INCENTIVE PAYMENTS
and improved man and machine performance

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INTRODUCTION

Bonuses are sometimes paid to stockmen and other specialists, and piece-rates have long been associated with a few seasonally important manual field operations, but neither form of incentive payment has ever been very widely applied in agriculture. Similarly although it is now quite common for Method Study to be applied on farms, hardly any farmers as yet operate incentive schemes based on Method and Time Study. There are a number of difficulties. Agriculture is concerned with living things, and is very dependent on the weather. There is therefore sometimes quite wide variation in the time required to undertake any particular job. Again, considerable time also elapses between work being done and the completion of the production process. Thus a year or more may elapse between ploughing and the time when crops are harvested and finally marketed; while even longer is required to produce a fat bullock. It is difficult to establish clearly defined quality standards for work contributing to production which is not yet complete. Without constant supervision, for example, it is difficult to judge whether livestock are properly tended. Cultivations, it is true, can be carefully inspected, but their effect may be much influenced by weather conditions or previous tillage operations. If piece-work seems to fall below the required standard, therefore, the farmer may often feel obliged to pay the agreed rate rather than to withhold payment. In either event, however, an unsatisfactory situation is the result. On the one hand paying for work below standard only encourages its repetition, while withholding payment will often seem unfair to a worker who is well aware of the possible effect of weather and previous cultivations on work done.

These difficulties may well underline the need for bonus schemes based on Method and Time Study, rather than more traditional incentive payments. For example, instead of applying straight piece-rates it might be better to pay ordinary time rates together with a bonus for all work done correctly over and above that normally expected from a man paid by the week; a common practice in other industries.

In the north the piece-rate for lifting and topping mangolds last year was about one and eightpence per 100 yards, which if we assume an hourly rate of four shillings, suggests that farmers expect their day workers to do just under 240 yards in an hour. Time study, however, suggests that with mangolds spaced to ten inches in the row it is reasonable to expect a skilled man on day rates to lift and top 290 yards an hour. Under suitable conditions, therefore, a fair rate for the job would be one and fourpence halfpenny per 100 yards, this being equivalent to five pounds an acre, and to four shillings an hour for a normal performance.

A man who topped and lifted 435 yards an hour, and did it satisfactorily, would then earn a bonus of up to two shillings in addition to his time rate of four shillings an hour. If, however, he did 580 yards in an hour, but was able to do only half correctly, he should on this basis receive four shillings for the time worked but no bonus, the work done satisfactorily being no more than that expected from men being paid by the hour. Thus he would earn less than for the 435 yards an hour, and would have nothing to gain from going too quickly. This is always likely to be true because, of course, once a man exceeds his capabilities a rapid increase in the proportion of unsatisfactory work is likely to result from further increases in speed. Apart from the many other advantages of using Method and Time Study, paid in this way, the worker is protected against any actual fall in earnings, as may occur with ordinary piece-rates, through no fault of his own.

Agreement as to the proportion of work qualifying for bonus may still be difficult, although less so than with a straightforward piece-rate. It would probably be best to pay bonus on the proportion of work found to be satisfactory in a number of short

lengths of row, these of course being selected at random. If this can be agreed beforehand there is less likelihood of an incentive payment resulting in work of poor quality.

*A number of such schemes are now being introduced on farms in the north. These are of two main types. Bonuses to stockmen based on yields and economy in the use of important inputs such as feed or labour, and payments intended to encourage more efficient field work. In each case their introduction has been preceded by a study of the methods now used, and the extent to which these could be improved. In this way it is possible to ensure that the bonus paid is fair both to worker and farmer. Without prior Method Study workers would frequently have the opportunity of merely exchanging a bad method for a better one, and of earning a large bonus quite out of proportion to the amount of extra effort and skill applied. This, on the one hand, defeats a main purpose of any incentive scheme; the encouragement of a satisfactory rate of work. It also puts the farmer in a position where he must either lose much of the advantage of improvements which he could have made himself, or in which he must reduce the rate of bonus payment. Neither alternative is satisfactory, and must inevitably lead to discontent, and the possible breakdown of the scheme.

Regardless of whether incentives are being introduced, however, a great opportunity of increasing labour productivity is lost if methods are not systematically studied and performances carefully defined. This is now widely accepted with reference to work carried out in and about farm buildings, and there are many published examples of the scope that exists for such labour saving. For field work the position is very different. Apart from the organisation of silage making there has so far been little attempt at systematic work study in the field, either with a view to initiating improvements, or to ascertaining the performances possible under suitably defined conditions. On the contrary, all too often supervision in the field is considered adequate if the work done is of satisfactory quality, and if it appears that enough effort is being put into it. As a result often far too little is done in a day.

Admittedly there are many arable jobs which have been mechanised to the point where the machine rather than the man appears to limit performance. This perhaps explains the almost exclusive reliance on further mechanisation to increase labour productivity in the field.

The examples which follow are intended to show that often substantial improvements may also be possible; by the systematic study and improvement of work methods; by careful measurement of the performances to be expected from machines in order to ensure that each operator is getting the best that conditions allow out of his equipment, or by encouraging operators to acquire and apply the skill and dexterity which is necessary if modern machines are to be used efficiently.

In addition the performance data given in the examples and the appendix provide farmers, using similar equipment, with standards which they can use for comparison or as a basis on which to introduce incentive schemes. A main purpose of this report is in fact to demonstrate the value of having data with which to manage efficiently.

CHAPTER 1

FIELD WORK AND THE APPLICATION OF BONUS SCHEMES

Preparing the Seed Bed and Drilling Corn

In this example the equipment available consisted of 5 tractors, a twelve-foot roller, 2 nine-foot disc harrows, heavy harrows eighteen feet wide and a fifteen-coulter corn drill. Two trailers were used to fetch fertilizers and seed from the steading.

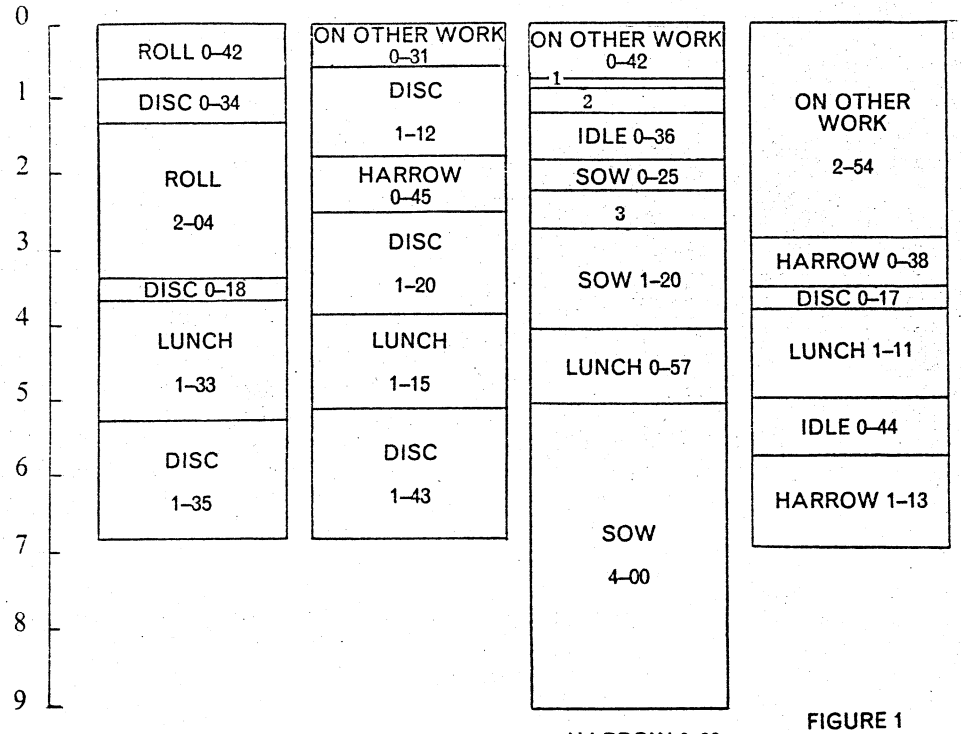
Ploughing and a first discing had been done well in advance. Depending on its condition, therefore, each field was to be rolled, and either disced, harrowed and drilled, or disced twice, harrowed twice and drilled.

Although there was scope for detailed improvement, all the implements were in general efficiently handled, operating rates being as follows:—

Average distance from headland to headland in yards	100	200	300	400
	Acres per hour and per man hour			
Rolling two ways and working across field	7·1	7·9	8·3	8·5
Discing „ „ „ „ „ „	5·7	6·3	6·6	6·8
Heavy Harrowing „ „ „ „	14·4	16·0	16·7	17·0
Drilling Seed and Fertilizer „ „	3·6	3·9	4·0	4·1

Fertilizer in granular form was applied at the rate of three hundredweights per acre. The seed rate was one and a half hundredweights per acre.

The organisation of this work in a field requiring to be disced and harrowed twice is shown in Figure 1.



1 HARROW 0–09
2 FETCH SEED & FERTILIZER 0–21
3 FETCH SEED & FERTILIZER 0–30

FIGURE 1

Drilling takes longest, so with two disc harrows available, even in fields that had to be disced twice, the drill limited the acreage that could be sown. The drill, therefore, should not have been kept idle for most of the morning, which occurred because each operation was begun at the same time. Figure 2 shows that both rolls and harrows should be used somewhat further ahead of the drill, to allow it to work continuously.

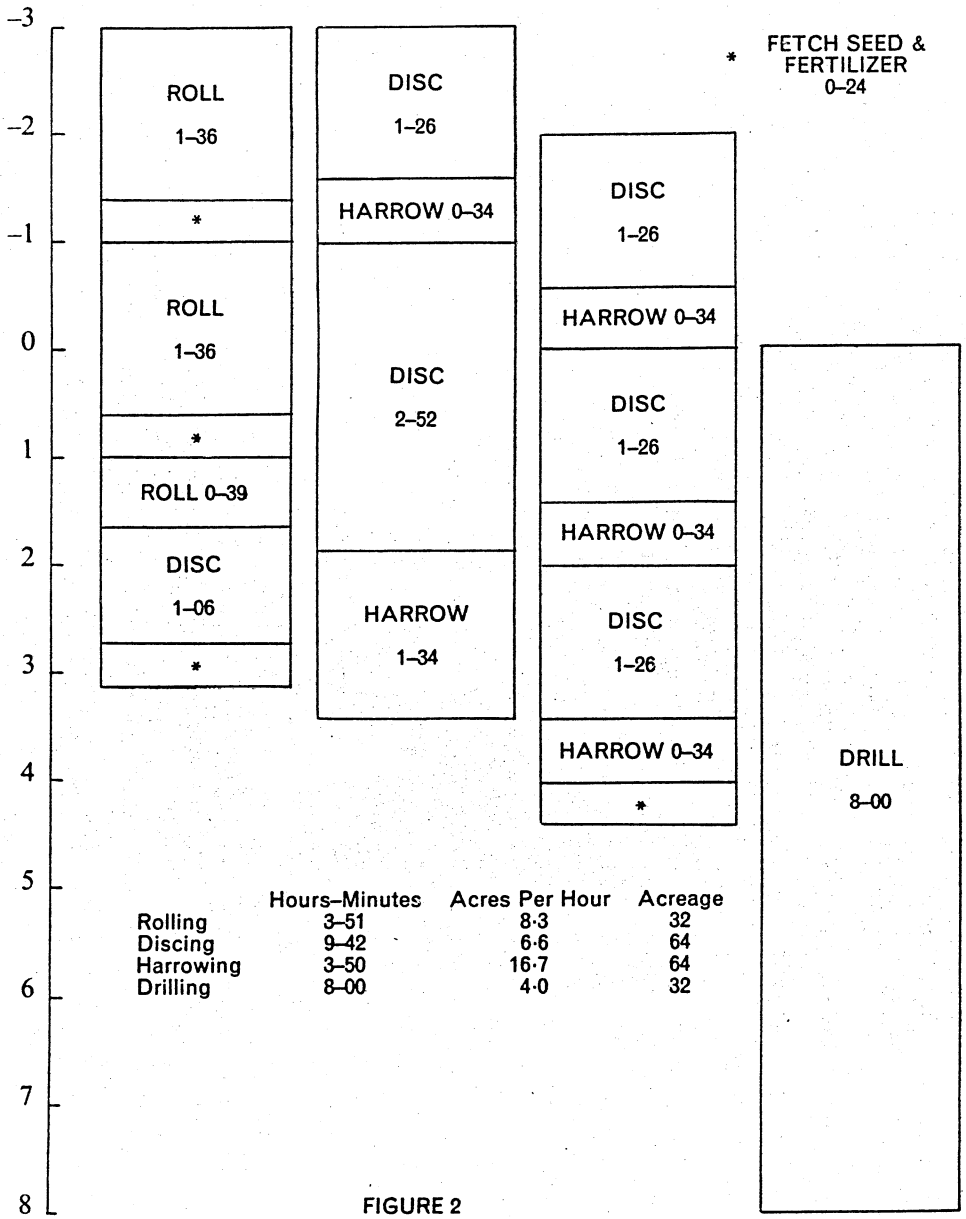


FIGURE 2

Similarly Figure 3 shows one of the many ways of organising this work in fields which only require to be disced and harrowed once more.

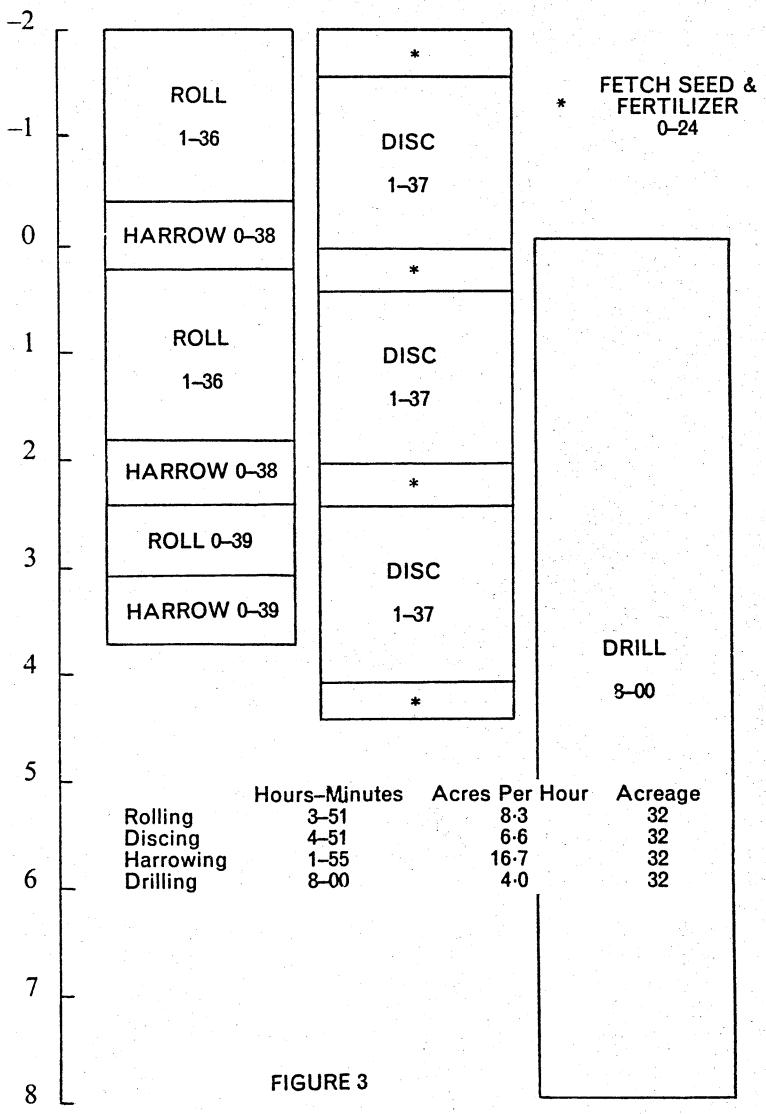


FIGURE 3

It is now clear that with the right organisation about thirty-two acres of corn can be drilled in an eight hour day on this farm. When this work was studied twenty-three acres were drilled. Even this considerably surprised the farmer as previous performance had not amounted to twenty acres.

The problem of organising work of this kind is often made more difficult because implements differ in their capacities. About eight acres could be rolled in an hour, six and a half double disced, and only four drilled. This would not be so under all

conditions, but good management can often make modifications in organisation of jobs of this type to suit prevailing conditions. Nevertheless, there is a good case for reviewing the capacities of implements which are frequently used together. When they are badly matched the output obtained from them is often far less than the potential output of the slowest.

Apart from the better performance and greater timeliness to be obtained by utilising machines as fully as possible, there is with any job a further saving to be obtained, not so much by increasing machine speeds or greater physical effort, but by suitably encouraging greater care and attention to detail. This may be the main benefit sought from an incentive scheme when applied to mechanised operations which appear to be carried out satisfactorily, and which at first sight sometimes seem to offer little scope for improvement. An illustration of the scope that may sometimes exist is given in the example dealing with hay making.

Performances on this farm were judged to be well above normal, and whilst it has been shown that about 32 acres can be drilled in a day, it would be reasonable to expect men on time rates to drill about 24 acres in an eight-hour day with minor variation to allow for differences in average distance between headlands.

To encourage greater efficiency, therefore, this farmer proposes to pay a bonus in one of the following ways.

The first possibility is to pay his men half the value of any time saved by drilling more than the following acreages each day:—

Average distance from headland to headland in yards	*Acres per hour*	*Acres prepared and drilled per eight-hour day*
100	2·7	22
200	2·9	23
300	3·0	24
400	3·1	25

As the men must have equal opportunity of earning bonuses, regardless of the number of cultivations carried out, the farmer will ensure that a large enough team is employed to keep the drill in continuous use.

Thus, for example, when the work involves rolling, discing, harrowing and drilling, and the distance between headlands is about 300 yards, it is possible to drill at least 32 acres if three men are provided for part of the time:—

	Man hours per 32 acres
Rolling @ 8·3 acres per hour	3·9
Discing @ 6·6 acres per hour	4·8
Harrowing @ 16·7 acres per hour	1·9
Drilling @ 4·0 acres per hour	8·0
Fetching seed and fertilizer	1·5
	20·1

Assuming an eight hour day, three men will be allocated to the job, but the men rolling, discing and fetching seed would be available for other work towards the end of the afternoon.

When the work involves double discing and double harrowing, and the distance between headlands is about 300 yards it is again possible to drill at least 32 acres, but four men are required part of the time.

	Man hours per 32 acres
Rolling	3·9
1st Discing	4·8
1st Harrowing	1·9
2nd Discing	4·8
2nd Harrowing	1·9
Drilling	8·0
Fetching seed and fertilizer	1·5
	26·8

This first method of paying a bonus emphasises the importance of drilling a large acreage each day, rather than the need to reduce total labour requirements.

The second possibility being considered is to pay a collective bonus equal to half the value of the time saved on each operation as compared with the following standards:—

Average distance from headland to headland in yards	100	200	300	400
	Acres per hour and per man hour			
Rolling two ways and working across field	5.3	5·9	6·2	6·4
Discing „ „ „ „ „	4·3	4·7	4·9	5·1
Heavy harrowing „ „ „ „	10·8	12·0	12·5	12·7
Drilling „ „ „ „	2·7	2·9	3·0	3·1
Fetching seed and fertilizer „ „	20·0	20·0	20·0	20·0

For example, on land requiring to be disced and harrowed once, with 300 yards between headlands three men may cultivate and drill 32 acres in a day. Paying in the first way it is argued that they have undertaken $8 \times \frac{32}{24} = 10\frac{2}{3}$ hours' work in eight hours and are therefore entitled to a bonus equal to half the value of the $2\frac{2}{3}$ hours which each of them has saved. If their hourly rate is 5s. they therefore earn an extra 6s. 8d., the labour cost of the work done being at the same time reduced by twenty shillings.

Paying in the second way their bonus is calculated as follows:—

	Man hours
Rolling, 32 acres @ 6·2 acres per man hour	5·2
Discing, 32 acres @ 4·9 „ „ „ „	6·5
Harrowing, 32 acres @ 12·5 acres per man hour	2·6
Drilling, 32 acres @ 3·0 „ „ „ „	10·7
Fetching seed and fertilizers, 32 acres @ 20·0 acres per man hour	1·6
	26·6
Time worked	20·0
Time saved	6·6

The time saved is 6·6 man hours, or 2·2 hours a man, and they have each earned an extra 5s. 6d.

In this case bonus is paid only for the time saved while each man is still on this job, and it is paid for any extra work regardless of whether an additional acreage is drilled or only cultivated. This may be fairer, as it enables bonuses based on

individual performances to be paid when it is not necessary for men to change over from one machine to another. The first method is, however, the simpler.

Silage Making

Example 1

Here again the labour required depends much on the organisation selected from a number of alternatives. There are indeed few jobs on the farm where this is likely to be more important as the following examples show.

On this farm the forage harvester was a new model with a 58-in. cut and a high potential output. Despite this, and the fact that quite a large acreage was cut and clamped each day, output per man was disappointingly low:—

	Distance between field and clamp in yards							
	200	400	600	800	1,000	1,200	1,400	1,600
4 TON CUT								
Acres per eight-hour day	8·6	8·6	8·6	8·0	7·2	6·6	6·2	5·8
Acres per man per day	2·1	2·1	2·1	2·0	1·8	1·7	1·6	1·5
6 TON CUT								
Acres per eight-hour day	7·7	7·7	6·8	6·0	5·5	4·9	4·5	4·1
Acres per man per day	1·9	1·9	1·8	1·5	1·4	1·2	1·1	1·0

Two rear tipping trailers with a capacity of about 25 hundredweights were used. Each, pulled by a separate tractor, was filled travelling alongside the harvester. At the clamp the trailers were backed on to a concrete apron, and the grass tipped against a wall of railway sleepers. These were placed to enable the fourth member of the team easily to buckrake the grass on to the clamp.

When conditions were suitable a full eight hours a day were spent making silage, the men being paid extra to service their equipment outside normal working hours. The table shows that with a six ton crop each man cut and clamped 1·9 to 1·0 acres a day, depending upon the distance between field and clamp.

It was found that improvements could be made in a number of ways, the performances to be expected being given in detail in the appendix.

The first and most obvious step was to reduce to a minimum all unnecessary waiting. In many of the fields, although the trailers could be emptied and brought back in less time than it took to cut a full load of grass, the men with the trailers frequently misjudged the time they had in hand, and kept the harvest driver waiting. Consequently although the trailer drivers had sometimes to wait two or three minutes before getting each load, the harvester was also often kept idle for as long as two minutes per load.

A second step was to persuade the men of the importance of getting really full loads. They had not been doing so, partly because a trailer was often waiting in the field before the other was full, and perhaps because the men received a bonus of one shilling for each load they got over six an hour.

With either a light or average crop it was found that a third tractor and trailer enabled a greater output per day where grass was being brought from the fields furthest from the steading, as shown in the appendix, but with five instead of four men in the team output per man was reduced.

Again, it was found better to cut a headland round an area providing a good day's work, and cut out diagonals, and then cut round and round. Using this

method it was found that some 3 per cent of cutting time was spent cornering as compared with about 10 per cent when working in lands.

It was also found better to tow the trailers behind the harvester when filling. Filled alongside a greater acreage can be cut and clamped in a day, but four men instead of three are required and output per man is much lower.

As a result of these changes it becomes possible for each man to cut and clamp at least 3·2 to 3·5 acres a day, depending upon the weight of grass.

	Distance between field and clamp in yards							
	200	400	600	800	1,000	1,200	1,400	1,600
4 TON CUT								
Acres per eight-hour day	10·4	10·4	10·4	10·4	10·4	10·4	10·4	10·4
Acres per man per day	3·5	3·5	3·5	3·5	3·5	3·5	3·5	3·5
Bonus acreage per man	2·7	2·7	2·7	2·7	2·7	2·7	2·7	2·7
6 TON CUT								
Acres per eight-hour day	9·7	9·7	9·7	9·7	9·7	9·7	9·7	9·5
Acres per man per day	3·2	3·2	3·2	3·2	3·2	3·2	3·2	3·2
Bonus acreage per man	2·4	2·4	2·4	2·4	2·4	2·4	2·4	2·4

Although there is scope for still further improvement, the attainment of these performances is dependent not only on good organisation, but also on the men maintaining a satisfactory rate of work. To encourage and repay them for working well this farmer again intends to pay a bonus equal to an agreed part of the value of time saved compared with 75 per cent of the performances he seeks to obtain. Thus with cuts of between three and five tons he will pay as bonus part of the value of the time saved compared with an output of 2·7 acres per man per day. With cuts of between five and seven tons, bonus will be paid for the time saved compared with an output of 2·4 acres per man per day.

For example, if the three men cut and clamp a twenty acre field in two days, and the cut averages about six tons per acre he will pay them a bonus calculated as follows:—

	Man hours
Time required to cut and clamp 20 acres when each man does 2·4 acres a day or 0·3 acres an hour $=\frac{20}{0{\cdot}3}=$	67
Time worked in 2 days by 3 men	48
Time saved	19

Their hourly rate of pay is five shillings. If he agrees to pay for half the value of the time saved he would pay them 2s. 6d. for each of the nineteen hours, or £2 7s. 6d. Each man would therefore receive an extra 15s. 10d., and labour costs on the 20-acre field would be reduced by £2 7s. 6d., and by far more as compared with actual labour costs this year.

Example 2

On another farm, the forage harvester is several years old, its cutting width being again 58 inches. In addition three rear tipping trailers are available each capable of holding about twenty-eight hundredweights of grass, and there are two buckrakes. A fifty horse-power tractor is used to pull the harvester, and there are two smaller tractors for carting grass to the silage clamp.

Last year a three man team made the silage. One man operated the harvester, and two carted grass to the steading, tipping it in front and slightly to one side of the end of the silage clamp. In the middle of the afternoon cutting and carting were stopped. One man then buckraked the cut grass on to the clamp, whilst a second, who was far from fully employed, spread each load. With an eight ton crop, and after allowing time for tractor maintenance, for starting and stopping both in the morning and in the afternoon, and for fitting and removing the buckrake, the three men were able to cut and clamp just over four acres a day.

The farmer doubted whether this was the best organisation he could employ. Depending on which field was being cut, grass had to be carted from 200 to 1,600 yards to the clamp, and although each man was fairly fully employed when the haul was long, the two men carting grass had to wait for each load when the haul was short. In order to avoid this the team was reduced to two men, and this proved to be a somewhat better arrangement:—

	Distance between field and clamp in yards							
	200	400	600	800	1,000	1,200	1,400	1,600
Using 3 men and 3 trailers:—								
Acres per day	4·2	4·2	4·2	4·2	4·2	4·2	4·2	4·2
Acres per man per day	1·4	1·4	1·4	1·4	1·4	1·4	1·4	1·4
Using 2 men and 2 trailers:—								
Acres per day	4·2	4·2	4·2	4·2	3·9	3·6	3·2	3·1
Acres per man per day	2·1	2·1	2·1	2·1	1·9	1·8	1·6	1·5

Whereas previously three men cut and clamped 4·2 acres a day, two men were now able only to cut and clamp 3·1 to 4·2 acres a day, depending on the distance between field and clamp. With a team of three, however, each man had only made 1·4 acres of grass into silage each day compared with 1·5 to 2·1 acres each by two men. As the two men could in any case make all the silage produced without the grass growing away it was right to seek a high output per man rather than a high output per day.

Seeking further improvement the farmer is again questioning the efficiency of the methods he employs. As in the previous example he finds that some saving results from cutting a headland round an area providing a really good day's work, by cutting out diagonals, and then cutting round and round.

He has also decided that he need not spread each buckrake load on the clamp. Much time has been wasted by trying, and often failing, to get very large loads on to the buckrake, and it would certainly be better if smaller loads were got. In addition, each load is very carefully positioned on the clamp, so it may be better to get the whole of each day's cut on to the clamp before doing the minimum amount of spreading which still seems necessary. If so, and as the clamp is very wide, both men will be able to buckrake the grass on to the clamp.

Finally this farmer has discussed the possibility of running the harvester tractor in one gear higher than before. The driver did not think that this was possible, fearing that with a heavy crop or bad conditions, cutting would be less satisfactory, and that reduced power take off speed would not be sufficient to blow grass to the back of the trailer, and therefore to get a full load. Tests, however, have shown that most of the time good work can be done in the higher gear, use of the lower gear only being necessary when travelling up the steepest slopes of one or two fields, or when the crop is particularly heavy. The delivery spout of the harvester will be modified slightly to enable the grass to be blown to the back of the trailer. A third man equipped with a tractor and trailer will be added to the team when the distance between field and clamp exceeds 1,000 yards.

Further experience of the new methods is required before they are proved, but if they are, it will be possible to increase labour productivity by 10 to 60 per cent, depending on the length of haul:—

	Distance between field and clamp in yards							
	200	400	600	800	1,000	1,200	1,400	1,600
Using 2 men and 2 trailers:—								
Acres per day	6·8	6·8	5·9	5·2	4·6	4·1	3·8	3·4
Acres per man per day	3·4	3·4	2·9	2·6	2·3	2·0	1·9	1·7
Bonus acreage per man	2·5	2·5	2·2	1·9	1·7	—	—	—
Using 3 men and 3 trailers:—								
Acres per day	6·8	6·8	6·8	6·8	6·8	6·8	6·8	6·8
Acres per man per day	2·3	2·3	2·3	2·3	2·3	2·3	2·3	2·3
Bonus acreage per man	—	—	—	—	—	1·7	1·7	1·7

To encourage the higher output he believes possible, this farmer intends to introduce a bonus scheme along the lines described in the previous example. Even if he is successful, however, by comparison with the other farm performance will be lower by as much as twelve man days to cut and clamp 100 acres of grass. However, the cost of this extra labour is less than the additional interest and depreciation on a new machine, and this farmer quite rightly intends to continue using his old machine for the time being.

Hay Making

When making hay, time must be allowed between successive operations, and except when carting and stacking, each machine tends to be operated independently. The need to organise men and machines into a well-balanced team does not therefore arise. This does not mean, however, that there is no scope for improvement; rather that improvement must be sought by reducing stoppages to a minimum, and by paying greater attention to detail. In particular, any study of performance shows that a man takes not one single time to undertake a repetitive operation, but a range of times reflecting the efficiency with which he executes the operation each time it is repeated. Improved performance is therefore always possible, the problem being to encourage workers to operate more continuously at a rate within the higher range of their observed performance.

The extent to which performances can be thus improved certainly depends on the adequacy of supervision. It is perhaps even more dependent on providing men with sufficient incentive to attain and maintain a higher level of performance.

The following example, therefore, is intended to illustrate the scope that exists for improving performances which would normally be accepted as good. The higher outputs suggested as possible are based on the best time in which each part of the work was observed to be undertaken, as distinct from average or "standard" performance. Admittedly these higher performances may represent ideal levels never wholly attainable in practice, and certainly not to be expected from men paid simply on a time basis, however well supervised. They do emphasise the potential importance of providing men with adequate incentives even if performances do appear at first sight to be limited by the machines they operate.

On this particular farm the equipment available consisted of a Ferguson 35 fitted with a 4 foot 6 inch cut mid-mounted mower and a New Holland crimper, a Ferguson 35 and 9 foot tedder, a Fordson Major and Vicon-Lely turner, a Fordson Power Major, Bamford BL61 baler and a bale sledge. This year for the first time bales were not led on trailers, but were taken to the barn, thirteen at a time, by two men

equipped with tractors and rear mounted rakes. One of these was a specially designed bale rake, the other being an ordinary buckrake. An elevator was used to help stack the bales in the dutch barn.

All the implements were handled efficiently, operating rates being as follows:—

Average distance from headland to headland in yards	100	200	300	400
		Acres per hour		
Mowing and crimping two ways in lands	1·4	1·7	1·9	1·9
Tedding two ways	4·9	5·2	5·4	5·5
Turning one way	2·5	2·7	2·9	2·9
Turning two ways in lands	2·9	3·5	3·8	3·9
Baling after 2 rows turned into 1 row (2 men)	2·7	3·0	3·1	3·2

Leading and stacking:—

Distance in yards	200	400	600	800	1,000	1,200	1,400	1,600
Acres per hour	4·2	2·7	2·0	1·6	1·3	1·1	1·0	0·9
Acres per man hour	1·0	0·7	0·5	0·4	0·3	0·3	0·2	0·2

Seventy-three bales per acre averaging between 47 and 48 lbs each were harvested, the yield of fresh hay per acre being approximately 31 cwts.

Comparison between different methods of leading bales suggests that it is quite possible for the following performances to be approached:—

Distance in yards	200	400	600	800	1,000	1,200	1,400	1,600
				Man hours per 100 bales				
Using 1 bale rake and 1 buckrake	0·42	0·58	0·74	0·90	1·06	1·24	1·40	1·56
Using 2 bale rakes	0·22	0·38	0·54	0·72	0·84	1·02	1·24	1·40
Using 3 men and 2 tractors and trailers	1·40	1·58	1·76	1·97	2·15	2·37	2·54	2·72

The relative efficiency of each method depends of course on the number of bales carried at a time. The figures given relate to trailer loads of thirty-eight bales, and to rakes picking up and transporting thirteen bales at a time, the number that could be tipped off the bale sledge in a stack on the example farm.

It will be noted that even when the distance between field and farm is considerable bale rakes are potentially much more efficient than trailers of this capacity. The rake designed to handle bales is also better than an ordinary buckrake on which each load has to be roped.

If the different parts of each operation were to be undertaken with the efficiency now only occasionally achieved the following performances would be approached:—

Average distances from headland to headland in yards	100	200	300	400
		Acres per hour		
Mowing and crimping two ways in lands	2·3	2·8	3·2	3·2
Tedding two ways	5·8	6·1	6·3	6·5
Turning one way	2·8	3·1	3·3	3·3
Turning two ways in lands	3·3	4·0	4·3	4·4
Baling after 2 rows turned into 1 row (2 men)	3·4	3·8	3·9	4·0

Leading and stacking using 2 bale rakes:—

Distance in yards	200	400	600	800	1,000	1,200	1,400	1,600
Acres per hour	12·5	7·1	5·0	3·8	3·2	2·7	2·2	2·0
Acres per man hour	3·1	1·8	1·2	0·9	0·8	0·7	0·5	0·5

One twenty acre field on this farm is 800 yards from the barn, the distance from headland to headland being about 400 yards. To make hay from it last year the following labour was required:—

	Man hours per 20 acres
Mowing and crimping two ways in lands @ 1·9 acres per hour	10·5
Tedding @ 5·5 acres per hour	3·6
Turning two rows into one, in this case one way @ 2·9 acres per hour	6·9
Baling after two rows turned into one row @ 3·2 acres per hour	12·5
Leading and stacking using one buckrake and one bale rake @ 1·6 acres per hour	50·0
	83·5

It is suggested that provided each operator can be encouraged to attain and maintain a higher performance, labour requirements might be reduced until the following standards are approached:—

	Man hours per 20 acres
Mowing and crimping two ways in lands @ 3·2 acres per hour	6·2
Tedding @ 6·5 acres per hour	3·1
Turning two rows into one, in this case one way @ 3·3 acres per hour	6·1
Baling after two rows turned into one row @ 4·0 acres per hour	10·0
Leading and stacking using two bale rakes @ 3·8 acres per hour	21·2
	46·6

The scope for improving upon even a quite good performance appears to be substantial, and anything that encourages workers to apply more skill would therefore seem worthwhile, even if successful to only a limited extent. Apart from reduced labour costs, in difficult years the value of the extra hay got in good condition might be much more than the value of the labour saved.

As in the previous examples one way of encouraging higher performances might be to pay a bonus equal to an agreed fraction of the time saved either by calculating the total number of hours saved on each field as compared with the standard of performance deemed satisfactory, the bonus being divided according to the time that each man has worked in the field. Alternatively, by making particular workers responsible for particular operations, a bonus could be paid to each according to the time saved with each machine.

CHAPTER 2

BONUS SCHEMES FOR STOCKMEN

Usually labour is responsible for only a very small part of the cost of producing eggs and meat, and on average amounts to less than a quarter of the cost of producing milk. Feed, on the other hand is responsible for 50 to 60 per cent of the cost of producing milk, and for 80 per cent of the cost of fattening a pig. Thus, whilst it is desirable to save labour, there is good reason to emphasise the importance of a satisfactory output, and of economy in the use of expensive feedingstuffs.

Many bonuses paid to stockmen fail in this aim, because either they provide too little incentive, or they do not encourage greater attention to the right factors. Cowmen, for example, are often paid a penny or two for each gallon of milk that they produce. This offers little encouragement to increase yields. For example, with a herd of thirty cows, and a bonus of a penny a gallon, an annual increase of 50 gallons per cow earns the cowman only six pounds five shilling, while profits may be increased by a hundred and forty pounds or more.

Bonus on Yields and Economy in the Use of Concentrates

Perhaps it is fortunate that many such schemes offer so little incentive for there is nothing to prevent increased yields being obtained at the expense of greatly increased feed costs. If the cowman is responsible for rationing concentrates it is better to pay a bonus linked to both yields and concentrate use, the amounts paid being balanced so that there is no incentive to feed too many concentrates, nor to skimp their use.

With milk averaging two shillings and tenpence a gallon, and concentrates costing approximately fourpence a pound, it pays to feed up to eight and a half pounds of concentrates to obtain an extra gallon of milk. It is, therefore, perfectly sensible to pay a bonus of say eightpence for each additional gallon, and to add or subtract a penny per pound difference between concentrate use and the amount that would have been required to produce the larger gallonage had concentrate feeding been at the same rate as before. Eightpence and a penny are in about the same ratio as the value of milk to concentrates, eightpence being also 25 per cent of additional receipts, and about the same proportion as labour costs to total costs. Thus the cowman is offered a share of additional receipts which roughly reflects the financial importance of his contribution.

The case of a forty cow herd producing 800 gallons a cow and using 2·5 lbs of concentrates for each gallon produced, can be taken as an example. If by extra effort and attention the cowman succeeds in increasing yields to 850 gallons, and uses 2·4 lbs of concentrates per gallon, he earns on this basis a bonus of £81. Profits are increased by £310, or by £229 after paying the bonus.

This scheme is simple to apply, and easily understood, but the bonus cannot be paid monthly. If this is considered to be a serious disadvantage it can be overcome by paying the bonus in twelve monthly instalments, the bonus at the end of each month thereby reflecting production and concentrate use in each of the previous twelve months. As can be seen from the table, calculating the bonus becomes a little more difficult, although the principles on which it is based remain the same. Apart from indicating the monthly bonus to be paid, however, the same calculation indicates average monthly production per cow and the quantity of

Cowman's Bonus based on Annual Average Yields and Efficiency in Use of Concentrates

Proposed Basis of Payment A quarter of the price received for each gallon in excess of 600 gallons per cow per annum less a quarter of the cost of concentrates used in excess of 3·5 lbs per gallon at present averaging approximately 9d. per gallon plus or minus 1d. per lb concentrates. To be paid in 12 monthly instalments according to production and concentrate use in previous 12 months.

MONTH	Monthly Prodn. (gals)	12 monthly total prodn.	Average No. cows	Prodn. per cow (gals)	12 monthly prodn. per cow	Bonus gallonage	Gross bonus £ s. d.	Concs. used (lbs)	Concs. used per gal.	12 monthly use per gal.	12 monthly gain or loss (lbs)	Bonus Adjust. £ s. d.	Net Bonus £ s. d.
1960													
July	2,028	—	31	65	—	—	—	—	3·5	—	—	—	—
August	1,829	—	31	59	—	—	—	—	3·5	—	—	—	—
September	1,634	—	32	51	—	—	—	—	3·5	—	—	—	—
October	1,758	—	32	55	—	—	—	—	3·5	—	—	—	—
November	1,556	—	32	49	—	—	—	—	3·5	—	—	—	—
December	1,342	—	32	42	—	—	—	—	3·9	—	—	—	—
1961													
January	1,314	—	32	41	—	—	—	—	3·9	—	—	—	—
February	1,046	18,968	31	34	597	−93	5 10	—	3·9	—	—	—	5 10
March	1,341	19,031	31	43	602	62	3 11	—	3·9	—	—	—	3 11
April	1,314	19,133	29	45	610	290	18 1	—	3·1	3·5	—	—	18 1
May	1,985	19,314	32	62	616	512	1 12 0	—	2·5	3·5	—	—	1 12 0
June	2,409	19,556	32	75	621	672	2 2 0	—	2·5	3·4	1955·6	13 7	2 15 7
July	2,395	19,923	30	80	636	1,080	3 7 6	—	3·5	3·4	1992·3	13 10	4 1 4
August	2,176	20,270	32	68	645	1,440	4 10 0	4,704	2·2	3·3	4054·0	1 8 2	5 18 2
September	2,453	21,089	36	63	662	2,232	6 19 6	5,936	2·4	3·2	6326·7	2 3 11	9 3 5
October	2,745	22,076	39	70	677	3,003	9 7 8	8,400	3·1	3·2	6622·8	2 6 0	11 13 8
November	2,191	22,711	41	53	681	3,321	10 7 7	6,944	3·2	3·2	6813·3	2 7 4	12 14 11
December	1,858	23,227	40	46	685	3,400	10 12 6	6,608	3·6	3·2	6968·1	2 8 5	13 0 11
1962													
January	1,648	23,561	40	41	685	3,400	10 12 6	6,720	4·1	3·2	7068·3	2 9 1	13 1 7

concentrates used per gallon of milk produced, information which in any case should be obtained for the efficient management of a herd.

The figures in the table show the effects that this scheme has had on a farm in Cumberland where it has now been in operation for twelve months. At the beginning of the year yields were low and concentrate use was high. Yields have since risen from 597 to 685 gallons per cow, and concentrate use has fallen from 3·5 to 3·2 lbs per gallon. The cowman has received £75 bonus during the year, the increase in profit being approximately £225 after paying the bonus.

Neither of these schemes offer any incentive to save labour, nor does it seem possible to devise a sufficiently simple scheme which encourages higher output, and economy in the use of both feed and labour. This is a difficulty which can perhaps best be overcome by farmers maintaining much closer control over the use of feed than is often the case. As a matter of good management this would in any case seem to be very desirable and it is not then difficult to devise a satisfactory scheme encouraging greater output together with economy in the use of labour. Any such scheme must, of course, be based on a careful evaluation of the work involved when the right methods are used and therefore implies prior study of what are likely to be the best ways of carrying out each job.

The method of basing bonus payments on labour use and annual average yields on one particular farm is illustrated in the following example.

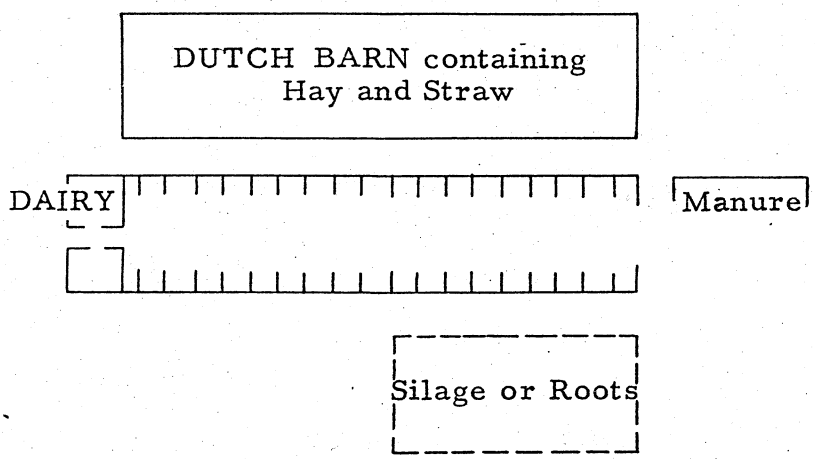
Bonus on Yields and Labour Efficiency

Originally the herd consisted of thirty cows looked after by one man. It is now being increased to seventy cows, a new byre having just been built. This contains two rows of standings, and the dairy is at one end.

In addition to suitable amounts of concentrates and silage each cow is given 14 lbs of hay, the ration being fed twice a day.

The herd has been averaging between 800 and 900 gallons per cow, and prior to expansion the cowman milked it single handed using four bucket type machines.

Although it will not be possible for the one cowman to look after the larger herd the farmer can supply him with help for part of the time, but does not want to take on another full time cowman. At the same time he intends to give his cowman the opportunity of earning more than he now gets.



Study of the methods employed has shown that it would be convenient to store food and litter in the positions shown in the diagram, and that with yields averaging about 900 gallons per cow it would be better for each man milking to be equipped with three rather than four bucket machines. Using suitable work routines each man can then be expected to milk approximately 33 cows an hour in a morning, or about 36 an hour in an afternoon, it being possible to reduce total labour requirements to the following levels without undue effort being applied:—

Number of cows in herd	15	30	45	60	75
			Man hours per cow a week		
Winter	1·4	1·2	1·1	1·1	1·1
Summer	1·3	1·1	1·0	0·9	0·9

In a typical year the cows are out to grass for about 30 weeks. Thus in seeking to attain these standards the farmer hopes that labour requirements will amount to 51 man hours a year per cow, and that the seventy cow herd will not occupy his staff for more than about 3,600 man hours a year. If so his cowman working a fifty-two hour week will provide 2,704 hours, and the rest of the farm staff will only be occupied with the herd for about 900 hours a year. To this end, the layout of the enterprise, and work methods, have all been planned with three basic principles in mind. As few materials as possible are handled. They are stored as close as possible to where they will be used, and as far as is practicable they are distributed in bulk. Thus straw is used sparingly. Hay, straw and silage need only be fetched a few yards, and the manure heap is just outside the byre. Milk is tipped into churns in the byre, and all materials handled are brought in and out of the byre on suitable trolleys.

The level of labour efficiency thus made possible is far above average, and greatly exceeds that previously achieved on this farm. Prior to reorganising the enterprise one full time cowman looked after thirty cows, labour use per cow amounting to 90 man hours a year, compared with an average of 99 man hours on a sample of farms surveyed in the area.

In seeking to reduce labour use to almost 50 per cent of this the farmer recognises that in addition to reorganising the enterprise he must gain the full co-operation of his cowman. The latter is a willing worker, and labour relations are good. Even so, the farmer thinks it would be worthwhile to pay a bonus, both to encourage him, and in recognition of his work. He has therefore decided to pay a monthly bonus of ninepence for each gallon of milk produced in excess of 800 gallons per cow per annum together with a weekly bonus of two shillings for each hour saved as compared with the time required when working with three quarters of the efficiency the farmer seeks to achieve. Thus he seeks to reduce labour requirements to 1·1 man hours per cow a week in winter and 0·9 man hours in summer, but the bonus is paid for time saved compared with a requirement of 1·5 man hours per cow a week in winter and 1·2 man hours in summer.

Basis of payment. Two shillings for each hour saved as compared with an allowed time of 1·5 man hours per cow per week in winter and 1·2 man hours per cow per week in summer plus ninepence for each gallon in excess of 800 gallons per cow per annum, the latter being paid in 12 monthly instalments according to production and concentrate use in previous 12 months, the former being paid only if production in the previous 12 months exceeds 800 gallons per cow.

Cowman's Bonus based on labour use and annual average yields

	Monthly Bonus on Yields					
Month	*Monthly Production (gals)*	*Average No. cows*	*Production per cow (gals)*	*12 monthly production per cow*	*Bonus gallonage*	*Bonus 1/12th × 9d.* £ s. d.
1960						
October	3,498	62	56	—	—	—
November	3,401	62	55	—	—	—
December	3,992	62	64	—	—	—
1961						
January	4,014	62	65	—	—	—
February	4,024	62	65	—	—	—
March	4,216	64	66	—	—	—
April	4,686	68	69	—	—	—
May	6,057	70	87	—	—	—
June	6,062	70	87	—	—	—
July	6,018	70	86	—	—	—
August	5,320	70	76	—	—	—
September	4,970	70	71	847	3,290	10 5 7
October	4,760	70	68	859	4,130	12 18 1
November	4,550	70	65	869	4,830	15 1 10
December	4,550	70	65	870	4,900	15 6 3

Weekly bonus on labour saved

Week	*Number of cows*	*Labour allowed per cow*	*Total labour allowed*	*Labour supplied*			*Bonus hours*	*Weekly bonus* £ s.
				cowman	*other*	*total*		
WINTER								
21	68	1·5	102	52	37	89	13	1 6
22	68	1·5	102	52	30	82	20	2 0
SUMMER								
1	70	1·2	84	52	25	77	7	0 14
2	70	1·2	84	52	11	63	21	2 2
ETC.								

Bonus on Output, Feed Use and Speed of Fattening

Similar schemes can be devised for workers looking after other kinds of stock. A man looking after broilers for example, can be paid a bonus on a per bird basis which takes account of any differences in batch size. To encourage a reduction in mortality it should be based on the number of chicks going into the house rather than on the number sold. It should also be designed to emphasise the importance of high liveweight gain, economy in the use of feed and fattening time, each according to their value.

For example, the following performance represents the average results obtained over a number of batches on one farm:—

Chicks put into the house	6,200
Weight sold	20,724 lbs
Weight sold per bird put in	3·3 lbs
Price sold	£1,468
Price sold per lb.	17d.
Food used	556 cwts
Food used per bird put in	10·0 lbs
Food cost	£1,095
Food cost per lb.	4d.
Batch time	76 days
Receipts per bird	56·1d.
Food cost per bird	40·0d.
Difference	16·1d.

Difference per bird per day $= \frac{16 \cdot 1}{76} =$ 0·2d.

This last figure, 0·2d. approximates to the loss of profit involved when an extra day is taken to fatten a bird.

One bonus scheme based on variations from these standards includes the following payments and penalties:—

One quarter of the value of meat sold above or below 3·3 lbs per chick put in.

One quarter of the value of concentrates used above or below 10 lbs per chick put into the house.

One quarter of the difference in profit involved as compared with a batch time of 76 days.

The method of calculating the bonus is best explained by reference to the efficiency with which particular batches have been produced on the example farm:—

(*a*) Chicks put into the house			6,300
Weight sold			23,040 lbs
Food used			525 cwts
Batch time			74 days
Weight sold per bird put in	3·7 lbs	Bonus weight	0·4 lbs
Food used per bird put in	9·3 lbs	Bonus weight	0·7 lbs
Batch time	74 days	Bonus days	2
Price sold per lb.			17d.
Food cost per lb.			4d.
Difference in profit per bird per day variation from 76 days			0·2d.
Difference in profit due to:—			£ s. d.
Extra weight per bird, 0·4 lbs × 6,300 × 17d.			178 10 0
Food saved per bird, 0·7 lbs × 6,300 × 4d.			73 10 0
Reduction in batch time, two days × 6,300 × 0·2d.			10 10 0
			£262 10 0
Bonus earned due to:—			£ s. d.
Extra weight per bird, 0·4 lbs × 6,300 × 4·25d.			44 12 6
Food saved per bird, 0·7 lbs × 6,300 × 1d.			18 7 6
Reduction in batch time, two days × 6,300 × 0·05d.			2 12 6
			£65 12 6

This batch was efficiently produced. Extra weight per bird together with a saving in food and time resulted in an additional profit of £262 10s., the bonus earned being £65 12s. 6d.

Although the increase in profit and the bonus earned are here calculated separately this is of course not necessary in practice, the bonus being one quarter of the increased profit.

(*b*) Chicks put into the house			6,500
Weight sold			20,780 lbs
Food used			536 cwts
Batch time			76 days
Weight sold per bird put in	3·2 lbs	Bonus weight	−0·1 lbs
Food used per bird put in	9·2 lbs	Bonus weight	+0·8 lbs
Batch time	76 days	Bonus days	Nil

Difference in profit due to:—	£ s. d.
Reduction in weight per bird, −0·1 lbs × 6,500 × 17d.	−46 0 10
Food saved per bird, +0·8 lbs × 6,500 × 4d.	+86 13 4
	£40 12 6

Bonus earned due to:—	£ s. d.
Reduction in weight per bird, −0·1 lbs × 6,500 × 4·25d.	−11 10 2
Food saved per bird, +0·8 lbs × 6,500 × 1d.	+21 13 4
	£10 3 2

In this case although batch time and feed use were satisfactory, a higher rate of mortality resulted in a lower weight being sold per bird put in. The additional profit was therefore only £40 12s. 6d., the bonus earned being £10 3s. 2d.

Profit Sharing

In a third case, that of a large farm with several major enterprises, the farmer wanted to reduce the time he spent on the day to day management of his dairy herd in order to have more time to manage the farm as a whole. In addition he had calculated that it would be profitable to increase the size of the herd from 40 to 50 cows. For these reasons he decided to offer his cowman a share of receipts, the idea being that the cowman should provide the labour and pay for all concentrates used, whilst the farmer paid for everything else:—

	£	£	£
Receipts per cow:—			
Milk, 800 gallons @ 2s. 10d.		113	
Calf		8	
		—	121
Costs per cow:—			
Farmer's fixed costs			
1·85 acres @ £4	7		
Depreciation on buildings and equipment	5		
Interest on buildings and equipment @ 6 per cent on average investment	3		
	—	15	
Farmer's variable costs			
Grazing, 1·0 acres	4		
Hay and silage, 0·75 acres	5		
Roots, 0·1 acres	2		
Miscellaneous	9		
Replacement	10		
	—	30	45
Stockman's variable costs			
Labour, £600 for 50 cows		12	
Concentrates, 2,000 lbs @ £34/ton		30	
		—	42
Profit per cow			34

In this way the farmer hopes to be able to reduce the amount of time he spends on the herd, and at the same time reward his cowman for accepting greater responsibility, and for looking after more cows.

With yields averaging about 800 gallons per cow he estimates that receipts per cow should be £121, whilst if labour be excluded both he and the stockman will each be responsible for half the variable cost of keeping each cow.

The rental value of his land, apart from the buildings, he considers to be £4 per acre, and the buildings and equipment used by the herd he values at £100 per cow, fixed costs per cow being approximately £15 per year. The farmer therefore expects to contribute £45 a year to the cost of keeping each cow as compared with the £30 he estimates his cowman will contribute.

In view of this he has decided to offer his cowman thirty seventy-fifths, that is two-fifths of receipts, the cost of concentrates used being deducted in order to arrive at the net payment due to the cowman each month:—

	£	£
Receipts:—		
Milk, 50 × 500 gals. @ 2s. 10d.	5,667	
Calves, 48 @ £8	384	
		6,051
Gross return to cowman		2,420
Estimated cost of concentrates		1,500
Net annual return to cowman		920
Average monthly return to cowman		77
Gross return to farmer		3,631
Fixed costs, 50 × £15	750	
Farmer's share of variable costs, 50 × £30	1,500	
		2,250
Net return to farmer		1,381
Net return per cow		28

He thinks the cowman ought to be able to earn at least £920 a year, compared with £600 before. The farmer himself expects to make a profit of at least £28 per cow against £34 per cow when paying his man in the normal way. However, with ten extra cows he expects £1,400 profit from the enterprise compared with £1,360 last year. This however is his minimum expectation as he anticipates that the new arrangement will lead to higher milk yields, and perhaps quite considerable economies in concentrate use.

In each of these examples, not only is considerable incentive to greater effort and attention offered, but it is offered for greater attention to some of the most important factors. Apart from this, however, it is hoped that the standards of performance presented in this report will emphasise the importance of obtaining planning data with which to manage efficiently.

APPENDIX

Seed Bed Preparation and Drilling Corn

1. Rolling two ways and working across field.

   Equipment. Fordson Major and set of 12 foot rolls.

Distance from headland to headland	290 yards
Time to roll from headland to headland	96 secs
180 degree turn on headland	9 secs

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	7·1
200	7·9
300	8·3
400	8·5

2. Harrowing round and round.

   Equipment. Fordson Major and set of 18 foot heavy harrows.

   Acres per hour and per man hour 18·2

3. Harrowing two ways and working across field.

   Equipment. Fordson Major and set of 18 foot heavy harrows.

Distance from headland to headland	245 yards
Time to harrow from headland to headland	60 secs
180 degree turn on headland	7 secs

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	14·4
200	16·0
300	16·7
400	17·0

4. Drilling corn two ways and working across field.

   Equipment. Ferguson 35 and Massey Ferguson 732 Combine Drill with 15 coulters spaced 7 inches apart.
   Seed rate 1½ cwts per acre.
   Fertilizer 3 cwts per acre (granular)

   Seed sacks in 1½ cwts, fertilizer in 1 cwt paper sacks, both on trailer, the trailer being situated on one of the headlands and occasionally moved along as the work proceeds.

Distance from headland to headland	254 yards
Time to drill from headland to headland	85 secs
180 degrees turn on headland	12 secs
To trailer, refill drill and return (average)	189 secs

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	3·6
200	3·9
300	4·0
400	4·1

Silage Making

Method One

Cutting 2 ways in lands, side delivery of blown grass to a trailer travelling alongside. Twenty-five cwt loads transported to clamp, trailers backed on to concrete apron at end of clamp and grass tipped on to apron and against wall in line with one side of clamp. Grass taken from up against the retaining wall then being buckraked on to the clamp. One man operating the harvester, one with each trailer, and one buckraking, four in all.

Equipment:—
Lundell Super 60 Forage Harvester with 58-in. cut (1961 Model) powered by Fordson Power Major. Two 2-wheeled rear tipping trailers of 25 cwt capacity, in this case powered by a Fordson Major and a Ferguson T20.
One rear mounted buckrake fitted to a Ferguson 35.

Distance between mid-field and clamp (yards)	200	400	600	800	1,000	1,200	1,400	1,600
4 ton cut:—								
Acres per 8 hour day	10·8	10·8	10·8	10·8	10·8	10·4	9·6	9·0
Acres per man per 8 hour day	2·7	2·7	2·7	2·7	2·7	2·6	2·4	2·2
6 ton cut:—								
Acres per 8 hour day	10·7	10·7	10·7	9·9	8·9	8·1	7·5	6·9
Acres per man per 8 hour day	2·7	2·7	2·7	2·5	2·2	2·0	1·9	1·7

Method Two

As method one but cutting out diagonals and then round and round instead of two ways in lands.

Distance between mid-field and clamp (yards)	200	400	600	800	1,000	1,200	1,400	1,600
4 ton cut:—								
Acres per 8 hour day	11·6	11·6	11·6	11·6	11·6	10·6	10·0	9·2
Acres per man per 8 hour day	2·9	2·9	2·9	2·9	2·9	2·7	2·5	2·3
6 ton cut:—								
Acres per 8 hour day	11·5	11·5	11·5	10·3	9·2	8·4	7·7	7·1
Acres per man per 8 hour day	2·9	2·9	2·9	2·6	2·3	2·1	1·9	1·8

Method Three

As method two but with a third tractor and trailer and a fifth man added to the team.

Distance between mid-field and clamp (yards)	200	400	600	800	1,000	1,200	1,400	1,600
4 ton cut:—								
Acres per 8 hour day	11·6	11·6	11·6	11·6	11·6	11·6	11·6	11·6
Acres per man per 8 hour day	2·3	2·3	2·3	2·3	2·3	2·3	2·3	2·3
6 ton cut:—								
Acres per 8 hour day	11·5	11·5	11·5	11·5	11·5	11·5	11·5	10·7
Acres per man per 8 hour day	2·3	2·3	2·3	2·3	2·3	2·3	2·3	2·1

Method Four

As method two but blowing cut grass to a trailer hitched behind the harvester. One man with harvester, one carting and one with buckrake, three men in all.

Distance between mid-field and clamp (yards)	200	400	600	800	1,000	1,200	1,400	1,600
4 ton cut:—								
Acres per 8 hour day	10·4	10·4	10·4	10·4	10·4	10·4	10·4	10·4
Acres per man per 8 hour day	3·5	3·5	3·5	3·5	3·5	3·5	3·5	3·5
6 ton cut:—								
Acres per 8 hour day	9·7	9·7	9·7	9·7	9·7	9·7	9·7	9·5
Acres per man per 8 hour day	3·2	3·2	3·2	3·2	3·2	3·2	3·2	3·2

NOTE:

When cutting two ways in lands there will be some small variation in performance due to differences in field size, and consequently in the average distance from headland to headland. This is not taken into account in the performance figures given for Method One, partly because the variation to be expected is relatively unimportant, but also because cutting round and round is to be recommended whenever it is practicable.

Haymaking

1. Mowing one way.

Equipment. Rear mounted mower with 4 ft 6 in. cut attached to Ferguson 35.

Yield. 31 cwts per acre fresh made.

Distance headland to headland	378 yards
Time to mow from headland to headland	172 secs
180 degree turn on headland	7 secs
Raising and securing cutter bar	46 secs
Time, headland to headland out of work	94 secs
Release and lower cutter bar	27 secs

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	0·7
200	1·0
300	1·1
400	1·2

2. Mowing and crimping two ways in lands.

Equipment. Ferguson 35, 4 ft 6 in. mid-mounted mower, New Holland crimper.

Yield. 31 cwts per acre fresh made.

Distance headland to headland	365 yards
Time to mow from headland to headland	184 secs
Turn 90 degrees, average travel along headland 46 yards, turn 90 degrees	28 secs

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	1·4
200	1·7
300	1·9
400	1·9

3. Tedding two ways and working across field.

Equipment. Ferguson 35 and 9 ft tedder.

Yield. 31 cwts per acre fresh made.

Average distance from headland to headland	467 yards
Time to ted from headland to headland (2 swathes)	83 secs
180 degree turn on headland	7 secs

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	4·9
200	5·2
300	5·4
400	5·5

4. Turning one way.

Equipment. Fordson Major and Vicon-Lely Turner.

Yield. 31 cwts per acre fresh made.

Average distance from headland to headland	486 yards
Time to turn from headland to headland (2 swathes)	242 secs
180 degree turn on headland	10 secs
From headland to headland out of work	103 secs

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	2·5
200	2·7
300	2·9
400	2·9

5. Turning two ways in lands.

Equipment. Fordson Major and Vicon-Lely Turner.

Yield. 31 cwts per acre fresh made.

Average distance from headland to headland	486 yards
Time to turn from headland to headland (2 swathes)	242 secs
Turn 90 degrees, average travel along headland 46 yards, turn 90 degrees	28 secs

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	2·9
200	3·5
300	3·8
400	3·9

6. Wuffling two ways and working across field.

Equipment. Ferguson 35 and Wuffler.

Average distance from headland to headland	384 yards
Time to wuffle from headland to headland	132 secs
180 degree turn on headland	7 secs

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	2·7
200	2·9
300	3·0
400	3·1

7. Baling two ways in lands after turning two swathes into one.

Equipment. Fordson Power Major, Bamfords BL 61 Baler and bale sledge. (one man on baler, one man on sledge).

Average distance from headland to headland	487 yards
Time to bale from headland to headland (2 swathes in 1)	320 secs
Turn 90 degrees, average travel along headland 15 yards, turn 90 degrees	17 secs

Number of bales per acre 73
Average weight of bales 48 lbs fresh made.
Yield of hay per acre 31 cwts fresh made.

Average distance from headland to headland in yards	*Acres per hour*	*Acres per man hour*
100	2·7	1·35
200	3·0	1·50
300	3·1	1·55
400	3·2	1·60

8. Leading hay bales from field to foot of elevator either in dutch barn or at stack.

Equipment. Fordson Major fitted with rear mounted bale rake.

Distance between mid-field and elevator 830 yards
Average time taken to travel between field and elevator 175 secs
Backing to bales and loading in field (stacked in 13's) 15 secs
Backing to foot of elevator and off-loading bales 15 secs
Number of bales carried per load =13
Number of bales per acre =73
Average weight of bales 48 lbs fresh made
Yield of hay per acre 31 cwts fresh made

Distance between mid-field and dutch barn or stack (yards)	200	400	600	800	1,000	1,200	1,400	1,600
Bales per hour per man equipped with tractor and balerake	411	236	165	127	104	87	75	66
Acres per man hour (73 bales per acre)	5·6	3·2	2·3	1·7	1·4	1·2	1·0	0·9

9. Elevating and stacking hay bales in dutch barn, in a stack, or in any easily accessible building.

Equipment. 1 Elevator.

One man loading bales on to foot of elevator, one man taking bales off top of elevator and stacking. The man stacking is the lead operator.

Time required to stack each 13 bales =224 secs.

Bales stacked per hour =209
Bales stacked per man hour =105

Harvesting Corn

1. Combining two ways in lands.

Equipment. Bamford Claeys 10-foot cut self-propelled "Zegelmen" combine harvester.

Average distance from headland to headland	520 yards
Time to combine from headland to headland	379 secs
Turn 90 degrees, average travel along headland 13 yards, turn 90 degrees	16 secs

Yield per acre 33 cwts barley.

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	2·8
200	3·1
300	3·2
400	3·2

2. Combining two ways in lands.

Equipment. Ferguson 35 and McCormick B 64 6-foot cut combine harvester.

Average distance from headland to headland	500 yards
Time to combine from headland to headland	362 secs
Turn 90 degrees, average travel along headland 25 yards, turn 90 degrees	25 secs

Yield per acre 33 cwts barley.

Average distance from headland to headland in yards	*Acres per hour and per man hour*
100	1·6
200	1·8
300	1·9
400	1·9

Harvesting Roots

1. Pulling and topping mangolds.

   Equipment. Turnip knife.

   Method. Holding the knife in the right hand, stoops and selects a mangold from either of two rows, grasping it around the stem near to the crown with the left hand. Pulls the mangold out of the ground with the left hand, moves it to the right side and locates it over a single row of topped mangolds at the same time turning it on to its side and lifting the knife in the right hand. Cuts off the top close to the crown and asides top with left hand.

   Type of Mangold. Intermediate.

   Yield. 18 tons per acre.

   Spacing. To 10 ins. in the row and 24 ins. between rows.

   Soil condition. Good.

   Soil type. Medium loam.

   Labour requirement:—
   26·65 man mins per 100 yards (and two rows).
   16·13 man hours per acre.

2. Pulling and knocking Sugar-Beet.

   Method. Facing down the rows and stooping forwards grasps next beet in each of two rows around the stem close to the crown, one in each hand. Pulls the beet out of the ground knocks together until most of the soil falls off, and turning 40 degrees left from the waist lays each beet in a single row, and in a precise line with crown level with crown ready for topping with a spade.

   Yield. 13 tons per acre.

   Spacing. To 10 ins in the row and 24 ins between rows.

   Soil condition. Bad—wet and sticky.

   Soil type. Medium loam.

   Labour requirement:—
   36·20 man mins per 100 yards (and two rows).
   21·90 man hours per acre.

3. Topping Sugar-Beet.

   Method. Holding the handle of the spade with both hands walks slowly up the row of knocked beet, which previously comprised two rows and after knocking had been placed crown level with crown, and slice off the stems just below the top of the crown with the spade.

Yield.	13 tons per acre.
Spacing.	To 10 ins in the row and 24 ins between rows prior to lifting and knocking.
Soil condition	Bad—wet and sticky.
Soil type.	Medium loam.
Labour requirement:—	
	12·06 man minutes per 100 yards (with two rows in one).
	7·30 man hours per acre.

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