AGRICULTURAL ECONOMICS
RESEARCH UNIT

Lincoln College

ECONOMIC IMPLICATIONS
OF INCREASED
AGRICULTURAL PRODUCTION

by

B. P. PHILPOTT

Lincoln

THE AGRICULTURAL ECONOMICS RESEARCH UNIT

THE Unit was established in 1962 at Lincoln College with an annual grant from the Department of Scientific and Industrial Research. This general grant has been supplemented by grants from the Wool Research Organisation, the Nuffield Foundation and the New Zealand Forest Service for specific research projects.

The Unit has on hand a long-term programme of research in the fields of agricultural marketing and agricultural production, resource economics, and the relationship between agriculture and the general economy. The results of these research studies will be published as Unit reports from time to time as projects are completed. In addition, it is intended to produce other bulletins which may range from discussion papers outlining proposed studies to reprints of papers published or delivered elsewhere. All publications will be available to the public on request.

Director
Professor B. P. Philpott, M.Com., M.A. (Leeds), A.R.A.N.Z.

Research Officers
R. H. Court, M.A., B.Sc.   A. R. Frampton, B.Agr.Sc.
R. J. Townsley, M.Agr.Sc.

Research Assistants
Miss M. J. Matheson, B.Sc.   E. D. Parkes, B.Agr.Sc.

LINCOLN COLLEGE LECTURING STAFF ASSOCIATED WITH
THE UNIT'S RESEARCH PROJECTS:

J. T. Ward, B.Litt. (Oxon.), B.Sc. (Econ.), Ph.D. (Lond.)
Senior Lecturer in Agricultural Economics

J. D. Stewart, M.A., Ph.D. (Reading)
Senior Lecturer in Farm Management

ECONOMIC IMPLICATIONS AT THE INDUSTRY LEVEL

B. P. PHILPOTT

Professor of Agricultural Economics, Lincoln College

IT IS proposed to discuss, at the broad aggregate level, the implications of a specific rate of growth of agricultural production in the future, and for this purpose, 4% per annum has been chosen. At this rate of increase, it would take 15 years to reach the required targets.

As all the implications of an increase to this level cannot be discussed in the space available, this paper will be confined to the following special questions:

(1) What resources are required for a 4% rate of growth?
(2) What rate of return would be earned on these resources?
(3) How can the resources be shifted into agriculture?
(4) The indirect use of resources.
(5) Some special quasi economic objections to faster agricultural growth.

Resources Required for 4% Growth

To assess the resources required for 4% growth, it is proposed to argue from the experience of the industry over recent years. Table 1 gives some of the salient agricultural statistics for four key years in the post-war period, 1946 to 1963, *i.e.*, 17 years. For each of these four years, the figures of gross farm income and output, expenses and net farm income are expressed in both money and real terms (using constant 1949–50 prices for deflation into real terms). At the end of the table are the growth rates of some of the variables.

TABLE 1: NEW ZEALAND FARM INCOME AND PRODUCT

	1945–6 Current Prices £m	1945–6 49–50 Prices	1945–6 Price Index 49–50=100	1949–50 Current Prices £m	1956–7 Current Prices £m	1956–7 49–50 Prices	1956–7 Price Index 49–50=100	1962–3(‖) Current Prices £m	1962–3(‖) 49–50 Prices	1962–3(‖) Price Index 49–50=100	Compound Rate of Growth 1945–6/1962–3 %
(1) Gross farm income	97				307			320			
Gross farm output (49–50 prices)		161	60	184		210	146		262	122	3.0
(2) Non-factor expenses (‡)	42				122			122			
Non-factor inputs (49–50 prices)		55	76	76		91	134		78	156	2.0
(3) Net farm income (§)	55				191(*)			198			
Net farm output (49–50 prices)		106		108		119			184		3.4
(4) Fixed capital (improvements, plant, livestock)		497		525		771			862(†)		4.0(†)
(5) Labour force (Nos.)		137,000		132,000		130,000			128,000		
(6) All inputs (exc. land)(¶) £m. 49–50 prices		174		194		233			230		
(7) Ratio gross output / all input		0.93		0.95		0.90			1.14		1.2
(8) Ratio output prices / input prices			79	100			109			78	

* Includes £6 million wool retention refund.   † 1960 figures for capital and rate of growth calculated to 1960.

‡ Non-factor expenses include all expenses other than wages, interest, rent, rates and taxes.

§ Net farm income includes all payments to factors of production employed (*i.e.*, wages, interest and rent); rates and taxes; and farmer' own profits.

‖ Provisional estimates.

¶ All inputs calculated as sum of non-factor inputs plus labour force at £500 per man plus 10% on fixed capital excluding U.V. of land.

Sources

Revised and extended figures from Philpott, B. P., "Capital Income and Output in N.Z. Agriculture", *Economic Record*, 1958.

The non-factor expenses (in money terms) or inputs (in real terms) represent all those expenses involving payment to people and firms outside the farm industry, and the remainder, called net farm income (in money terms), represents the income accruing to farmers themselves and to the owners of factors of production, land, labour and capital employed in the industry. It therefore represents the contribution of the farm industry to the national income, and is the amount available to pay for the labour employed, including the farmers' own labour, the capital and land used, and the taxes, including rates, which the industry has to pay. Net farm output is the corresponding concept in real terms, and represents the contribution of the industry to the real national product, *i.e.*, the real productivity of the industry being the volume of output produced less the volume of inputs purchased from outside the industry — the balance being the real product of the factors within the industry.

Gross Output

Gross output over the 17-year period 1946–63 rose at an average compound rate of 3% per annum — from a low rate of about 1.3% in the first five years and 3.4% in the latter end of the period. The target rate of growth to be discussed is 4% per annum, *i.e.*, a rise of 33⅓% on the steady post-war achievement.

Non-factor Inputs

Non-factor inputs rose at a rate of 2% per annum. Up to 1956–57, they increased at a much faster rate than this in response to high money incomes earned and the repayment of wool retention funds. A large amount of this increased spending was undoubtedly of a capital nature — fertilizer, development expenses, etc. — which went into farm accounts as deductible current expenses. It is very difficult to sort out true current spending from capital spending, but it will be assumed that the effect of the cost-price squeeze in the last few years has now reduced much of the spending on farms to that which is absolutely essential for maintaining current levels of output. To sustain a 3% rate of growth of gross output there has therefore been a 2% per annum increase in non-factor inputs. A 4% increase in output will probably require proportionately a 2.6% per annum increase in inputs — in current prices about £3 million more per annum.

FIXED CAPITAL

Fixed capital grew over the period at 4% per annum. To sustain a 4% rate of growth of output, this rate of growth of capital would probably require to increase proportionately to about 5.3% per annum. In value terms, this represents an annual rate of investment of about £60 million per annum at present prices, compared with an average of about £45 million per annum at present prices over the period since 1949–50. However, somewhere about £15 to £20 million per annum of this investment has represented new buildings, many of which were new farm houses. Such investment would not be expected to continue, or be necessary for increasing output growth.

The necessary annual rate of investment, on these calculations, would therefore seem to be about £40 to £45 million per annum. Whatever it is, it is much higher than what is currently being invested each year in farming.

LABOUR

Pending the results of research, the assessment of direct labour requirements must be nothing other than a wild guess. The official statistics of the labour force are very unreliable and the best that can be said is that in recent years there has been a very slow downward trend. This may in part reflect the shift from labour-intensive dairy farms to sheep farms, and, indeed, there is some evidence from Meat and Wool Boards' Economic Service data of a small increase of about 0.6% in labour used on some types of sheep farms. There is no doubt that, with the increased sheep numbers implied by a 4% growth rate, more direct current labour would be required, apart from the labour required for capital developmental expenditure. A rise of 1,000 to 2,000 men per anum might be estimated. Of far greater importance, however, than this somewhat wild estimate of the required increased direct labour force, is an assessment of the indirect labour force which will be discussed later.

EFFICIENCY

Some part of the 3% growth rate achieved in recent years has come from increased efficiency over and above the increased inputs used. There are various ways of measuring efficiency, none of them very satisfactory. In Table 1, items (6) and (7), it has been measured by the

ratio of total output to total input and on this basis it appears efficiency has risen by about 1.2% per annum. The importance of efficiency, even if it is difficult to measure, is that if it can be increased by more research and extension the resource requirements become that much less. This, therefore, is a major justification, if any more were required, for increased spending on these activities.

Summary of Increased Resources Required for 4% Growth Rate

Working Capital ...... £3 million increase per annum
Fixed Capital ...... £40 to £45 million per annum
Labour .... 1,000 to 2,000 men per annum

Rate of Return on Resources Required

On the face of it, utilization of biological potential is not necessarily justified unless it can be shown that the increased resources required will contribute more to the national income than they would in some other use, *e.g.*, non-agricultural exports, or import replacement. To some extent, however, this point is quite academic for the following reasons.

The prospects of increasing exports of manufactured goods so that they contribute to export income the £15 million more per annum required are, to say the least, highly improbable. As it is, many manufacturers find it difficult to survive against import competition without import control. As far as import replacement is concerned, the N.Z. Institute of Economic Research has calculated that a very great increase in exports will be required, even after allowing for further substantial import replacement. If these increases are not secured, the exchange rate will have to be devalued. The grave shortage of exports which we face implies that they are under priced.

Similarly, the effect of import control has been to divorce completely the prices of many N.Z. manufactured goods from the prices of similar imported goods, with the result that many so-called import replacements are over priced.

For these reasons, calculating rates of return on resources at current price-levels is a rather academic exercise, and even if it were found that the return in agriculture was quite low, this need not necessarily suggest that it is not well worth while and, indeed, imperative, to increase production rapidly.

However, some very rough aggregate measures indicate that, even at current prices, marginal returns to marginal

resources are quite high. Measuring everything in 1959–60 prices, the picture for the agricultural industry as a whole is something like this for the period 1949–50 to 1962–63:

Increase in gross output	......	......	£103 million
Increase in net output	......	......	£100 million
Increase in fixed capital	......	......	£481 million
Marginal return to increased capital			
(using net output)	......	......	20%

Over this period, there was no great change in the labour force. Thus, the increase in output may be attributed to the input which did change, *i.e.*, fixed capital. In fact, there was also an increase in efficiency over the period which would have increased output, even if there had been no increased capital. When allowance is made for this, the return is probably reduced to about 12%. However, neither the data nor the method of calculation are such that very great reliance can be placed on such adjustments.

On a group of 65 North Island hill country farms, and on a group of 51 North Island fattening farms (from the Meat and Wool Boards' Economic Service sample), having data for both 1953–54 and 1959–60, the marginal returns to increased fixed capital shown in Table 2 were registered. In these calculations, capital was converted into 1950–60 values, and the figures of gross output were calculated by using the Economic Service's production figures for meat and wool and valuing such production at 1959–60 prices.

TABLE 2: CHANGE IN REAL GROSS OUTPUT, ETC., BETWEEN
AVERAGE OF 1953–54 TO 1955–56 AND 1959–60

(£000 1959–60 prices)

	65 Hill Country Farms N.I.	51 Fattening Farms N.I.
Change in gross output	116	66
Change in non-factor inputs	–5	–12
Change in fixed capital	644	459
Marginal return ($\frac{\text{change in gross output}}{\text{change in capital}}$)	18%	14%

These measures of marginal return to capital depend very much on the validity of using the deflated valuation of improvements as a measure of the increase in real capital which has been employed on farms. As such, this is a very frail measure indeed, and there is no certainty that mar-

ginal returns are anything like as high as this until a lot of the work of a cost-benefit nature on individual farms and areas, currently under way at Massey and Lincoln Colleges, is completed but the evidence certainly suggests that, in real terms, the increased production has been quite worth while as a marginal return on capital.

Encouraging the Flow of Resources into Agriculture

Given that a 4% rate of growth will require more resources in agriculture, and given that, albeit with very imperfect measures, it seems that the use of such resources is economic, the further implication is how to encourage the resources to flow into agriculture.

CAPITAL

It seems very doubtful whether the ploughing-back process by farmers can be relied upon to provide the £40 million to £50 million annual investment which it has been suggested is required for 4% growth. In the nineteen-fifties, much of the agricultural investment came from this source, but we are now faced with the following facts:

(1) The cost-price squeeze has reduced the level of farm incomes to the extent that in many cases current spending is near maintenance level and there is a far lower level of disguised capital spending.

(2) The surplus available for farmers' saving and capital investment has been enormously reduced if not wiped out.

(3) The cost-price squeeze has reduced the real value (in terms of goods and services) of any given money amount of capital spending of various sorts which is occurring, and this will continue as long as the cost-price squeeze continues.

(4) More farms each year pass into new hands at high land values and are presumably highly mortgaged, so that there is less available for ploughing back from interest on owner's equity.

It is suggested, therefore, that there will need to be a lot more borrowing for development than there has been in the past. This is not just a question of setting up new financial institutions, such as Rural Banks, or improving existing ones like Marginal Lands, though these matters are of great importance, particularly if they lead to more lending based

resources are quite high. Measuring everything in 1959–60 prices, the picture for the agricultural industry as a whole is something like this for the period 1949–50 to 1962–63:

Increase in gross output .... £103 million
Increase in net output .... £100 million
Increase in fixed capital .... £481 million
Marginal return to increased capital
(using net output) 20%

Over this period, there was no great change in the labour force. Thus, the increase in output may be attributed to the input which did change, *i.e.*, fixed capital. In fact, there was also an increase in efficiency over the period which would have increased output, even if there had been no increased capital. When allowance is made for this, the return is probably reduced to about 12%. However, neither the data nor the method of calculation are such that very great reliance can be placed on such adjustments.

On a group of 65 North Island hill country farms, and on a group of 51 North Island fattening farms (from the Meat and Wool Boards' Economic Service sample), having data for both 1953–54 and 1959–60, the marginal returns to increased fixed capital shown in Table 2 were registered. In these calculations, capital was converted into 1950–60 values, and the figures of gross output were calculated by using the Economic Service's production figures for meat and wool and valuing such production at 1959–60 prices.

TABLE 2: CHANGE IN REAL GROSS OUTPUT, ETC., BETWEEN AVERAGE OF 1953–54 TO 1955–56 AND 1959–60
(£000 1959–60 prices)

	65 Hill Country Farms N.I.	51 Fattening Farms N.I.
Change in gross output	116	66
Change in non-factor inputs	−5	−12
Change in fixed capital	644	459
Marginal return ($\frac{\text{change in gross output}}{\text{change in capital}}$)	18%	14%

These measures of marginal return to capital depend very much on the validity of using the deflated valuation of improvements as a measure of the increase in real capital which has been employed on farms. As such, this is a very frail measure indeed, and there is no certainty that mar-

ginal returns are anything like as high as this until a lot of the work of a cost-benefit nature on individual farms and areas, currently under way at Massey and Lincoln Colleges, is completed but the evidence certainly suggests that, in real terms, the increased production has been quite worth while as a marginal return on capital.

Encouraging the Flow of Resources into Agriculture

Given that a 4% rate of growth will require more resources in agriculture, and given that, albeit with very imperfect measures, it seems that the use of such resources is economic, the further implication is how to encourage the resources to flow into agriculture.

CAPITAL

It seems very doubtful whether the ploughing-back process by farmers can be relied upon to provide the £40 million to £50 million annual investment which it has been suggested is required for 4% growth. In the nineteen-fifties, much of the agricultural investment came from this source, but we are now faced with the following facts:

(1) The cost-price squeeze has reduced the level of farm incomes to the extent that in many cases current spending is near maintenance level and there is a far lower level of disguised capital spending.

(2) The surplus available for farmers' saving and capital investment has been enormously reduced if not wiped out.

(3) The cost-price squeeze has reduced the real value (in terms of goods and services) of any given money amount of capital spending of various sorts which is occurring, and this will continue as long as the cost-price squeeze continues.

(4) More farms each year pass into new hands at high land values and are presumably highly mortgaged, so that there is less available for ploughing back from interest on owner's equity.

It is suggested, therefore, that there will need to be a lot more borrowing for development than there has been in the past. This is not just a question of setting up new financial institutions, such as Rural Banks, or improving existing ones like Marginal Lands, though these matters are of great importance, particularly if they lead to more lending based

on the productivity of the loan rather than the security offered by the borrower. It also means that, if there is to be more lending, there has to be a corresponding avail-ability of real resources on which the loans are to be spent; otherwise there will simply be an inflationary rise in the price of resources. Greater availability of capital resources can come about only by increased national saving, or by ensuring that resources are not sucked into, or are freed for, other less economic uses such as uneconomic manu-facturing industries.

One way of assisting in this process would be to rely on the price mechanism by the abolition of import control, and the substitution of industrial protection in the form of a flat-rate tariff on all imports. This would (1) protect only industries which, compared with agriculture, can justify on economic grounds their claim on resources; and (2) offer less inducement than does import control to wage-price inflation, by increasing the degree of overseas com-petition in the manufacturing industry, and thus put a brake on the cost-price squeeze.

Such a policy would need to have, as a complement, special tariffs or subsidies for industries which could not otherwise survive, to allow the consumer and the investor to measure the cost of these industries to the country. Such special tariffs would need to be terminable and, in the meantime, everything possible would need to be done to assist in the transfer of resources to other more economic uses. This implies a much higher level of unemployment pay and retraining schemes for workers rendered transi-tionally unemployed.

In connection with this matter of borrowing for devel-opment, it is the writer's view that, in the past, far too much emphasis has been placed on the need to reduce debt and finance development from profits, and not enough on borrowing. This is understandable, in view of the grave financial problems of the 1930s, but it has led to the situa-tion where many farmers, year after year, over their whole lifetime, are paying off table mortgages with funds that might better be employed in development.

This problem springs partly from our system of land tenure, and also from the very high land values to which we have become accustomed, which mean that the savings required by way of deposit to purchase a farm and amortise the debt are inordinately high.

To meet this situation, consideration might be given to a shift of some part of farm taxation from income tax to a fixed tax, based, like the old land tax, on the productivity

of the farm with deductions for mortgage interest (and adjustable in the light of prices for farm products and farm inputs). The effects of such a tax shift would be (1) to reduce land values by the capitalized value of the annual tax; and (2) to increase the incentive to develop and to provide the tax-free income with which to do so, since everything earned above the fixed tax would carry a far lower rate of income tax than at present.

LABOUR

The major problem with getting good-quality labour in agriculture seems to be the difficulty many young men see in eventually getting a farm, and the high premium placed in this process on possession of capital. Many of the suggestions made above for capital would apply equally to the encouragement of more labour into agriculture.

Also worthy of commendation are the suggestions about farm labour put forward by J. Andrew at the Massey College Sheepfarmers' Conference in 1962 (1).

EFFICIENCY AND INCENTIVE

This aspect of increased production, insofar as increased efficiency depends on the extension process and the spread of new ideas and new processes of production, is dealt with elsewhere in these *Proceedings* by A. T. G. McArthur. To the extent that increased efficiency depends on incentive, the fixed tax idea could be a powerful motivating force if such a tax were based on the potential productivity of the farm.

Indirect Use of Resources

In discussing the implications of a 4% growth rate in agriculture, reference to the indirect repercussions on resource use throughout the economy must not be omitted. New Zealand agriculture is renowned for its low direct dependence on labour, and its high dependence on inputs purchased from other industries, all of which require the use of resources and make up labour and capital used indirectly in agriculture. Similar considerations apply to resources used in transporting and marketing agricultural products.

The study of the reactions throughout the economy to an increase in agricultural growth is best carried out with an inter-industry transactions matrix, or input-output table.

This question is discussed by I. D. Dick in his paper, so only brief mention will be made of it here. In any case, few empirical results can be given because the Government Statistician, who is very short of resources for this project, has yet to complete and publish the accounts for 1959–60. Moreover, to study the question effectively needs a thorough disaggregation of the agricultural sector in the accounts. Work on this aspect has recently been started at Lincoln College.

One thing that can be said (using the results of some calculations based on the earlier 1954–55 accounts) is that the indirect labour force on which agriculture is dependent is very high. For every 100 men directly employed in primary industry, it has been calculated that there are approximately 114 indirectly employed in other sectors of the economy. Using the same accounts, one can calculate (again approximately) that the indirect labour requirement for 4% growth for working capital alone amounts to an annual increase of 0.33% of the total New Zealand labour force. The total annual increase in the local labour force is about 2% per annum, and a large proportion of this is automatically required for normal growth of other sectors. Thus, agricultural growth can have a very important influence in the economy. The belief that a growing agriculture cannot fully employ the labour force (hence the need for uneconomic high labour-using industries) is too facile a view and ignores completely the indirect, as compared with the direct use of labour in agriculture.

Nevertheless, a thorough exploration, using input-output techniques, is needed (and is starting at Lincoln College) of the whole pattern of indirect resource use springing from various rates of agricultural growth, allowing not only for labour but also for direct and indirect capital requirements throughout the economy. Only in this way can a scientific assessment be made of such questions as full employment, and a picture gained of the necessary changes in the structure of the economy which are implied by our target rate of growth.

One last point on this question of indirect use of resources. It seems fairly obvious (though this again can be measured by input-output analysis), that the import requirement of current and capital resources used in increasing agricultural production would be fairly low. Such increase would employ far more of New Zealand labour and materials, with far less reliance on imported machinery, than does the manufacture of raw materials and semi-

finished goods. This is important in assessing the net contribution of increased agricultural production to the overseas balance of payments of New Zealand.

Some Objections to Increased Agricultural Production

Finally, some commonly heard objections to increased agricultural production are discussed briefly.

THE DISTRIBUTION OF INCOME ARGUMENT

This is a variant of the full employment argument mentioned earlier. Increased agricultural production and imports from cheap-labour countries, rather than rapidly increased manufacturing production (and it must be remembered that both are not possible) may carry the danger of shifting the distribution of the national income away from salaries and wages towards the earnings of land. There is a degree of truth in this argument which must be treated seriously, but, if necessary, the situation might logically be met by the use of the fixed tax idea discussed earlier.

THE DIVERSIFICATION ARGUMENT

Increased agricultural production, it is said, means that too many eggs are in one basket, causing national economic insecurity. The answer to this is that if agricultural specialization pays better than a diversified economy, then it is foolish to sacrifice the gains for security at a lower level of national income, especially when there are other methods (such as prudent administration of overseas reserves) to act as protection from overseas market fluctuations.

THE MARKETING ARGUMENT

Can 4% more agricultural products per annum be sold? It is doubtful whether we can expect to sell 4% more of all our products year by year over the next decade without causing a marked drop in the prices, and, therefore, in the revenue received. Current market research, and projections based on it, suggest that, in established or possible new markets, not much more than about 1 to 2% of some products, e.g., dairy products, could be sold, or much more than 4% of others, e.g., wool. This implies that the overall 4% target rate of growth would need to take the form of a much slower growth for dairying, and a much faster rate for the sheep industry, particularly in the case of wool production from hill country. To secure this would require some form of conscious planning and policy to

ensure that, in districts where it is advisable, resources at present in dairying be shifted to sheep while, in other areas, maximum economic production of dairy products be encouraged; and that thought be given to incentives to wool and mutton production matched perhaps with deterrents to lamb production.

Acknowledgement

REFERENCE

(1) Andrew, J. C., 1962: Some thoughts on farm labour problems in New Zealand. *Sheepfarming Annual 1962*, pp. 57–65.

Lincoln College

✳

PUBLICATIONS

1. *The Systematic Evaluation of Development Projects,* J. T. Ward
2. *The New Agricultural Economics Research Unit,* B. P. Philpott
3. *Indicative Planning for the Poultry Industry in New Zealand,* J. T. Ward
4. *The International Sugar Situation and New Zealand's Sugar Policy,* A. R. Frampton
5. *Economic Implications of Increased Agricultural Production,* B. P. Philpott