Some Aspects Of Production Costs In Irish Agriculture, As Illustrated By The Cost Of Producing Sugar Beet

By Lieut.-General M. J. Costello.

(*Read before the Society on 26th March*, 1954.)

For reasons which are mainly historical but in part arise from our political evolution since 1922, very little is known of the actual costs of production and marketing on Irish farms. We have more data about the economic aspects of Irish agriculture in the 18th century than in the 20th. While an ever increasing volume of publications about agricultural economics is emerging from Universities, Research Establishments and Government Institutions abroad, similar publications about Ireland's greatest industry appear to have diminished in volume and in value since we got control of our own affairs in the Twenty-Six Counties.

In 1947 it was agreed between the Irish Sugar Company and the Beet Growers' Association that it was necessary to know how current costs of production of beet were made up and distributed between the different operations on the farm, in order that attempts might be made to reduce costs and increase profits. It was for this and other reasons decided to make a detailed investigation into the costs of production of the 1948 crop. This was done on a sample of non-mechanised farms selected by two eminent statisticians—Drs. McCarthy and Carey. The actual costing was done by Professor M. Murphy of University College, Cork, with the assistance of a large number of other workers. A Costing Committee of Beet Growers' Association and Sugar Company representatives with Professor Murphy as Chairman, settled the procedure and organised the work of the farmers and others concerned. Professor Murphy's report was published by the Mercier Press in 1949. It is a monument to his ability and learning in the field of agricultural economics and a manifestation of his tremendous energy. It has attracted considerable notice abroad but has been practically ignored in Ireland except in so far as it has provided the facts upon which the Irish Sugar Company based its programme for reducing farmers' costs of production.

No such widespread investigation of costs has been attempted since 1948, but the joint costing committee continues to make a yearly review of production costs and brings the 1948 figures up to date in so far as this can be done by substituting current rates of pay and other ascertainable current figures for those prevailing in 1948. A considerable amount of data is also available each year from the beet fields on the land owned by the Sugar Company and by a small number of progressive farmers who keep accounts. It is the opinion of the Company that another complete costing should now take

place and that the yearly revision of costs in the intervals between full costings should be based on data from a small number of representative farms in order to take into account the economics effected since 1948.

Gross Costs of Production.

The average gross costs, including the costs of harvesting tops and crowns and delivering beet to the pick-up-point on a hard road, but excluding any charge for interest on capital or for management, were :—

TABLE 1

	Per Acre	Per Ton of Beet
	£ s. d.	
1. In 1948 as ascertained on non-mechanised farms, average yield, 11·21 tons	41 14 8	74/5d.
2. A recalculation of these costs with the same input of labour and fertilisers and the same yield in 1953 ...	58 11 9	104/6d.
3. By substituting known costs of work done by co-operative groups equipped with modern tools the 1953 costs at the same yield would be ...	48 2 0	85/10d.
4. No. 3 recalculated for actual 1953 yield of 12·58 tons would be	48 9 0	77/0d.
5. Actual costs on farm of Mr. R. Bryan, Bandon—see " Beet Grower " Vol. 7, No. 4, page 430—at 15·93 tons per acre	42 8 4	
Add Rent, Rates, Other Overheads and incoming manurial residues	4 10 3	
	46 18 7	58/11d.

Some Corresponding Figures from the West of England.

	Per acre	Per Ton of Beet
	£ s. d.	
6. Shropshire and Staffordshire, 1949, 10·75 tons (Estimated freight charges deducted from published figures)	45 17 6	85/4d.
7. Shropshire and Staffordshire, 1951, 12·5 tons (Actual freight charges deducted)	55 16 2	89/3d.
(6 and 7 are derived from University of Manchester, Agricultural Economics Department, Bulletin 68/EC37, May, 1952.) Other Universities publish similar data, notably Cambridge, Oxford, Nottingham, Leeds.		

DIVISION OF GROSS COSTS PER ACRE, INCLUDING FREIGHT BUT EXCLUDING RESIDUES FROM PREVIOUS CROPS.

TABLE 2.

Based on costed farms and yield of 11·21 *tons.*

	1948	1953
	£ s. d.	£ s. d.
Manual Labour: 350 hours	20 12 9	32 11 4
Animal and tractor work	4 11 11	5 4 11
Farmyard Manure and Seaweed	3 11 8	5 7 6
Artificial Manure	7 8 4	8 2 7
Seed (Natural)	1 14 1	1 17 5
Rent	0 5 1	0 5 1
Rates	0 6 10	0 9 1
Other Overheads: Fencing, Beet Growers' Association Subscription, Travelling, etc.	2 0 0	2 10 11
Freight charge on beet paid by farmer to public carriers	4 19 0	2 10 5
	45 9 8	58 19 3
Freight paid by Company	1 12 8	6 14 6
	47 2 4	65 13 9
Cost of delivery included above are:		
Total costs of delivery borne by farmer, including labour and use of farmer's own transport ...	6 1 8	4 6 0
Add Freight Subsidy	1 12 8	6 14 6
TOTAL COSTS OF DELIVERY ...	7 14 4	11 0 6

Nett Costs per Acre.

Sugar is a pure carbohydrate synthesised in the beet out of air and water by the action of sunlight on the chlorophyll in the leaves. None of the mineral elements in the soil are in the final product which is white sugar. Some of the large quantities of fertilisers required to produce a vigorous plant remain in the soil (manurial residues), some may be leached from the soil in drainage water; some are contained in the residual dry matter of the beet after extraction of sugar. The latter go back to the farmer in the pulp and molasses and when fed to animals on the farm are in part returned again to the land as manure. Others are extracted from the beet juice by precipitation and filtration and are incorporated in the factory filter press lime which now goes back to the land. But the largest amount of the minerals in the beet plant are in the tops and crowns left on the farm.

Beet tops are a valuable feeding stuff and the present yield per acre (1·2 tons starch equivalent) affords more fodder per acre than the average crop of mangels or turnips, and over twice the estimated yield of starch equivalent from an average acre of Irish grass. (Dr. Kennedy's estimate of about 10 cwts.).

14 tons beet tops @ 8·6% Starch Equivalent=1·2 tons S.E.
17 tons mangels @ 6% Starch Equivalent=1·02 tons S.E.
15·7 tons turnips @ 7% Starch Equivalent=1·1 tons S.E.

Incidentally, the starch equivalent of the beet pulp produced in 1953 was 0·64 tons per acre.

To arrive at the nett cost of beet it is therefore necessary to credit the crop with the value of the beet tops and the residual manurial values. An arbitrary figure for cleaning is also credited to the crop in Irish costings.

The credit for tops allowed in 1948 was arrived at on the basis of the ascertained disposal of tops on the costed fields. Some, instead of being fed were ploughed in as manure and were therefore valued only as manure. There is now a greatly increased usage of tops for fodder and a new costing investigation would no doubt show a greatly increased credit under this head.

The credits per acre are as follows:—

TABLE 3.

	For Tops	Manurial Residues	Cleaning	Total
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
In 1948 (11·21 tons) ...	8 0 8	6 13 8	1 4 0	15 18 4
In 1953 as recalculated on the basis of 1948 results (11·21 tons)	11 8 2	8 9 6	1 17 11	21 15 7
1953 credits on actual realised yield (12·58) and assuming full utilisation of tops and crowns (14 tons)	17 10 0	8 9 6	1 17 11	27 17 5

Nett Costs of Beet after deducting above.

TABLE 4.

	Per Acre	Per Ton
	£ s. d.	£ s. d.
In 1948 (11·21 tons)	25 16 4	46/3d.
Recalculated for 1953 at 11·21 tons	36 16 2	65/2d.
Recalculated on basis of realised yield of 12·58 tons and 100% utilisation of tops	31 1 10	49/4d.
Nett Costs on Mr. Bryan's farm in 1953 excluding management, interest and freight charges, 15·93 tons	20 11 0	25/10d.

The overhead costs, other than B.G.A. Contribution, per acre are constant irrespective of yield. The labour costs for cultivation are almost independent of yield assuming that work is not skimped. The outstanding feature of the 1948 Beet Costings was the proof given that the cost of production of a ton of beet depended to a

greater extent on the yield per acre than on any other factor. This, of course, is only a confirmation (even though a striking one) of a fact well established by agricultural economists abroad, namely that the decisive element in the cost of production of a unit of agricultural produce is the yield per acre whether it be in tillage crops, butter fat or meat.

Until some other limiting factor intervenes, the yield is of course determined, other things being equal, by the amount of plant food available. In discussing the economics of using fertilisers, Irish economists have been handicapped by inadequate data. The experiments upon which conclusions have been based were an unreliable foundation because they did not provide for the application of a quantity of the manurial elements balanced in relation to the demands of the crop and the supply of the required elements already available in the soil. Shortage of lime, low pH, inadequate drainage, the existence of a plough pan are each in practice limiting factors, which fix the maximum yield. Fertilisers over and above the quantity required to feed a crop so limited can give no return.

Except in the most extraordinary price conditions, the law of diminishing returns does not apply in the case of fertilisers so long as the plants are able to utilise all that is applied. If, however, the various types of fertilisers are not applied in a balanced form corresponding to the needs of the crop and to the quantities of each available in the ground, the application of an excess of one or more will not only confer no benefit but may, on the contrary, reduce yields by depressing the uptake of other elements. This fact has not been sufficiently understood and to some extent at least the inadequate use of fertilisers in Ireland is due to the painful experience of farmers who have applied unbalanced fertilisers and had bad results.

The following typical examples of the effects of liming acid soils are taken from demonstration plots grown in 1950. In each case half the field was manured and cultivated and sown by the farmer in accordance with his usual practice. These are Plots "B." The other half, Plot "A," was limed, manured and cultivated according to the directions of the Sugar Company, but all work was done by the farmer himself.

In one case a nett expenditure of £27 8s. 2d. per acre on Plot "B" resulted in a total crop failure while on Plot "A" the expenditure of £32 19s. 4½d. per acre resulted in the production of beet value £65 5s. 10d. and tops with a value as used of £10 18s. 3d. The essential difference between a loss of £27 and a profit of £45 was the application of 7 tons of Sugar Factory Lime.

In another case, Plot "A" which got 7 tons of lime and balanced fertilisers, produced over 15 tons of beet at a nett cost of 43/6 per ton, while plot "B" also well fertilised but without lime, yielded 7 tons 8 cwts. at a cost of 75/5 per ton. In 1948, each of the costed beet fields was sampled and analysed by the Sugar Company and the farmer was advised of the manurial requirements. No pressure was put on him to apply the lime and fertilisers required and, indeed, in some cases the required lime could not be obtained. Nevertheless, a large number did apply the manures indicated to be necessary. This is the principal reason for the fact that a sample selected to give the National average yield in fact produced 11·21 tons of washed

beet per acre or nearly 2 tons more than the National average of 9·3 tons.

The following table shows the effect of yield per acre on costs and profits of the beet fields costed in 1948 :—

TABLE 5.

Yield per Acre	Average Nett Cost per acre at Factory	Average Nett Value per acre* at Factory at £4 16s. 9d. per ton	Average Cost per ton at Factory	Average Nett Profit per Acre	Average Nett Profit per Ton
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
4–7	27 3 2	27 9 6	4 15 7	0 6 4	0 1 2
7–8	28 6 5	36 5 7	3 15 6	7 19 2	1 1 3
8–9	28 4 1	41 4 4	3 6 2	13 0 3	1 10 7
9–10	29 13 11	45 15 3	3 2 9	16 1 4	1 14 0
10–11	30 10 9	50 13 0	2 18 4	20 2 3	1 18 5
11–12	30 14 6	55 15 6	2 13 3	25 1 0	2 3 6
12–13	31 4 3	60 3 7	2 10 2	28 19 4	2 6 7
13–14	31 17 3	64 19 4	2 7 5	33 2 1	2 9 4
14–15	36 9 7	69 18 0	2 10 6	33 8 5	2 6 3
15–19	33 18 4	76 9 7	2 2 11	42 11 3	2 13 10
All costed Fields	30 15 4	54 4 7	2 14 11	23 9 3	2 1 10

*At an assumed average sugar content of 17·00.

This Table shows that :

(1) A yield of six tons per acre was required to give a profit in 1948.

(2) To growers in 4–7 ton per acre group, a rise in yield to 7½ (average increase 1·82 tons) would increase their profit per ton as much as an increase in price of £1.

(3) A rise in yield from 7½ to 11½ tons would double the profit per ton, viz., £2 3s. 6d. for the latter, as against £1 1s. 3d. for the former yield.

(4) For growers with a yield of 13½ tons per acre the profit is more than 100% on the cost of production.

From the point of view of the National economy as well as from the point of view of the Beet Sugar Industry, the most valuable result of the 1948 beet costings has been the acceptance for the first time by a considerable number of farmers of the proposition that increased profits depend upon yield per acre to an extent even greater than upon reduction in costs of production per acre.

There are, however, still some beet growers who do not appreciate this point. The number whose yield is so low as to cause a loss on the crop is rapidly diminishing, but those left in this category are often vocal and are in many cases men in public life with platforms from which they can get publicity for their opinions that the price of beet is too low. It is not so easy as it might appear to make it known that the real trouble in these cases is that the yield is too low

and that it would in some cases require an increase of 250% in the price of beet to give such farmers a profit equal to *the average of all beet growers*. An increase of 290/- per ton of beet would bring the price to 406/- a ton for beet of 17% sugar. Assuming 7 tons of beet to be required for the production of 1 ton of sugar, the cost of extractable sugar in the beet would be $7 \times 406 = 2{,}842$/- plus 7×12/- $= 84$/- average freight subsidy, or a total of 2,926/- per ton, that is 146/4 per cwt. If the cost of distribution of sugar which is 9/9 per cwt. is added, the cost of sugar, excluding all costs of manufacture, bagging, storage, insurance, etc., would be 156/1 per cwt., or over 1/4 per lb.

While the significance of possible savings in costs of production is small by comparison with the reduction in cost per ton that follows increased yields, there is, nevertheless, immense scope for economy in the cultivation and harvesting of the crop as practiced on the fields costed in 1948. A substantial saving in costs of production per acre has, in fact, been achieved on perhaps the majority of farms and this saving has been made concurrently with a progressive increase in yields.

The National average yields per acre are :—

Prewar	..	9·83 Tons
1948	..	9·23 ,,
1949	..	10·80 ,,
1950	..	9·81 ,,
1951	..	9·66 ,,
1952	..	10·46 ,,
1953	..	12·58 ,,

An analysis of the reasons for these increased yields is of great interest. and value but would be outside the scope of this paper. The matter is mentioned here only to refute the widely held idea that increased yields must necessarily involve significant increases in costs per acre

In 1948 the spread of costs per acre was as follows :—

TABLE 6.

Spread of Production Costs per Acre.

	Average of 31 high cost farms	Average of 31 low cost farms	Average Difference
	£ s. d.	£ s. d.	£ s. d.
Total costs, excluding rent, rates, overheads and freight ...	40 3 5	24 17 5	15 6 0
All labour for cultivation (at a uniform rate per ton) ...	25 15 7	16 6 1	9 9 6
Labour Costs of Singling and Weeding	9 14 10	5 13 5	4 1 5
Labour costs of harvesting ...	9 10 3	6 0 2	3 10 1

These figures give an indication of the potential savings in production costs on " high cost " farms.

The spread of costs between districts is even more remarkable and indicates the tendency in different localities for farmers to conform to a standard traditional manner of working.

TABLE 7.

Summary of variations in Average District Costs of Labour.

Groups of Operations	Lowest Average district cost per acre	Highest Average district cost per acre	Over all district range per acre	Average cost per acre (All fields)
Stubble operations and deep ploughings ...	35/3d.	59/2d.	23/11d.	46/4d.
Harrowing and other cultivations ...	20/1d.	60/10d.	40/9d.	35/0d.
Drilling and Sowing ...	18/5d.	39/9d.	21/4d.	27/6d.
Manuring and Liming	42/0d.	93/3d.	51/3d.	63/1d.
All operations—Crop in ground	136/0d.	242/6d.	106/6d.	174/11d.

These variations in cost are due to a great many different factors of which the following are the most important.

(*a*) Inadequate tools.

(*b*) Inability to get work such as scarifying stubbles, ploughing, hoeing, weeding and singling done at the most favourable time. (Insufficient labour for peak demands but surplus at other times.)

(*c*) Small fields and fields distant from the farmyard involving much unprofitable travelling.

(*d*) Avoidable ploughings and other cultivations arising partly from (*a*) and (*b*) and partly from following traditional practices instead of ones now proved more economical and equally satisfactory and superior.

(*e*) Lack of skill.

Effect of Improved Methods on Production Costs.

From the comparisons already made it will be apparent that a considerable reduction in the average cost of production per acre is attainable without any loss of yield. In fact the adoption of methods used on farms such as that of Mr. Bryan would have a powerful effect in increasing yields as well as reducing costs. The double effect is a gross cost per ton of beet little more than half of the national average. If credits for the manurial residues and tops as actually used on Mr. Bryan's farm be taken into account, his nett costs of production are about 40% of the national average. He is farming only 70 acres of land and it would not be possible for him to work at such a high level of efficiency if it were not for the following :

(*a*) He is a manager of exceptional skill and energy.

(*b*) He works in co-operation with his brother so as to reduce the cost of much work such as ploughing, by having the same machines work both farms and thus halve the standing charges on them.

(*c*) He has a well balanced farming programme, which provides full employment throughout the year for a farm staff of 12 persons, thus providing an ample labour force for dealing adequately with the singling of his 10 acres of beet. Incidentally, if it were possible to farm the whole of our 11½ million acres of agricultural land with the same intensity as Mr. Bryan achieves, there would be regular employment for 2,136,000 men or nearly 1,700,000 more than the number now employed. The gross farm income would be raised to about £1,150,000,000 and the importation of maize or other fodder would cease.

(*d*) He was one of the guiding spirits in an efficient co-operative group of beet growers, which was able to make full use of precision seeders, multi-row hoes and mechanical harvesters to reduce production costs and get good work under the most favourable conditions, and to avail to the full of the advisory services provided by the Sugar Company.

The following Table 8 shows the financial effect of improved methods on the average cost of production.

TABLE 8.

Table showing the effect of Mechanisation and co-operation on some costs of Production.

	Charges allowed per acre in Costing, 1953 crop	Charges of Co-operative Machinery Groups or Contract work	Saving
	£ s. d.	£ s. d.	£ s. d.
Ploughing	2 14 10	1 5 0 (Contract)	1 9 10
Seed Bed Preparation	2 2 3	1 7 0 (Contract)	0 15 3
Sowing	1 18 11	1 5 0 (Precision Seeder)	0 13 11
Seed	1 17 5	1 4 0 (Decorticated Seed).	0 13 5
Pre-singling cultivation	2 0 9	1 10 0 (Multi-row hoe)	0 10 9
Gapping and Singling	6 15 8	4 0 0 (Contract)	2 15 8
After Cultivation ...	3 11 10	3 10 0 (more cultivation done).	0 1 10
Harvesting	9 9 1	6 0 0 (Armer Harvester)	3 9 1
	£30 10 9	£20 1 0	£10 9 9

NOTE: The charges for harvesting with Armer Harvesters are:

£5 0 0 per acre for October.
£5 10 0 ,, ,, in first half of November.
£6 0 0 ,, ,, in second half of November.
£6 10 0 ,, ,, in first half of December.
£7 0 0 ,, ,, in second half of December.

Ploughing on the average beet field cost £2 14s. 10d. in 1953 when done by horses. It is possible to get contractors who will do the job for £1 5s. 0d. Mr. Bryan's cost is £1. Contractors charges in England are much higher than this because the contractor cannot be certain of full employment for his equipment. But the 40 acres of tillage on Mr. Bryan's farm and in a well organised co-operative group, give full employment for each expensive tool. Some of the high cost of ploughing is due to the fact that fields were unnecessarily ploughed more than once.

Speaking generally and without reference to the costed farms, the position is that much of the ploughing for beet is not done in a satisfactory manner. It is often too shallow due to lack of power and to the force of tradition, it is often too late to avail of winter frosts to condition the seed bed and it is sometimes just badly done. Seed beds can be better prepared at lower cost by shallow spring cultivation just before sowing instead of repeated cultivations over a longer period of time, and by sowing on the flat instead of making drills. The saving here as shown in Table 8 should be combined with an increase in yield. Efficient tools such as simple floats and the old type spiked harrow on a wooden frame are not generally available. Much tractor power is wasted by hauling implements below the tractor's capacity or single implements where two or more could be hauled in tandem.

For the sowing of the seed a precision drill costing about £200 is made by the Sugar Company. This will do better work and thereby improve germination and even growth of the crop. It will also sow decorticated seed which, when sown with precision, results in a stand of plants which can be singled with much less labour and much less check in growth of the beet, by comparison with the old methods. The high cost of the machine is in part off-set by the fact that it sows 4 rows instead of one, and by its ability to sow on the flat. But there are about only half a dozen farmers in Ireland who have enough beet to afford full employment during the sowing season, for such a machine. As much as 180 acres have in fact been sown by one, so it must be in the hands of a contractor to get overhead costs per acre down to the minimum. And the contractor must have a guaranteed acreage to enable him to work at a fixed charge eliminating the speculative element. The contractor, therefore, is in a co-operative group, each member of which guarantees to offer his share of the work and has in return a guarantee of getting the job done at the right time, because the contractor is not allowed to take on more work than he can do. The work is done well because the man sowing so much gets more experience and develops more skill than would each man sowing a little. It is done well also because the contractor is appointed by the group, is a neighbouring farmer or farmer's son and is dependent in turn upon other members of the group to do contract work with other tools on his land.

The savings in cost of seeding arise from the fact that with the precision seeder only 6 lb. of decorticated seed @ 4/– are required instead of the 20 lb. natural seed @ 1/10 used with the ordinary seeder. The decorticated seed is dearer by reason of the cost of processing it at the factory and the proportion of weight lost in processing.

The reduction in singling costs is due to :

(*a*) decorticated seed,
(*b*) better inter-row hoeing with improved multi-row hoes,
(*c*) the introduction of long-handled hoes for singling,
(*d*) the introduction of expert migratory workers from Mayo who acquired their skill in England.

Some of these have earned £2 to £2 10s. a day at beet singling in Munster and Leinster.

Cultivation after singling was in general inadequate on beet fields in the past. The introduction of a 4 row hoe to replace the common single row horse hoe, has speeded up the work and reduced the cost per hoeing. It is a better tool giving much superior results and because several more hoeings can now be given, the fact that there is no saving in production cost is of no importance, by comparison with the possibilities of greatly increasing the yield.

Mechanical harvesting saves a good deal in harvesting costs only because very high wages used to be paid to task or contract workers at this peak of labour demand. The introduction of an efficient harvester has greatly lessened the peak and made hand labour more freely available at rates which are satisfactory to the farmer and the task worker. They can earn 30/- to £2 a day and when in competition with the machine are doing much better work than was formerly the case.

If experience with the beet crop is a reliable guide thereduction of costs of production on Irish farms depends upon the organisation of farmers into small co-operative groups, capable of employing the most efficient machines, each at the most economic level of output and securing a high standard of skill through specialisation.

The following figures for man hours per acre of beet give an indication of the potential savings in man hours on the farm. Even though such savings result in increased expenditure on machinery and part of the man hours saved on the farm is off-set by increased labour in machine factories and repair establishments, the economic possibilities are great in the case of crops like beet and potatoes with such a high labour content at present, and there are no less spectacular possibilities in the production of milk, bacon, poultry products and even beef.

TABLE 9.

Man Hours per acre of Beet.

Ireland	Average on farms costed in 1948	350
	Mechanised farms 1948	212
	Mechanised farms with mechanical harvesting 1949	124
	Mechanised production on flat with precision seeder, multi-row hoe and mechanical harvesting Thurles Factory	84
United Kingdom	Shropshire average in 1948	176
	Estimated average 1953	100
U.S.A.	Mechanised farms with multi-row sowing and hoeing 1930	118
	After introduction of mechanical harvesting 1933...	95
	After mechanical singling 1953	58½

Seasonal Labour Demand.

The attached curves illustrate the seasonal input of labour on the beet crop on the costed farms in 1948, and on a mechanised farm in 1949 when mechanical harvesting was adopted on this farm.

Perhaps the greatest economic problem in beet production in Ireland is the unbalanced labour demand on the average family farm in most parts of the country. The pattern of production is largely traditional and is hampered by inadequate equipment, often by inadequate capital and still more often by a lack of confidence in the profitability of intensive production. This is reflected in a marked reluctance to pay regular labour even at rates which are effectively about half the English rates. In turn this leads to poor work and delays in critical operations such as sowing, singling and weeding, which cause serious loss of yield and increase costs when operations are delayed beyond the most suitable times.

There is a great need for conscious planning of agricultural production in relation to the labour force available, and for more adequate equipment for dealing with work which should be done promptly or at periods of peak labour demand. Increased tillage, intensive dairying and increased production of pigs and poultry would have far-reaching effects on the total output per man, as well as the total output per acre.

Progress in the reduction of costs of production of beet is also retarded in many areas by the persistence of relatively primitive methods of production of other crops.

Possible Future Developments.

So far I have dealt only with those ways of reducing the costs of production of a ton of beet, which have been adopted and proved on many Irish farms. There are some additional possibilities.

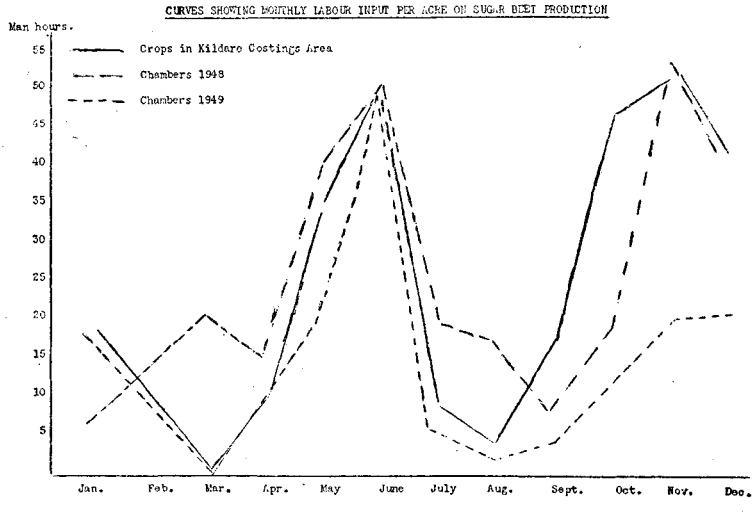
It is obviously too much to expect that any considerable number of farmers can attain to the standard of skill of Mr. Bryan. Such men would be exceptional in any walk of life and would in other vocations be likely to reap rewards vastly greater than the average. But if all our farmers cannot be of his calibre association together in a co-operative group is likely to raise the level of management of many towards that of the best men in the group.

If such association leads to more rational planning of land utilisation, a general improvement in land fertility is bound to follow. There would be a more adequate use of lime and fertilisers. The production of much heavier yields of better quality grass with clover to fix nitrogen from the air and the reduction of weed infestation would follow. This and the heavier stocking it would make possible would ensure higher crop yields with less buying of artificial fertilisers than has proved necessary for heavy beet crops.

By adopting the proved technique of making methane gas while at the same time conserving nitrogen phosphates and potash now lost, an immense increase in the supply of fertilisers to the land could be secured from the resources of the farms. A further significant saving in costs could be secured by exploiting the possibilities of spreading the slurry from the gas-producing tanks with tractor hauled tanks loaded by a pump.

The very high costs of transport could be reduced by the intensification of beet growing so as to reduce the average length of haul by getting the necessary supplies for each factory within a shorter radius and by better loading and carrying equipment.

Any development which would lead to an evaluation of agricultural work and agricultural produce on the basis of economic facts would result in home grown fodder being exploited for what it is worth, and in maize being given a value corresponding to its starch equivalent instead of a sentimental or even political value as at present. For instance, while dried beet pulp is available at its present price, a corresponding value for maize would be 16/7 per cwt. For those purposes for which wet pulp is suitable one would want to get maize at 7/- a cwt. and dried pulp at 5/- a cwt. to get equal value. The general understanding of such points as this is only one of the fruits which might be expected of a systematic and widespread study of farm economics. Such understanding would, by leading to a better appreciation of the value of beet tops and crowns and beet pulp, enable beet to be bought at a lower price without lessening the real profit margin of the farmer. Until we get the facts and the national action which they indicate, Irish farming and farmers must suffer from the consequences of using instead those less satisfactory guides now so popular, that is, catcheries, prejudices and appeals to the emotions.



DISCUSSION.

Dr. H. Kennedy proposed the vote of thanks.

Mr. J. R. Richards-Orpen said: As a member of the Society who is also a beet grower I have been deeply interested by General Costello's paper and would like to comment on some of his findings in the light of my own experience and costings.

I think that the saving in cost through the use of machinery as

set out in Table 8 is somewhat exaggerated and instance the cost per acre of the precision seeder and the Armer harvester. When the Armer harvester is used it is necessary to have a second man on the machine whose labour cost is not included in the hire charge for the machine, and it is also necessary to open headlands by hand, both round the field and through the crop, before the machine can start work. Personally I have not found machine harvesting cheaper than handwork, an experience confirmed by other farmers, and I think that the advantage of mechanisation lies more in the ability which it gives the farmer to get the work done where a large acreage of beet is desired than in reducing costs.

Table 3 shows a credit for tops assuming full utilisation which amounts to £14 12s. per ton of starch equivalent. I would prefer to reckon the value of tops as equivalent to the cost of silage which the tops can be used to replace, or alternatively as equivalent to the cost of producing starch equivalent in some other comparable form such as kale on farms where beet-growing is given up. Generally speaking most beet growers are progressive farmers and these can produce starch equivalent in the form of silage or kale at around £10 per ton.

The credits for the residual values for manures used in the 1948 costings are taken from British figures published in 1946. No other values were available at that time but I think that our present knowledge of the nutrients withdrawn by the crop and of the degree of fixation of nutrients which occurs in many soils in this country enables us to calculate more accurately what these values are.

No allowance was made in the 1948 costings for interest on the farmer's capital or for his time spent in management. I hope that in any future costings this position will be reversed. With full use of precision seeders, steerage hoes and harvesters the capital invested specifically for beet will amount to some £20 per acre of the crop. The element of management involved in growing beet is large and probably takes more time and paper work than is the case with any other crop.

I have found the published results of the 1948 costings of great value. It has been possible for me to correct some of my own shortcomings as a beet grower by comparing my own costs with the published figures, and these figures have also helped to supply costings for other crops in so far as the operations are comparable. As a farmer I would like to support the suggestion that a new costings be undertaken. There are undoubtedly misconceptions amongst farmers as to the trend of costs and I suspect that there may be misconceptions on the other side also.

I note in the concluding paragraphs that there is a hint of an extension of the limited form of rationing of the beet acreage introduced for the first time this year. It seems unfortunate that this rationing is likely to be based on the distance of the grower from the factory, and therefore the decision taken some two years ago to increase the capacity of the existing factories rather than to build new ones is regrettable. The farming community as a whole was not consulted prior to this decision which will have the effect, if beet-growing is to become concentrated around the factories, of confining the crop in the case of Carlow to a region already well favoured agriculturally

and in the case of Mallow of excluding parts of West Cork which are particularly well farmed and suited to beet-growing.

In conclusion I would like to emphasise that much more important to me than any relatively minor criticisms which I have made is my feeling of gratitude to General Costello and the Sugar Company for the services they are rendering to the farmers. In research, advisory work and progressive outlook their contribution to our agriculture is outstanding.

Dr. R. C. Geary : I would like to join other speakers in congratulating General Costello on his illuminating, heartening and generally excellent paper. May I also take this opportunity of congratulating Comhlucht Siuicre Éireann Teo. and its collaborators on the success of the beet costings inquiry?

There are two points in the paper, however, about which I must demur. The second sentence in the paper which reads : " We have more data about the economic aspects of Irish agriculture in the 18th century than in the 20th " completely mystifies me. There is a vast wealth of official statistical material relating to Irish agriculture extending over a long term of years, relating to holdings, man power, numbers of live stock, crop yields and acreages, output, prices and external trade which were practically non-existent in the 18th century. Admittedly we have little costing or survey material except for sugar beet and milk (report in preparation) but surely nothing was known of costings in the modern sense of the term in the 18th century. The main lacuna in official statistics is the National Farm Survey, which was promised at a meeting of the Society some years ago. I can now inform all interested persons that an important announcement on this subject will be made in a few weeks' time.

The second point is contained in sub-paragraph (*c*) on page 12. Here the lecturer exalts Mr. Bryan's impressive experience into a national statistical principle, in the statement that—

> (*c*) " He has a well balanced farming programme, which provides full employment throughout the year for a farm staff of 13 persons, thus providing an ample labour force for dealing adequately with the singling of his 10 acres of beet. Incidentally, if it were possible to farm the whole of our 11½ million acres of agricultural land with the same intensity as Mr. Bryan achieves, there would be regular employment for 2,136,000 men or nearly 1,700,000 more than the number now employed. The gross farm income would be raised to about £1,150,000,000 and the importation of maize or other fodder would cease."

This is simply fantasy. It is about as useful as to speculate on what the National Income would be if every person with a job had General Costello's salary which I am sure is not half what it should be, at any level. It is biologically impossible to quadruple the existing farm force from the present farm population in less than 200 years even if migration from farms were eliminated. Are we then to contemplate the immigration of 1,000,000 foreign farm workers ? The gross output value suggested is about 8 times current output : where are we to find a market for surplus production on this scale or investment capital to bring it about ? On the plane of realism it would

be a major achievement to stabilise the existing farm force at its present level of half-a-million, given the steep downward trend in recent years, which is a universal phenomenon. General Costello implicitly recognises this elsewhere in his paper in his advocacy of mechanisation to cut costs, for mechanisation will lead to reduction in manpower unless production is greatly increased. Everyone will be in sympathy with General Costello's object in citing these figures. He clearly regards this as a vivid way of bringing home to all concerned the potentialities of Irish agriculture. My surmise is that he will obtain far more publicity for these fantastic figures than for the wealth of useful statistics and the solid train of argument based on them, of which the rest of the paper consists, and this will be a great pity. A Gresham's law applies here also that bad statistics drive out good. I am convinced that, to be effective, propaganda should be realistic. Wherever we go we have to start from where we are now.

I hope that our distinguished lecturer will not think that I am making a mountain of caveat out of the mole-hill of a sub-paragraph. The present is not, however, the only instance during recent months of what we statisticians regard as oversimplified estimating or targeting, or what you will. We would not worry unduly if these kinds of figures did not propagate false ideas of the facts of the case, and take people's minds away from the right approach to the solution of national problems.

Subsequent to the meeting, *Dr. M. D. McCarthy* sent the following written communication :

I regret very much that time did not permit me to speak at the meeting so that I might associate myself with the remarks on the value and interest of General Costello's paper and the well-deserved vote of thanks which was carried to him. His paper amply illustrates the usefulness of costing inquiries in agriculture, not only for the help which they give in the formulation of agricultural policy but also, particularly, for the way in which they can assist in the solution of problems of management on individual farms. There is, however, one thing which such costing inquiries are not capable of doing by themselves, and that is the main thing which they are expected to do in this country : fix the prices which farmers should get for their produce.

In the first place I agree with previous speakers that, while it is difficult enough to devise an inquiry which will ascertain the various elements of the prime cost of production, there are other elements, which should be allowed for when settling the price, which are impossible to evaluate in any costings inquiry, especially in one which relates only to a single enterprise. I refer, of course, to items such as managerial expenses and interest on capital. In the second place, even if we assume that all the elements of price can be estimated, there are considerations other than costing ones which should enter into price fixation. It may be that the interests of the community justify the payment of either more or less than what is considered " fair " profit to the farmer.

My main objection, however, relates to the impossibility of getting, with the present costing techniques, returns from a truly " representative " sample of farmers whose average costs may reasonably be

taken as those of all farmers. I am particularly anxious to get this on record since General Costello states that the responsibility for picking the sample of farms for the 1948 Beet Costing Inquiry was mine and Dr. Carey's. He implied in remarks which he made, though perhaps not in the paper itself, that the fact that we selected the farms was a guarantee that the sample was "representative." May I state categorically that we did not select the farms for the Inquiry? What we did was to analyse the available data on the geographical location, size of farm, acreage of beet grown and yield in previous years. We grouped the various beet producing areas into reasonably homogeneous geographical units on the basis of those figures, and indicated the number of farms to be selected in each size, acreage and yield group in each area so that the stratification of the sample might correspond to that of the population being sampled. The actual selection of the farms in each of the specified groups was not made by us. As far as I know it was made by the Irish Sugar Company's agricultural advisers. Even though the farms chosen to be costed were selected to the appropriate numbers in the different groups in the various areas, unless this "within group" selection was made at random, without reference to any other characteristics of the farm or farmers, the originally selected sample cannot *prima facie* be considered as representative in the statistical sense. I personally am extremely doubtful that this selection was truly random. I believe that, unconsciously or otherwise, farmers who were considered to be likely to agree to co-operate in the Inquiry were picked to the numbers needed in the appropriate categories. The effect of this lack of randomness on the Inquiry is known only in regard to the single factor of yield per acre. On page 31 of the Report of the Inquiry, it is stated that on the 338 beet fields originally selected the average yield was 10·45 tons per acre compared with the national average of 9·23 tons per acre. Whether this difference is due to the method of selection or to especially close contact between the farmers and the agricultural advisers to the advantage of the farmers I do not know. The fact remains that the discrepancy is of serious dimensions and it is virtually certain that equally important discrepancies, which cannot be evaluated, exist in the case of other factors between the originally selected sample and the general population of beet growers. It is quite impossible to say how the costings were affected by these discrepancies.

Such divergences between sample and population are serious, but superimposed on them there are the divergences which arise from the fact that only 50 per cent. of the originally selected sample is included in the final figures. Again, we can determine the effect of such defections from the sample only for a single item, the yield of beet per acre. The average yield of the farms included in the Inquiry was 11·21 tons per acre, as compared with the two figures for the original sample and for the generality of beet growers quoted above. It is also highly probable that the fact that only one-half of the originally selected sample was included in the final figures gave rise to considerable differences between the costings figures, which were actually derived from the sample, and those which would have been obtained had it been possible to include all the original sample. In the case of the only factor for which results are available—the yield of beet per acre—the sample was not "representative," and it is very unlikely

that, in the statistical sense, it was "representative" for the other elements of cost.

One feature of Irish agriculture which is made abundantly obvious by the Beet Costing Report is the extreme variability of the results on different farms. On individual farms costed the net cost of washed beet per acre varied from £16 to £20 to over £44, and the net cost of washed beet per ton varied from 20s. to 30s. to over 100s. It is therefore clearly necessary that in devising such an inquiry the numbers included should be large enough adequately to sample the very variable material. An increase in the numbers sampled is essential if one is to have accurate final averages. It is purely an illusion to imagine that meticulous accuracy in a very limited sample can yield accurate statistics for such variable material. Increase in numbers also makes it possible to relax somewhat the requirements of randomness and by the use of controls to correct for any deviations which may be thus introduced. For a given cost of an inquiry greater overall accuracy can be attained by an increase of numbers even at the cost of a certain decrease in accuracy in each individual return. One of the prime needs for accurate representative results in agricultural costing inquiries in this country is that a technique should be devised for simplifying individual returns so that larger numbers can be included in the inquiry with the minimum loss of accuracy in individual returns as compared with the present methods.

In a further communication, General Costello stated :—

With reference to Dr. McCarthy's comment, I would like to say that the actual selection of farms was not made by the Agricultural Advisers of the Sugar Company. The areas determined consisted of a number of loading areas and the division of the sample over those areas practically determined the matter. Actual farms to fit the specifications in each loading area were found by office clerks from the records. In most cases, there was only one in each category. The doubts now expressed about the randomness of the sample were never communicated to the Costings Committee. If they had been, the Committee would, in this, as in all other technical matters, follow its decision to adhere to whatever method might have been prescribed by Dr. McCarthy. It is not true to say that the effect of the alleged lack of randomness in picking the costed farms is known in regard to the factor of yield. The reasons for the increased yield of the sample are discussed at length in my paper. The reasons were closely studied by competent professionals on the Sugar Company's staff and are of much value as indications of how yields might be raised. The reasons why only about 50 per cent. of the selected sample completed the work of costing the crop and were otherwise qualified for inclusion in the final figures, are all set out in detail in the report of the Costings Committee.