Hay - Cost of production U.S.

THE NORTH OF SCOTLAND COLLEGE OF AGRICULTURE

AGRICULTURAL ECONOMICS DEPARTMENT

ECONOMIC REPORT NO. 98

HAY MAKING METHODS - COMPARISON OF COSTS

1961

by

R. J. COLLEY

September, 1961

Price 1/6d.
plus postage

AGRICULTURAL ECONOMICS DEPARTMENT

Provincial Agricultural Economist	Albert D. Imper, M.B.E., B.Sc. (Agr.), M.Sc. (Econ.), Ph.D., N.D.A.
Senior Agricultural Economist	Gordon G. Hayes, B.Sc. (Econ.), N.D.A.
Agricultural Economists	John Clark, B.Sc. (Agr.), N.D.A. Alexander Grant, B.Sc. (Agr.), Dip. Agr. Econ., A.C.W.A. A. B. K. Tracey, B.Sc. (Agr.), N.D.A. Miss Margaret Haughs, B.Sc. (Agr.) Miss Audrey M. Chalmers, B.Sc. (Agr.) R. J. Colley, B.Sc. (Agr.), Dip. Agric. (Leeds) J. M. Dunn, B.A. (Agr.) (Cantab.)
Executive Officers	George Cowie Walter A. Duthie

The North of Scotland College of Agriculture,
Economics Department,
41½ Union Street,
Aberdeen.

INTRODUCTION

The survey of "Hay Making Methods Comparison of Costs" which was carried out in 1960 (Economic Report No. 90) has been continued on a larger scale. Records were obtained from 40 fields in the counties of Aberdeenshire and Kincardineshire, practically all of them situated on the lower land to the east of the mountains. Last year Deeside was included as a separate group; this year it was decided to drop this geographical sub-division of the sample and so make possible a larger, and thus more reliable, sample of the farms in the main hay making areas.

The weather has been rather variable in the area. On the whole, farms in Kincardineshire seem to have been more fortunate in this respect than those further north in Aberdeenshire where there were some complaints of a poor hay making season. As last year farmers who cut their hay in the middle of June seem to have had the best of the weather and harvested the hay quickly, while those who left it another fortnight to get a better crop, or took early grazing off the field before the hay crop, were often still busy with the hay till just before the harvest in the last ten days of August.

Methods of Haymaking

Three main methods of haymaking were employed:-

1) Conditioning the hay by forced ventilation
2) Making coles with or without tripods.
3) Baling from the windrow

It must be emphasised that the first method is not the same as "Hay Drying" which produces a much superior product.

Hay conditioning entails cutting the hay as for other methods of haymaking, but only allowing it to wilt in the field for a limited time. It is then baled at a slightly higher moisture content than for normal pick up baling, stacked round an open tunnel and air is forced through the bales. The result is a better quality hay than is produced with a pick up baler and the risk of damage in bad weather is reduced.

Hay drying consists of baling the hay at a much higher moisture content and driving a higher percentage of the initial moisture off in the drier. The product in this case is a great deal superior to that produced in hay conditioning at the same time loss of leaf in the field is reduced, thus the yield of dried

hay is higher than from a similar crop of grass made into hay by any of the three methods discussed in this report. The extra yield from pick up baling in this report is the result of a heavier initial crop and NOT the result of the method of haymaking used.

It was felt that the results of the survey would be of little value if the cost of production only was calculated and no consideration given to the differences in quality of the finished product under the different systems. For this reason samples of hay were taken from each farm and analysed for dry matter, protein, fibre and starch equivalent. In this area protein is usually present in excess in rations of beef and dairy cattle so it is reasonable to compare samples of hay on the basis of starch equivalent. This has been worked out in two ways:-

a) The cost of producing a hundredweight of starch equivalent taking into consideration both the cost of growing and harvesting the grass.

b) The value of the sample of hay per acre and per ton taking the value of starch equivalent as 32/- a hundredweight, the price being paid for starch when barley is £20 a ton. Thus in Table II (Page 5) the hay valued at £10:5:4 per ton requires the addition of £1:1:6 worth of barley if the animals are to obtain the same quantity of nutrients as they would from a ton of the better hay valued at £11:6:10.

COST OF PRODUCTION

The cost of hay production can be divided into two sections:-

1) Costs incurred before the grass is cut
2) Costs of harvesting

Costs incurred before the grass is cut

RENT This year the average rent on farms costed was slightly lower than last year - £1:14:5 compared with £2. The range was from £1 to £3:10/-.

FERTILISER This year rather more fertiliser was applied than last, and in addition slightly more was brought forward from the previous crop. The fertiliser applied is up by some 13/6 per acre at £3:17/- (net) i.e.about 1 cwt. of compound fertiliser extra. Fertiliser brought forward is up by 5/- at £2:11:8.

SEEDS Value of seeds was similar to last year being 3d down at £1:1:4 per acre for a year's grass. The actual cost of seeds was £4:5/- spread over three years' grass and a quarter being ploughed in as green manuring and thus debited to the next crop. On threequarters of the farms the value of the seeds sown was between 80/- and 90/- per acre.

OVERHEADS In Table III the overheads of 15/10 consist of 9/- per acre plus the labour and machinery overheads for spreading the manure. The Table IV overheads are those allocated according to man and tractor labour in harvesting

on the basis shown in the appendix. As this is only an arbitrary method of allocating the overheads they have not been included in the direct harvesting costs which, for the purposes of comparison between systems, only include the cost of labour, running the tractor and twine. In the case of hay conditioners fuel and depreciation on the machine are also included.

Costs incurred harvesting the crop.

In this report last year it was stated that a dry spring had resulted in a reduced yield and a dry haymaking reduced the labour and machinery requirements for the harvest. This year inspite of a higher yield the labour and tractor hours in harvesting are lower and the quality of the finished product is higher. The reason for this is not altogether clear, the whole saving in labour having come from coling and carting the hay. In all the tables in this report the farms have been divided into three groups according to the methods of harvesting. These are as follows:-

Group I - 15 fields totalling 131 acres baled from windrow and conditioned.

Group II - 10 fields totalling 88 acres using coles with or without tripods

Group III - 15 fields totalling 136 acres baled from the windrow with a pick up baler.

TABLE I

Labour Requirements Per Acre (In Hours)

	Cutting		Turning		Coling or Tripodding		Baling		Stacking		Total	
	Man	Tractor	Man	Tractor	Man	Tractor	Man	Tractor	Man	Tractor	Man	Tractor
Conditioned	1.2	1.2	1.9	1.9			0.9	0.8	5.9*	2.4*	10.0	6.3
Coled	1.5	1.4	1.0	1.0	8.8	2.0	0.4[x]	0.4[x]	6.0	2.0	17.7	6.8
Pick up Baled	1.5	1.2	1.5	1.4			1.2	1.1	5.2	2.2	9.4	5.9

*These figures include 1.4 and 0.5 for moving the stack to enable a second batch to be conditioned on the tunnel. This was only done in four cases; the actual time involved per acre was 4.6 man hours and 1.8 tractor hours.

[x]Baling was only done in four cases from the tripod; the actual time involved was 0.9 man and 0.9 tractor hours.

As last year Table I brings out the low labour and tractor requirements of using a pick up baler compared with coling or conditioning, but the higher risk of the pick up baler should be remembered; as shown at the foot of Table II this resulted in a reduction in the value of the hay (valued on the basis of Starch Equivalent) from £11:6:10 to £10:1:9. In this table the coled hay does not show up as well as it should as in some cases coling has been used as a salvage operation on hay intended for the pick up baler. This is shown in the analysis figures where some farms had a starch equivalent figure of under 29, one has 32.1 and the otherswere over 32.9. Possibly in the case of the under 29 S.E. the weather broke and farmers had the choice of expensive low quality hay or none at all.

As this is only the second year in which hay conditioning has been carried out in this district it may be appropriate to devote a little space to a discussion of this method of hay making. The system consists of installing a diesel motor with a large fan at the end of an open sided tunnel round which 700 to 1000 bales of partly wilted grass are placed. When the motor is started air is blown through the stack of bales, drying them out in from five to ten days. The bales are put in weighing about 70 lbs. During drying about 30 lbs. of moisture is driven off, leaving a bale weighing 40 to 45 lbs. One loading of the hay tunnel usually represents the crop off about ten acres.

It is claimed that this system produces better quality hay than coles or pick up balers and avoids risks in bad weather. The yield of starch per ton of hay was 12½% better than pick up baled hay and 10% better than coled. This year the quality was better than last; in fact S.E. was 35.2 compared with 32.5 last year when all farmers except one were using conditioners for the first time; the one with experience of the method achieved an S.E. of 35.2. Now that farmers and machinery instructors have had another year's experience the average is as good as last year's best, and the best figure for S.E. this year is 37.5 so there is still scope for an improvement in the average. It should be noted that the best quality hay included in the group of hay conditioners is the kind of result that one should obtain from hay drying, the average is half way between the quality of pick up baled and dried hay, and the worst was a very inferior product containing only 75% of the nutrients contained in the best.

TABLE II

Hay Quality, Yield, Cost and Value

	Conditioning	Coles and Tripods	Pick Up Balers
QUALITY			
Starch Equivalent	35.2	32.1	31.6
% Dry Matter	82.3	81.0	80.3
Crude Protein (in dry matter)	6.9	8.0	6.6
Crude Fibre (in dry matter)	29.5	33.6	33.0
YIELD PER ACRE	cwts. per acre	cwts. per acre	cwts. per acre
Hay	50.4	51.0	58.1[x]
Dry Matter	41.5	41.9	53.5
Starch Equivalent	18.1	16.8	18.6
COST PER ACRE			
Direct Costs	7: 5: 1	5:13: 1	3:18: 3
Indirect Costs	8: 1: -	8:15: 9	7: 7: 5
TOTAL	15: 6: 1	14: 8:10	11: 5: 8
COST			
Hay (per ton)	6: 1: 5	5:13: 3	4: 1: 3
Dry Matter (per cwt.)	-: 7: 5	-: 6:11	-: 4: 5
Starch Equivalent (per cwt.)	-:16:11	-:17: 2	-:12: 8
VALUE OF HAY*			
Per Acre	28:17: 9	26:13: 6	29:14: 6
Per Ton	11: 6:10	10: 5: 4	10: 1: 9

*Value based on Starch Equivalent of hay. For explanation of calculation see first page of the report.

[x]This high yield is due to a higher initial crop - NOT to the system of hay making.

In the conditioning group there is quite close agreement between farms on all items of harvesting cost except fuel cost. The average is £1:14:11 with a range from 13/6 to £3:9/-. These extremes are not just unusual cases for there is an even distribution through the range. From discussion with farmers it appears lack of experience is a common cause of high fuel consumption. Several farmers had trouble in drying their first batch as the bales were too large and too tightly tied. A tight bale impedes air circulation and drying may take twice as long as it would otherwise; in fact both this year and last, cases have been encountered where the hay was blown for a week and considered dry, taken off the tunnel and stacked under cover, only to find that it had been improperly dried and started to heat. After the second batch of hay had been dried this first batch had to be put on to the tunnel again and given a second blowing.

Other people have carried on blowing long after the majority of bales were dry because they judged the dampness of the heap by the top bales. These, however, trap moisture from the escaping moist air. Some farmers with more experience of hay conditioning now put the top bales from the first batch at the base of the second heap.

CONCLUSIONS

The year, like 1960, proved to be a fairly favourable one for hay making. There were, however, some local areas where the weather was bad, and those who cut hay late missed the fine weather.

On the farms costed it happens that the yield of hay where pick up balers were used was about 8 cwt. higher than farms using hay conditioners or coles, but there is nothing to suggest that this extra yield can in any way be attributed to the system of hay making. In a survey of this type it is impossible to draw any conclusions about the influence of husbandry, soil, seed mixtures and fertilisers on yield. It can be noted, however, that in spite of a chance yield of hay 8 cwt. lighter from hay conditioning than from pick up baling the yield of starch per acre from the two systems is almost indentical (Table II).

The extra quality of hay from conditioning has, however, cost a considerable amount to obtain. In Table II the cost per cwt. of S.E. is recorded as 12/8d from pick up baled hay, and 16/11d from conditioned hay; the former figure has been depressed slightly by the higher yield spreading the costs over a

larger quantity of hay, but even if allowance is made for this the cost is still only about 15/- per cwt. of S.E. For all practical purposes it can be taken that hay made on coles cost the same amount per cwt. of S.E. as conditioned hay.

From the evidence produced in this year's report taken in conjunction with the 1960 report, it is possible to make a few tentative conclusions. In this area the pick up baler appears to be able to produce reasonably good quality hay at a low cost provided the weather is suitable, equipment for artificial drying or conditioning being a useful reserve weapon if the weather breaks. If the hay is cut with the intention of drying it on coles the product obtained is not much lower in quality than that produced by conditioning. (On looking at Table II it must be remembered that the S.E. for coles has been reduced by some farmers using it as a salvage method for hay intended for baling). It is possible that hay conditioning will produce better quality hay in a wet season than coles, but so far this has not been shown in this survey owing to two dry haymaking seasons, and it must be remembered that there is very heavy capital expenditure (over £650) in buying equipment for conditioning.

In this report only a third of the depreciation of the conditioning equipment has been charged to the hay. If the equipment were to be used for hay drying alone, unless it was on a very large acreage, it would appear to be uneconomic. If it were only used on 20 acres a year the depreciation figure in Table IV would have to be increased by about £2:15/- and the cost per cwt. of S.E. would increase to about 20/-. In this case the cost per acre would be about 70% higher than for pick-up baling or 25% higher than coling and it would have to produce an almost impossibly large increase in yield to make it economic.

On the other hand if the farmer has decided that a grain drier is essential, and that the motor used for hay conditioning is ideal for that purpose and that he is justified in buying it for grain alone, then he would be foolish not to use it for hay conditioning as well. In this case it would not be unreasonable to charge no depreciation against the hay (as the machine was essential for grain drying and the extra use would not appreciably shorten its life) and the harvesting cost would be reduced by £1:7/- thus bringing it below the cost of coling hay and the cost per cwt. of S.E. down to 15/6d or per acre down to about £14. This is only some £2:5/- above the cost of pick up baling and it would be almost bound to

TABLE III

Average Costs of Production to Harvest

Establishing grass		-: 3: 3
Seed Cost ($\frac{1}{4}$ of £4:5:4)		1: 1: 4
Rent		1:14: 5
Manures applied	£3:17: -	
+ R.M.V. b/f.	2:11: 8	
	6: 8: 8	
- R.M.V. c/f.	2: 6: 3	4: 2: 5
Applying manures. 1 man 1 tractor hour		-: 8:10
Overheads		-:15:10
Total growing cost		8: 6: 1
Less one-third to grazing		2:14: 8
Average cost to harvesting per acre		5:11: 5

TABLE IV

Harvesting and Total Costs per Acre

	Hay Conditioners		Coles or Tripods		Pick up Balers	
	Hrs.	£ s. d.	Hrs.	£ s. d.	Hrs.	£ s. d.
Labour	10.0	2: 3: 4	17.7	3:16: 8	9.4	2: -: 9
Tractor cost	6.3	1: 8: 4	6.8	1:10: 7	5.9	1: 6: 7
Twine		-:11: 5		-: 5:10*		-:10:11
Fuel		1:14:11				
Depreciation		1: 7: 1				
Harvesting Cost		7: 5: 1		5:13: 1		3:18: 3
Cost to Harvest		5:11: 5		5:11: 5		5:11: 5
Harvesting Overheads		2: 9: 7		3: 4: 4		2: 6: -
TOTAL		15: 6: 1		14: 8:10		11:15: 8
Av. Yield per acre		50.4 cwt.		51 cwt.		58.1 cwt.
Av. Cost per ton		6: 1: 5		5:13: 3		4: 1: 3
Value of hay per ton on S.E. (From Table II)		11: 6:10		10: 5: 4		10: 1: 9
Acreage Hay costed		131 acres		82 acres		127 acres

*Only some farms baled the hay. The average cost of those baling was 10/7d.

produce at least this extra food value in the hay even in a good season. This better quality hay could well prove invaluable in the profitable rapid fattening of beef animals.

From the 65 sets of costings kept during 1960 and 1961, it appears that pick up baling will produce reasonably good quality hay at a low cost in a good season. For an extra £2:10/- an acre the hay can be coled and a better quality product obtained, and at the same time the risk of spoiling in bad weather can be reduced. This extra cost is largely labour and in fact, unless extra overtime is worked, the cost to the farmer may only be that some other job is not done. The third alternative of hay conditioning is uneconomic unless a very large acreage of hay is conditioned or the machine is used for grain drying, ventilating bulk potato stores or as an irrigation pump. If the machine can be fully used it produces good quality hay without risk at a relatively small increase in cost over coled hay. If the machine has been bought as a worth while investment for other jobs on the farm it would be foolish for it not to be used for hay making as well.

The fourth alternative, hay drying, costs for which have not been obtained preparing this report, will probably cost a relatively small amount more than conditioning. Work in the field should be about the same in both cases, but as the grass is baled at a higher moisture content the blowing has to be continued longer to dry the stack out. If a pessimistic viewpoint is taken this might double the fuel cost, thus adding £1:15/- to the cost of drying. In exchange for this extra cost the quality of the hay is much better. Research done by the English N.A.A.S. suggests that the feeding value may be up to 50% better than normal hay; at the same time as a result of reducing movement of the partly dry material in the field, leaf loss is cut down and a higher yield of hay is produced. Experiments indicate that this may be in the order of 7 cwt. per acre. Of supreme importance is the fact that the crop can be secured in a much shorter time.

ACKNOWLEDGMENTS

The staff of this department would like to thank the co-operating farmers for keeping records and supplying the information used in this report. They would also like to thank the Chemistry Department for analysing the large number of hay samples which this survey has entailed taking, and the Machinery Instructors for their advice in the preparation of this report.

APPENDIX

Labour, tractor work and overheads have been charged as follows:-

Labour	-	4/4 per hour
Tractor Work	-	4/6 " "
Overheads	-	9/- per acre
		7/6 per £1 man labour
		5/3 per tractor hour

Overheads on the "per tractor hour" basis cover depreciation on machinery with the exception of the hay conditioner, this being a high cost specialised piece of equipment. This has been depreciated at 12½%, i.e. purchase price £650, depreciation £81:5/-. Besides hay drying the machine can be used for irrigation, grain drying and ventilating potatoes. It has been decided, after discussion with the machinery instructors, that it is reasonable to assume that a third of the hay conditioners' time was spent on the hay crop. This year the average acreage per machine was twenty. Depreciation has thus been taken at £1:7:1 per acre for the hay crop.

The cost of establishing the grassland has been spread over four years and costs not directly chargeable to the hay crop have been split in the ratio two-thirds to hay and one-third to grazing.