	1, 6-12	1, 5-12
Self Finance Year ..	11	11	9	7	6

Area Sown (Acres)

Year 1	63 PSB	77 PSB	139 PSB	150 PSB	200 RC1 ₇ , 100 RC1 ₈
2	89 RC2 ₉	109 RC2 ₈	196 RC2 ₉	129 RC2 ₉ , 171 RC2 ₈	150 PSB
3 .. .. .	..	..	..	..	150 PSB
4 .. .. .	..	..	..	78 RC4 ₁₁	100 RC4 ₈
5	182 RC5 ₁₁	197 RC5 ₁₁ , 61 RC5 ₁₂	129 RC5 ₁₁ , 86 PSB	150 PSB	150 PSB
6	181 RC6 ₁₂	146 RC6 ₁₂	150 PSB	150 PSB	150 PSB
7 .. .. .	..	41 PSB	150 PSB	150 PSB	200 RC1 ₇
8	270 COM	68 PSB, 109 RC2 ₈	150 PSB	22 PSB, 171 RC2 ₈	100 RC1 ₈ , 100 RC4 ₈
9	66 PSB, 89 RC2 ₉	150 PSB	196 RC2 ₉	129 RC2 ₉	..
10	150 PSB	150 PSB	..	..	..
11	182 RC5 ₁₁	197 RC5 ₁₁	129 RC5 ₁₁	78 RC4 ₁₁	..
12	181 RC6 ₁₂	146 RC6 ₁₂ , 61 RC5 ₁₂	..	..	..
Time to Sow	10	10	8	8	6

TABLE 5
Some Optimum Plans for Varying Levels of Annual Savings
Wool 4s. 0d. per lb.; Tax 5s. 0d.; No Clearing Costs

	Plan Number							
	4	9	18	19	23	28	31	37
Net Revenue £	13,756	16,705	19,214	19,235	20,942	22,491	23,333	23,981
Savings .. £	419	531	649.5	650.7	797	972	1,111	1,337
Capital not Limiting—Years	8, 9	7, 8, 9, 12	6, 11, 12	6, 7, 11, 12	1, 5, 6, 10, 12	1, 5, 6, 8-12	1, 6, 8-12	1, 4, 6-12
Self Finance Year	..	12	11	11	10	9	9	8

Area Sown (Acres)

Year 1.. ..	93 PSB	118 PSB	144 PSB	144 PSB	150 PSB	150 PSB	150 PSB	200 RC1 ₁ , 100 RC1 ₄
2.. ..	57 PSB	72 PSB	78 PSB	77 PSB	100 PSB	125 PSB 48 RC2 ₉	142 PSB 16 RC2 ₈	150 PSB
3.. ..	..	..	13 PSB	17 PSB	53 PSB	78 PSB	85 PSB 130 RC3 ₉	150 PSB
4.. ..	..	..	7 RC4 ₁₁	..	..	..	..	100 RC4 ₁₁
5.. ..	107 PSB	136 PSB	150 PSB	150 PSB	150	150	150	150 PSB
6.. ..	66 PSB	83 PSB	92 PSB	94 PSB	106 PSB	150	150	150 PSB
7.. ..	22 PSB	15 PSB	65 PSB	67 PSB	141	150	150	200 RC1 ₇
8.. ..	111 COM	276 COM	150 PSB	150 PSB	150 PSB	150	27 16 RC2 ₈	100 RC1 ₈
9.. ..	191 COM 182 ATD	150 PSB	150 PSB	150 PSB	150 PSB	48 RC2 ₉	130 RC3 ₉	..
10.. ..	150 PSB	150 PSB	150 PSB	150 PSB	..	..	..	..
11.. ..	..	..	7 RC4 ₁₁	..	..	..	..	100 RC4 ₁₁
Time to Sow ..	..	10	10	10	9	8	8	6

TABLE 6

Some Optimum Plans for Varying Levels of Annual Savings
Wool 4s. 0d. per lb.; Tax 10s. 0d.; No Clearing Costs

	Plan Number							
	2	5	10	19	30	34	38	41
Net Revenue £	3,281	10,379	11,029	12,565	14,364	15,066	15,693	15,971
Savings .. £	78	266	289	391	559	681	854	980
Capital not Limiting—Years..	3, 9, 11	8, 9, 11, 12	7, 8, 11, 12	6, 9-12	1, 6, 8-12	1, 6-12	1, 6-12	1, 5-12
Self Finance Year	..	11	11	10	9	8	7	7

Area Sown (Acres)

Year 1.. ..	23 PSB	77 PSB	84 PSB	114 PSB	150 PSB	150 PSB	150 PSB	200 RC1 ₇ , 100 RC1 ₈
2.. ..	37 COM	127 COM	138 RC2 ₈	115 RC2 ₈ , 28 PSB	194 RC2 ₈ , 37 PSB	200 RC2 ₈ , 48 PSB	97 RC2 ₈ , 102 PSB	150 PSB
3.. ..	..	..	..	..	..	152 RC3 ₁₀	150 PSB	150 PSB
4.. ..	..	..	..	..	19 RC4 ₁₀	..	52 RC4 ₁₀	100 RC4 ₁₀
5.. ..	4 RC5 ₁₁ , 50 ATD	149 RC5 ₁₁	162 RC5 ₁₁	200 RC5 ₁₁ , 50 PSB	150 PSB	150 PSB	150 PSB	150 PSB
6.. ..	72 RC6 ₁₂	241 RC6 ₁₂	262 RC6 ₁₂	69 PSB	150 PSB	150 PSB	150 PSB	150 PSB
7.. ..	..	105 COM	17 PSB	150 PSB	150 PSB	150 PSB	150 PSB	200 RC1 ₇
8.. ..	..	..	36 PSB, 138 RC2 ₈	64 PSB, 115 RC2 ₈	150 PSB	200 RC2 ₈	97 RC2 ₈	100 RC1 ₈
9.. ..	8 PSB	150 PSB	150 PSB	150 PSB	194 RC2 ₈	..	..	..
10.. ..	150 PSB	150 PSB	150 PSB	60 PSB	19 RC4 ₁₀	152 RC3 ₁₀	52 RC4 ₁₀	100 RC4 ₁₀
11.. ..	4 RC5 ₁₁	149 RC5 ₁₁	162 RC5 ₁₁	200 RC5 ₁₁	..	..	..	..
Time to Sow ..	..	10	10	10	8	7	7	6

5s. 0d. tax, 5s. 0d. wool price at the highest input capital in Years 1, 4-12 had ceased to be limiting. Therefore, past this point the marginal revenue is zero. The point was reached with £800 or £1,450 for seven years respectively. The other plans were extremely close to capital not being limiting as can be seen by inspecting Tables 3-6.

Examination of Tables 3, 4, 5 and 6 shows that at low levels of investment capital in the middle years of the plan does not limit development so much as it does in the early and later years. However, as the annual expenditure on investment rises the middle years become restricting and the early and late years are no longer limiting. The years in which the programme becomes self financing is probably the most important date to look for as having capital available if it becomes limiting in a later year is of little value—except it may give some flexibility if something reduces the capital supply at that period.

Finally, the tax concessions markedly affect the amount of capital required before the whole property is under pasture as shown below:—

			No Tax	5s. 0d.	10s. 0d.
Wool Price 5s. 0d. £	..	..	586	476	214
Wool Price 4s. 0d. £	..	..	836	429	266

Once again we see that tax may have a greater affect than does wool price.

(ii) *The Methods of Pasture Establishment Selected*

The introduction of considerations of income tax did not alter the fact that all methods of pasture establishment entered one or other of the final plans but it did cause considerable changes in the proportions in which they appear. Thus ATD appears only in the 4s. 0d. selection (Tables 4 and 5) and then only to a maximum of 200 acres. The COM was present in all four sets of solutions, and generally rose to a maximum value of 300 acres. The PSB sowings became much more important, one plan being 100 per cent of this method. Its emphasis changed depending on the capital supply from about 40 per cent in the early plans to over 70 per cent and finally dropping to 60 per cent of sowings at that stage where capital ceased to be a restraint. The RC combination also gained in importance, mainly at the expense of ATD.

As in the previous report there were intervals between the sowings, especially in years 3 and 4 until a considerable amount of capital was available. There were differences due to wool price and to tax levels for a given wool price as will be seen by studying the Tables. In all cases the earliest plans⁸ did not permit the whole area to be shown in ten years but at the highest level of capital all the initial sowing was completed in six years. However, there is still cultivation to be done in later years due to the resowing of the RC activities.

(iii) *Sensitivity of the Plans to Changes in Capital Availability*

The capital was not permitted to vary over quite so great a range in these studies as in the ones previously reported. So as there were as

⁸ It will be recalled that most of this discussion is in terms of the simplified plans as shown in Tables 3-6 but with occasional reference to the full range of solutions.

many or more changes of plan it is evident that there must be more changes of plan per £100 invested and it was found that the rate of change between plans was greater than in Fig. 1 of the previous report.⁹

The use of the simplified plans obscures these rapid changes and hides the fact that some quite dissimilar plans may need about the same capital and provide the same returns. Such plans may be of importance where the method of establishment is different. Here the changes are usually between one form of RC and another and therefore it is likely that little is lost in not considering them.

Due to the different capital requirements at the different tax rates quite different optimum plans arise for a given level of investment, e.g., Plans 4 and 23, Table 5, compared with Plans 19 and 38 in Table 6. These plans also differ significantly from the optimum plans at the appropriate level of capital investment when tax is not considered.

The final plans of each of these four comparisons differ only in that the second working of the Year 4 RC combination is in either Year 8, 10, or 11. For two of the plans capital is no longer limiting. The figures below summarize the situation and highlight the effect that income tax has on both capital requirements and returns. The effects of price change should also be noted.

			5s. 0d. Tax	10s. 0d. Tax
5s. 0d. Wool-Investment	£	.. ..	1,411	1,042
Revenue	£	.. ..	30,450	20,302
4s. 0d. Wool-Investment	£	.. ..	1,337	980
Revenue	£	.. ..	23,981	15,971

The lower requirement of capital for the 4s. 0d. wool price is due to the lower cost of sheep.

(iv) *The Marginal Value Products of the Limiting Resources*

In considering the marginal value products it is important to recall first that the returns are the undiscounted returns over 20 years *after* paying income tax at either 4s. 0d. or 5s. 0d. wool price and, secondly, that in practice plans may not be as rigid in the timing of capital expenditures as postulated in the programme. The marginal value products for the plans shown in Tables 3-6 are set out in Tables 7-10 respectively, with the addition of an extra plan in Table 9.

For either wool price the marginal value of capital is much higher in the early years than when tax is not considered. For example, at the 4s. 0d. wool price capital in Year 1 was limiting up to £980 when tax was nil, and had a maximum value of £1.19 whilst at 5s. 0d. tax it is limiting up to £677 but has a value of £2.22, and at 10s. 0d. tax it is limiting to £516 and has a maximum value of £3.56. The tendency was for a lower value in the later years than in the previous report. This reflects the shorter period of capital requirement and the earlier period at which capital is available for reinvestment in the development programme. These high values in the early years lay emphasis to the fact that there would be pressures to defer consumption spending for a few years and get on with the development job as quickly as possible. Based on marginal values this incentive would be lower in the nil tax situation.

⁹ Pearse, *op. cit.*, 194.

TABLE 7

*The Marginal Value Product of the Limiting Restraints for
Selected Plans*

Wool 5s. 0d. per lb.; 5s. 0d. Tax

	Plan Number						
	4	10	17	23	31	35	40
	£	£	£	£	£	£	£
Net Revenue	14,011	20,750	23,333	25,117	27,828	29,400	30,450
Annual Savings	321	490	585	698	929	1,126	1,411
Capital—Year 1	3.23	2.81	2.23	..	..	..	..
Year 4	1.65	1.50	.92	1.21	.96	.44	..
Year 5	1.73	.34	1.04	.02	0	.52	.64
Year 6 .. ..	..	.90	..	..	..	..	..
Year 7 .. ..	..	.23	0	.63	.82	.40	..
Year 8 .. ..	.76	0	.75	.20	..	..	..
Year 9 .. ..	..	..	.18	.31	..	..	..
Year 10 .. ..	.74	1.36	.43	..	..	..	..
Year 11 .. ..	.94	..	..	..	..	..	..
Property Size .. ..	..	4.98	8.94	13.7	17.44	19.34	21.58
Sowing Year 1 .. ..	..	..	..	7.72	5.99	7.11	10.87
Restraint—Year 2 .. ..	..	..	..	..	..	2.03	7.12
Year 3 .. ..	..	..	..	..	..	..	3.74
Year 5 .. ..	..	.17	..	.28	..	1.11	3.34
Year 6 .. ..	..	..	..	..	1.12	2.53	3.40
Year 7 .. ..	..	..	..	0	1.02	1.02	.61
Year 8 .. ..	..	..	.21	2.26	1.90	..	..
Year 9 .. ..	..	.79	3.40	1.39	.15	..	..
Year 10	3.0	2.57	2.84	..	..	..	..

TABLE 8

*The Marginal Value Product of the Limiting Restraints for
Selected Plans*

Wool 5s. 0d. per lb.; 10s. 0d. Tax

	Plan Number				
	13	26	44	51	63
	£	£	£	£	£
Net Revenue	12,447	14,096	17,495	18,794	20,302
Annual Savings	217	266	479	627	1,042
Capital—Year 1	3.77	3.20	1.41	..	..
Year 4	3.45	1.78	1.34	.63	.317
Year 5 .. ..	..	0.6	..	.88	0
Year 6	1.78	1.19	..	..	..
Year 7 .. ..	..	..	.69	..	..
Year 8 .. ..	.12	..	..	..	..
Year 9 .. ..	.16	.80	..	..	..
Year 10	1.21	..	..	..	..
Property Size	2.86	6.56	11.45	12.45	15.68
Sowing Year 1 .. ..	..	..	..	3.49	9.05
Restraint—Year 2 .. ..	..	..	..	0	6.50
Year 3 .. ..	..	..	..	..	5.48
Year 5 .. ..	..	..	0	3.05	3.09
Year 6 .. ..	..	..	.85	4.19	1.21
Year 7 .. ..	..	..	.92	2.30	.76
Year 8 .. ..	..	1.29	1.43	.43	.33
Year 9 .. ..	..	1.67	..	..	..
Year 10	2.11	2.56	..	..	..
Year 11 .. ..	..	.42	..	..	..

TABLE 9

*The Marginal Value Product of the Limiting Restraints for
Selected Plans*

Wool 4s. 0d. per lb.; 5s. 0d. Tax

	Plan Number							
	4	9	18	19	23	28	31	37
	£	£	£	£	£	£	£	£
Net Revenue	13,756	16,705	19,214	19,235	20,942	22,485	23,333	23,981
Annual Savings	419	531	649.5	650.7	797	972	1,111	1,337
Capital—Year 1	2.22	1.84	1.45	1.33	..	..	..	..
Year 4	1.22	.92	1.38	1.28	1.04	.82	.43	..
Year 5 .. ..	.55	.60	.05	.15	..	0	.46	.50
Year 6 .. ..	.77	.65	..	..	..	..	..	..
Year 7 .. ..	.16	..	.27	..	.33	.58	.27	..
Year 8 .. ..	..	..	.45	.63	.35	..	..	..
Year 9 .. ..	..	..	.28	.50	.23	..	..	..
Year 10	1.0	1.30	.41	.10	..	..	..	..
Year 11 .. ..	.19	.02	..	..	..	..	..	..
Year 12 .. ..	.40	..	..	..	..	..	..	..
Property Size .. ..	..	2.87	5.17	5.95	10.56	14.25	15.13	16.61
Sowing .. ..	..	..	..	..	4.84	3.81	4.43	9.12
Restraint—Year 2 .. ..	..	..	..	..	..	..	1.20	6.61
Year 3 .. ..	..	..	..	..	..	..	3.27	4.16
Year 5 .. ..	..	..	1.94	2.22	1.19	1.05	1.59	3.06
Year 6 .. ..	..	..	..	..	..	1.09	2.49	3.04
Year 7 .. ..	..	..	..	..	..	.5	1.02	2.74
Year 8 .. ..	..	..	1.22	1.51	1.21	.88	..	..
Year 9 .. ..	.57	.15	3.37	3.88	1.19	..	..	..
Year 10 .. ..	..	1.71	3.54	4.15	..	..	..	..

TABLE 10
*The Marginal Value Product of the Limiting Restraints for
 Selected Plans*
Wool 4s. 0d. per lb.; 10s. 0d. Tax

	Plan Number							
	2	5	10	19	30	34	38	41
	£	£	£	£	£	£	£	£
Net Revenue	3,281	10,379	11,029	12,565	14,364	15,066	15,698	15,971
Annual Savings	78	266	289	391	559	681.3	854	980
Capital—Year 1	3.56	3.59	2.25	1.65	..	..	..	..
Year 4	2.46	2.14	1.28	1.04	.31	.25	.13	.17
Year 5 .. ..	.09	.24	.44	.12	.89	.88	.53	..
Year 6	1.39	.27	.93	..	..	..	..	..
Year 7 .. ..	.73	1.44	..	.43	.27	..	..	..
Year 8 .. ..	..	..	..	.39	..	..	..	..
Year 9 .. ..	..	..	.58	..	..	..	..	..
Year 10	1.0	1.10	.30	..	..	..	..	..
Year 12 .. ..	.33	..	..	..	..	..	..	..
Property Size .. ..	..	0	3.81	7.01	8.65	9.93	10.96	12.27
Sowing .. ..	..	..	..	..	4.02	3.18	5.26	7.11
Restraint—Year 1 .. ..	..	..	..	..	..	..	2.76	5.26
Year 2 .. ..	..	..	..	..	..	..	.99	4.30
Year 3 .. ..	..	..	..	..	..	..	1.77	2.30
Year 4 .. ..	..	..	..	.21	.71	1.62	2.10	.79
Year 5 .. ..	..	..	..	..	2.95	3.13	2.10	.79
Year 6 .. ..	..	..	..	.79	2.05	1.62	.59	.43
Year 7 .. ..	..	..	..	1.72	1.40	.33	..	..
Year 8 .. ..	..	..	..	1.51	..	..	..	..
Year 9 .. ..	..	1.20	.90	..	..	..	..	..
Year 10 .. ..	.55	2.76	2.16	..	..	..	..	..
Year 11 .. ..	..	..	..	.32	..	..	..	..

In the case of land the marginal value does not rise to the levels recorded with nil tax at either wool price. This was not the case with the sowing restraints where the values tended to be as high or higher than in the nil tax situation. In fact the higher tax rate resulted in higher marginal values at the 5s. 0d. but not at the 4s. 0d. wool price. The first year sowing restraint was exercised relatively later in the development programme and except in Table 7 does not exhibit the rise and fall it showed previously. This increase in the cost of the sowing restraints suggests that it might be important to consider them more carefully where development is occurring to obtain the benefit of taxation concessions.

In Table 9 Plans 18 and 19 are shown to give an example of how a very small change in capital may quite considerably alter the marginal values of both capital and sowing restraints, although actual sowing programme exhibits little change—see Table 5. However, whilst these fluctuations can be demonstrated the usual pattern is a fairly steady rise or decline as the case may be. The marginal values in this study may be treated as a guide to the most critical periods of capital shortage or to indicate the importance of a particular sowing restraint rather than be given any economic significance in view of the problem of defining what these values are in monetary terms.

3. THE EFFECT A NOMINAL CLEARING COST CHARGE

THE BASIC DATA

The basic data for this study was that of the previous work except that for all ground sowing methods a clearing cost of £2 10s. 0d. per acre was added. The costs of a PSB sowing therefore rose from £525 to £775, and of a COM from £240 to £490 per 100 acres in the first year.

It is a common belief amongst graziers that, if anything, the protection offered by fallen timber assists the establishment of pasture so that it is better than would be the case in a fully cleared paddock. However as the author is unaware of any experimental evidence on the point no adjustment was made to the ATD carrying capacity coefficients due to the fact the ground has now some timber cover.

A difference in the matrix is that sowings were permitted for only eight years in the case of no tax, 5s. 0d. wool price and for seven years for the 4s. 0d. wool price, no tax and for the 5s. 0d. wool price with tax at 5s. 0d. and 10s. 0d. in the pound. This means that in the latter case there were PSB1-7, COM1-7, ATD1-7, RC1₈₋₄₁₁ and RC4₈₋₇₁₁. This was done to ensure that all activities could enter the solutions as the selection of activities on the basis of values when some restraints are relaxed is open to the possibility of error. The eight-year period was abandoned because it did not allow of an RC activity in each possible year of establishment.

RESULTS AND DISCUSSION

The revenue for each solution, recalculated on the basis of a payment of 5s. 0d. income tax, is shown in Figure 2. Once again we find the curves to be "kinked" and these turning points have been used to select the sowing plans presented in Table 11, showing the 5s. 0d. and 4s. 0d. wool price and no tax, and Table 12, showing the 5s. 0d. wool price and the 5s. 0d. and 10s. 0d. tax.

From Figure 2 we see that at any level of capital expenditure the amount produced is higher as we move from the no tax to the high tax situation. The returns are lower for any given expenditure than they are if there is no clearing charge. Also there is no marked decline in the apparent marginal return to extra investment except perhaps for the 10s. 0d tax case. Except for the 10s. 0d. case the capital was set to vary to £1,000. It is clear that very large inputs of capital would be required to obtain the incomes attained without clearing costs.

Several points are clear from Table 11. First there is a complete change in importance of ATD from a minor to a dominating role. COM is excluded and the RC activities, up to the capital levels studied, are present only to a limited extent. PSB activities are present at the early stage of the solutions. This suggests that apparently if one is going to clear land it should be used most intensively, especially if there is little capital. Secondly, PSB sowings occur in Years 1 and 2 even with very limited capital at the low wool price but are quite late at the higher price. This may be due to the capital supply function of PSB or perhaps to the lower capital requirements for sheep permitting some expenditure on clearing. The first plan at which the whole property is developed (Plan 5) shows a

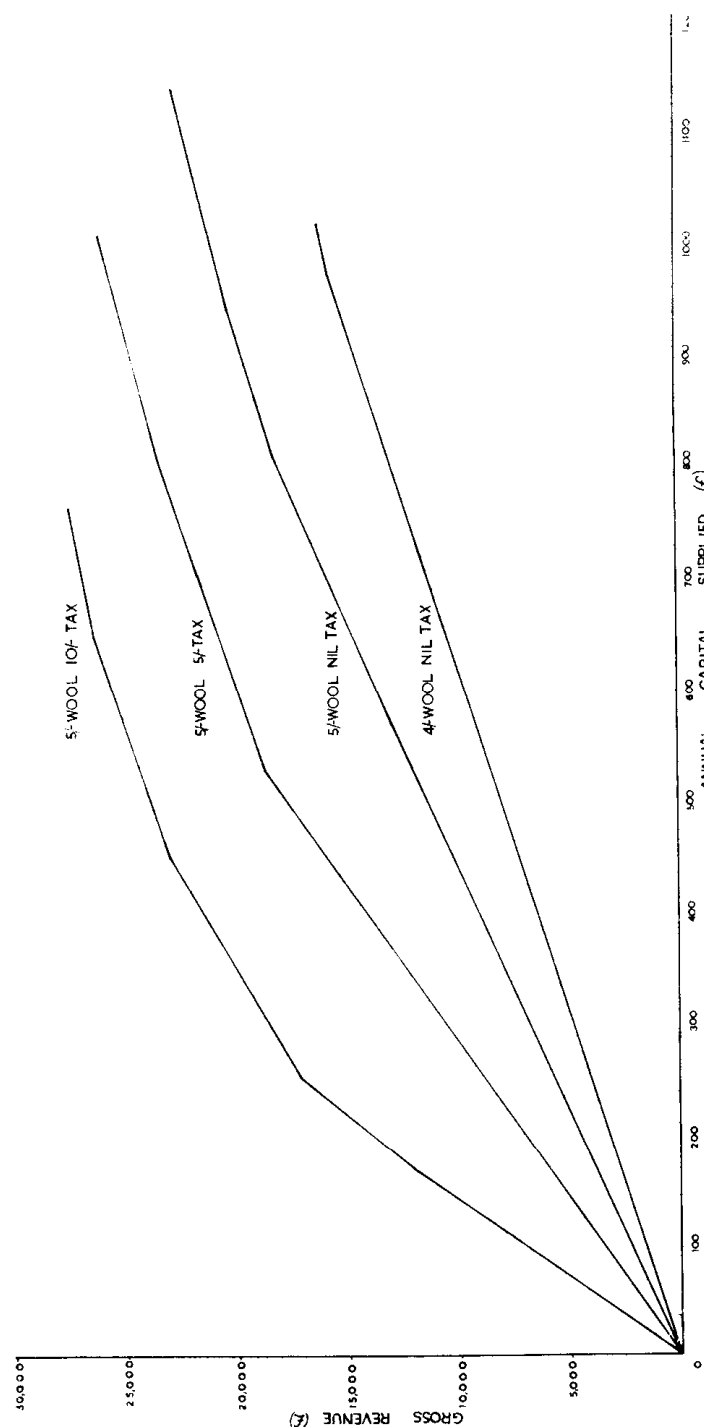


Fig. 2. Gross Revenue Calculated at a Standardized Value of Tax at 5s. 0d. for all Situations. (See Text)

TABLE 11
*Some Optimum Plans for Varying Levels of Annual Savings
Wool Price 4s. 0d. and 5s. 0d.; No Tax; £2 10s. 0d. per Acre
Clearing Cost*

		4s. 0d. Wool Price			5s. 0d. Wool Price			
		Plan Number						
		1	6	10	1	5	13	15
Net Revenue	£	17,065	22,750	23,220	19,873	27,669	30,191	33,000
Savings	£	722	973	1,009	569	812	944	1,141
Capital not Limiting —Years	.. ..	5, 8, 12	5, 7, 11-12	6, 7, 10-12	1, 5-9, 12	5, 7, 9, 12	6, 7, 11, 12	6, 7, 11, 12
Self Finance Years		12	12	12	..	12	11	11

Area Sown (Acres)

Year 1 ..	46 PSB 174 ATD	9 PSB 455 ATD	65 PSB 238 ATD	265 ATD 0 PSB	142 ATD 64 PSB	301 ATD 42 PSB	183 ATD 94 PSB
2 ..	35 PSB	..	80 ATD	..	71 ATD	68 ATD	206 ATD
3 ..	26 ATD	13 ATD	140 ATD	..	..	..	..
4 ..	..	..	..	..	204 ATD	..	..
5 ..	..	9 ATD	..	..	..	106 ATD	53 RC5 ₁₁
6 ..	..	16 ATD	..	..	..	..	66 RD6 ₁₂
7 ..	500 ATD	500 ATD	477 ATD	..	18 ATD	482 ATD	248 ATD
8 ..	..	..	..	500 ATD	500 ATD	..	150 PSB
Time to Sow ..	..	7	7	..	8	7	8

lower Year 1 sowing than some earlier plans, which shows that income is not necessarily maximized by increasing early sowings. Thirdly, we see that wool price has a highly significant effect on the timing of the sowings. At the lower price there is practically no sowing of consequence in years 2-6 between the first and last plans whilst at the higher price there are sowings in years 2, 4 and 5. Fourthly, the period of sowing may rise as is the case in that Plan 13 requires only seven years to fully improve but Plan 15 requires eight years. Fifthly, we see that there are markedly fewer plans, 10 and 15 compared with the more usual 30-40. Finally, it requires £812 per annum before the whole property is sown compared with £586 with no clearing cost.¹⁰ However, the time available for sowing is two years less, and without clearing costs £1,390 per annum would be required before sowing was complete in eight years if a period of ten was permissible. However, the revenue would be about £8,500 or 25 per cent greater over the 20 years.

¹⁰ Calculated for 7 years; Plan 1 is an investment of £937 with land wholly improved; Plan 4 is the same as Plan 13, Table 11; and capital is unlimiting at £2,594 per annum after 36 changes of plan, giving a revenue of £45,100.

4. CONCLUSIONS AND SUMMARY

The first section of this paper is an attempt to assess the effect of income tax and special taxation concessions for primary producers on the optimum development plans for a pasture improvement programme. Attention was paid especially to the amount of capital required, the financial returns, the period before the programme became self financing, and the establishment methods selected compared with the situation where no regard was paid to taxation effects. The second section considers the effect of introducing a charge for clearing land before ground sowing methods can be used, again with reference to the points above. In both cases the stock carrying coefficients, sowing restraints, and land area of 1,000 acres were the same. Changes occurred in the capital requirement coefficients and in the incomes used in the maximizing function.

It was found that taxation concessions greatly reduced the capital required to obtain any given level of production. This meant that the income which had to be sacrificed in investment for any level of production was reduced as the marginal rate of income tax increased—see Figure 1. The picture was more complex if income after tax was considered but due to the more rapid rate of development (because of the lower capital requirements) at low levels of annual investment the return after taxation was greater than if no regard was paid to tax, at either wool price.

The development programmes were changed in that aerial sowing became of minor importance and greater emphasis was laid upon the more intensive methods of establishing pasture. The timing of sowings was not greatly affected but the optimum programme at any level of capital expenditure was considerably changed. In two instances capital was increased to a level where it ceased to be limiting, thus defining the optimum programme with unlimited capital. There were also changes in the marginal values attributed to the limiting resources. This suggested that at high levels of capital investment more consideration should be given to the need for these restraints.

The effect of the clearing charge was to completely alter the optimum sowing programme by giving aerial sowing a dominating role until very high levels of capital were invested annually. Even so, prepared seed bed entered the programme in the early stages, suggesting that if land were cleared it should then be sown by the most intensive method possible. The effect of considering taxation was to increase the importance of prepared seed bed sowings, especially in the later years of the plan and at high levels of investment. As before, capital requirements were reduced to obtain a given level of production.

There are admitted imperfections in this analysis, especially those due to the assumption of rigid tax rates, but despite this the conclusions that special taxation deductions permit a greater rate of capital accumulation for a given sacrifice of consumption spending, and that the optimum pattern of expenditure alters is valid. Therefore taxation cannot be ignored in considering development plans if a rational result is to be obtained. This field is one which could be most usefully and fruitfully further developed.