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THE WEST OF SCOTLAND AGRICULTURAL COLLEGE

Economic dept.

BRACKEN-CUTTING TRIALS

(Fourth Year)

West Perthshire, 1955

Report No. 29
November, 1955.

6, Blythswood Square,
Glasgow, C.2.

THE WEST OF SCOTLAND AGRICULTURAL COLLEGE

BRACKEN-CUTTING TRIALS

West Perthshire

Season 1955

INTRODUCTION

This report, the fourth in the series, presents some results of the 1955 bracken-cutting trials on hill land near Comrie, Perthshire. The trials, started in 1952, have now reached the stage where further mechanical treatment of the area originally selected will probably be unnecessary. The question of a final report on the experiment has to be deferred, however, until the effects of this year's cutting becomes apparent in the growth of the bracken fronds next year. Consequently, the figures given in this report are confined mainly to the 1955 season.

The four machines under trial were supplied by the Scottish Machinery Testing Station and the supervision of the field work was carried out by Station staff. Unlike previous years when tractors and drivers were supplied by the Machinery Service of Department of Agriculture for Scotland, in 1955 the work was undertaken by a contractor. This change was necessitated by the closing down of the Machinery Service. Members of the College staff made botanical and other observations and prepared the costing figures from the field book records.

The College material is handled in three sections as follows:-

Section 1.

"Report on 1955 Trials" - A. Broadfoot, M.B.E., County Advisory Service.

Section 2.

"Costings of the Trials" - J.B. McCreath, Economics Department.

Section 3.

"Botanical Aspects" - J.D. Forrest, Botany Department.

Acknowledgments

Grateful acknowledgment is made:-

To Messrs F. McDiarmid, T. Rimmer and D.M. Stewart, O.B.E. on whose land the trials took place.

To members of staff of the Machinery Testing Station, particularly Mr. P.S. Hutchison for his careful recording in the field books and Dr. I.M. Robertson for subsequent information pertaining to the machines.

SECTION 1

REPORT ON 1955 TRIALS BY COUNTY ADVISER

Following three years of double cutting, the bracken growth is now down to a point where the machines at present in use are missing many of the smaller, weaker fronds and the cuts are less effective.

Bracken on the cut areas is now very weak. A late frost this spring killed some of the early fronds and by the time cutting would normally have begun the growth was so poor that it was debatable whether it was worth putting the machines over the ground or not. Eventually it was decided to make one late cut and this was not started till 11th July, being completed on 2nd August, 1955.

Bracken has now been reduced to a point where it no longer interferes greatly with the grazing, but so long as it is present, it remains a constant menace and will require cutting from time to time to keep it under control. In the West (unlike the experience in the East of Scotland area) we can find little or nothing in defence of bracken and would like to see it completely eradicated. This is not feasible with the present machines. A Rotoflail was suggested but the Machinery Testing Station say it would be impracticable and uneconomic in our rocky conditions. So far no Hormone type of weed killer has been produced which could do for bracken what M.C.P.A. has done for some arable weeds. It seems probable that further cutting will be uneconomic meantime.

On the problem of control - trials are now in progress at Touchmollar in Stirlingshire to see how often cutting will be necessary. Bringing the bracken under control is only solving part of the problem and further work in pushing the improvement beyond this point is urgently needed.

The cost of reducing bracken even with mechanical aid remains a heavy one and while the farmers in the area consider that the cutting has been worth while, it is extremely difficult to find any way by which the improvement can be measured. On Kingarth, most of the top lambs have come off the treated area and this is becoming more noticeable each year as the bracken increases on the remainder of the hill.

In July a meeting of various parties interested in the bracken problem was held on the Comrie area and a full discussion took place on the results. The question was raised then of further treatment and as to whether anything could be done in the way of cultivation, manuring and stocking which might increase the dividend from the cutting programme or retard the regrowth of bracken. During this discussion many suggestions for improving the sward were considered. An area on Locherlour has already been ploughed and re-seeded and has yielded excellent results in the current year. On Kingarth, Mr. Rimmer is considering going ahead with a scheme to plough and reseed the more arable parts of his area and on the farm of Balmuick, with the kind co-operation of Mr. D.M. Stewart, O.B.E. the owner, a large scale trial of rotational grazing coupled with manuring has been proposed.

To the farmers who have made their farms available for this trial, I would like to add my personal thanks for their help and interest.

SECTION 2

COSTINGS OF THE TRIALS

One of the main aims is to ascertain the comparative costs of treatment per acre and it is with that objective that this section of the report is chiefly concerned. Throughout, the term "outfit" means "tractor plus machine" and "machine" used alone refers only to the bracken-destroying machine.

Type of Outfit and Acreage Treated

The outfits used and the acreage treated in 1955 are summarised in the following table.

Table 1.

Type of Outfit and Acreage Treated in 1955

<u>Make of Tractor</u>	<u>Type of Machine</u>	<u>Acreage Treated (Single Cut)</u>
Ferguson Diesel	Holt Breaker	147.9
Fordson Major on Half-Tracks	Cuthbertson Crusher	110.9
Standard Ferguson	Henderson Slasher	89.9
Standard Ferguson [‡]	Ferguson Mower	<u>49.7</u>
	TOTAL	<u>398.4</u>

[‡] This paraffin tractor was replaced by a Ferguson Diesel for the last two days.

The same four machines as in earlier years were used in 1955 but the tractors and their drivers, supplied by a contractor this season, were, of course, different.

Three of the machines treated the same acreage as in the previous season, but one cut only. In the Ferguson Mower area, bracken growth was not vigorous enough to warrant recutting all the acreage done in 1954 (100.8 acres). Treatment was restricted to those parts where the fronds were approximately one foot high. In all, only approximately half the mower area required cutting in 1955.

Field Organisation

This was virtually the same as detailed in previous reports.≠

Time of Cutting

As mentioned earlier in the County Adviser's report, the lateness and much reduced growth of bracken on the areas treated in previous seasons delayed the time of cutting this year. Work began on 11th July, three weeks later than the time of the first cut in 1954. In the Mower area, cutting was not started until the 23rd of July. No second cut was required in any area.

Recording

Weekly record sheets, similar to those used in previous years, gave details of hours spent, fuel used and other relevant data.

Information on the cost of the repairs and maintenance of the machines was supplied by the Machinery Testing Station.

Method of Costing

The costing method used in 1955 was the same as that used in previous seasons and detailed in the reports. Briefly, the method was as follows:-

(1) Tractor Charges

To ascertain the comparative operating costs per acre of each machine, it is necessary to use a method of costing which will eliminate, as far as possible, any differences in cost caused solely by the tractors.

To achieve this, the wheeled tractors were each charged at the same hourly rate of 4/6d and the Fordson Major, being on half-tracks, at 5/- per hour. These rates have been unaltered throughout the trials.

These standard hourly rates for tractors were applied to the number of hours spent actually cutting or bruising and to the hours spent on travelling and transporting the fuel trailers. Travelling time was, in the main, the time spent going between the fuel site and the "cutting face". No charge was made for the time lost through stoppages of any kind.

(2) Wages of Tractor Drivers

The drivers' times were charged at the "ordinary-time" rate of 2/10d per hour for exactly the same number of hours as the tractors. Although the work was done by a contractor on an inclusive contract charge per hour for tractor and driver, the hourly rate of 2/10d was used to keep the costs in line with previous seasons. The increase of 1½d per hour over the 1954 rates was due to the increase in wages in February, 1955. No charge was made for the technical manager's supervision.

(3) Depreciation of Machines.

1955 was the fourth working season for all four machines. The cutting types (Ferguson Mower and Henderson Slasher) were depreciated at an annual rate of 25% of their written down value; the two bruising types

≠ Bracken-Cutting Trials, 1952, 1953, 1954. West of Scotland Agricultural College.

at 15% of same. Unlike in previous seasons where the full year's depreciation was spread over two cutting periods, in 1955 it was charged against the single cut. Consequently, the depreciation per acre this season is higher than the depreciation for each individual cut last season.

In the case of the Ferguson Mower, it was decided to charge only half of the full year's depreciation as this machine, due to the effectiveness of the cutting in previous seasons, had to cut only approximately half of the acreage treated in 1954. To charge the whole amount on the reduced acreage would give an unfairly high depreciation cost per acre compared with the other three machines.

(4) Repairs and Maintenance of Machines

As in previous years, the cost of on-the-spot repairs and any maintenance required when the machines returned to the Station are included under this heading.

(5) Stage of Finishing.

This was when the machines had treated their respective acreages once.

Operating Costs, 1955

Using the above costing procedure, the following tables give the operating costs for a single cut for each of the four outfits.

Table 2(A)
Operating Costs for a Single Cut, 1955:-
using the

	<u>Holt Breaker</u>				<u>Cuthbertson Crusher</u>			
	<u>Hours</u>	<u>Total</u> £. s.d.	<u>Per</u> <u>Acre</u> s. d.	<u>%</u>	<u>Hours</u>	<u>Total</u> £. s.d.	<u>Per</u> <u>Acre</u> s. d.	<u>%</u>
Tractor Charges (@ 4/6 & 5/- per hour)	100½	22.12.3	3. 1	55.2	75¾	18.18.9	3. 5	38.0
Driver's Wages (@ 2/10 per hour)	100½	14. 4.9	1.11	34.3	75¾	10.14.8	1.11	21.3
Depreciation of Machine		3. 4.6	5	7.5		17.14.9	3. 3	36.1
Repairs and Maintenance of Machine		1. 4.9	2	3.0		2.10.4	5	4.6
TOTAL OPERATING COSTS		<u>£41. 6.3</u>	<u>5/7d.</u>	<u>100%</u>		<u>£49.18.6</u>	<u>9/-</u>	<u>100%</u>
 Acreage Bruised (Once only)			147.9				110.9	

Table 2(B)
Operating Costs for a Single Cut, 1955:-
using the

	<u>Henderson Slasher</u>				<u>Ferguson Mower</u>			
	<u>Hours</u>	<u>Total</u> £. s.d.	<u>Per</u> <u>Acre</u> s. d.	<u>%</u>	<u>Hours</u>	<u>Total</u> £. s.d.	<u>Per</u> <u>Acre</u> s. d.	<u>%</u>
Tractor Charges (@ 4/6 per hour)	66½	14.19.3	3. 4	49.4	46½	10. 9.3	4. 3	45.9
Driver's Wages (@ 2/10 per hour)	66½	9. 8.5	2. 1	30.9	46½	6.11.9	2. 8	28.8
Depreciation of Machine		3.19.1	10	12.3		3.19.1	1. 7	17.2
Repairs and Maintenance of Machine		2. 4.6	6	7.4		1.19.9	9	8.1
TOTAL OPERATING COSTS		<u>£30.11.3</u>	<u>6/9d.</u>	<u>100%</u>		<u>£22.19.10</u>	<u>9/3d.</u>	<u>100%</u>
 Acreage Cut (Once only)			89.9				49.7	

As in all former seasons, the Holt Breaker outfit again had the lowest operating costs per acre (5/7d). This was due in the main to lower depreciation, arising from the lower initial purchase price of the machine and to a smaller repairs and maintenance bill. The Henderson Slasher outfit occupied second place at 6/9 per acre for a single-cut. The Cuthbertson Crusher outfit (9/- per acre) was only 3d per acre cheaper than the Ferguson Mower outfit, which once again had the highest operating costs per acre (9/3) despite only charging half the annual depreciation for the reason previously mentioned. The main factor giving a high operating cost per acre with the Cuthbertson outfit is the heavy depreciation charge. Also the charge for the half-track tractor is 6d per hour dearer than for the other three tractors, but the faster rate of working counteracts this to a certain extent. Machine repairs and maintenance per acre was again heaviest with the Mower.

Analysis of Time Spent

Although, due to the method of costing adopted, the time lost through stoppages of all kinds did not directly enter into the costs, an analysis of the time spent at the trials in 1955 is of interest.

Table 3
Analysis of Time Spent, 1955 Season

	<u>Holt Breaker</u>		<u>Cuthbertson Crusher</u>		<u>Henderson Slasher</u>		<u>Ferguson Mower</u>	
	<u>Hours</u>	<u>%</u>	<u>Hours</u>	<u>%</u>	<u>Hours</u>	<u>%</u>	<u>Hours</u>	<u>%</u>
Actual Cutting or Crushing Time	91½	69.7	66	73.8	62½	72.9	40½	72.5
Travelling Time≠	9	6.9	9¾	10.9	4	4.7	6¼	11.3
Time Lost due to:-								
Machine Breakdowns	9	6.9	-	-	7¾	9.0	3	5.4
Tractor Breakdowns	13¾	10.5	2	2.2	4½	5.2	-	-
Other Idle Time	8	6.0	11¾	13.1	7	8.2	6	10.8
TOTAL TIME (Single Cut)	131¼	100%	89½	100%	85¾	100%	55½	100%

≠ Includes transport time where applicable.

Although the actual hours are not comparable - since the acreages treated are different - the percentages are comparable. The proportion of time lost due to stoppages of all kinds was approximately the same (23%) for the Holt Breaker and Henderson Slasher outfits. The Cuthbertson Crusher and Ferguson Mower outfits lost 14% and 9% respectively of the total time on the job through stoppages.

No time was lost due to breakdowns of the Cuthbertson machine; the figure of £2.10.4 in Table 2(A) was for maintenance carried out when the Crusher returned to the Machinery Station. The Ferguson Mower outfit lost a smaller proportion of time through machine breakdowns than did the other two outfits but the cost of replacing specific parts damaged, mainly cutter bar fingers and knife sections, coupled with the smaller acreage treated, gave a higher machine repair bill per acre than for the other three machines.

"Other idle time" includes hours lost due to miscellaneous causes such as absence of drivers, waiting for orders etc. Unlike in 1954 which was a very wet season, no hours were lost by any outfit due to the weather. Although there was only a single cut compared with a double cut in 1954, in general the proportion of time lost by each outfit was lower than in the 1954 season.

Some comparative figures for the four outfits in the 1955 season are given in the following table.

Table 4

Some Comparative Figures for Season 1955

	<u>Holt Breaker</u> Per Acre	<u>Cuthbertson Crusher</u> Per Acre	<u>Henderson Slasher</u> Per Acre	<u>Ferguson Mower</u> Per Acre
Tractor Charges	3/4d	3/5d	3/4d	4/3d
Driver's Wages	1/11d	1/11d	2/1d	2/8d
Depreciation of Machine	5d	3/3d	10d	1/7d
Repairs and Maintenance of Machine	2d	5d	6d	9d
TOTAL OPERATING COST PER ACRE (Single Cut)	<u>5/7d</u>	<u>9/-</u>	<u>6/9d</u>	<u>9/3d</u>
Acreage Treated	147.9	110.9	89.9	49.7
Value of Machine at Start of Season	£21.9.9	£118.4.6	£15.16.5	£31.12.10
Annual Rate of Depreciation	15%	15%	25%	25%
Operating Cost per Actual Working Hour	8/3d	13/11d	9/3d	10/3d
Actual Rate of Working (acres per hour)	1.62	1.68	1.44	1.23
^x Overall "Rate of Working" (" " ")	1.13	1.24	1.05	.90

^x The overall "rate of working" was obtained by dividing the acreage done by the total hours spent at the trials.

The "operating costs per actual working hour" were obtained by dividing the actual working costs, including depreciation, by the number of hours spent cutting or crushing the bracken. Travelling and transport hours and costs were omitted from this calculation.

With three of the outfits, the operating costs per actual working hour were higher than in 1954. This was due, firstly, to the increase in the wage rate of 1 $\frac{1}{2}$ d per hour and secondly, to the fact that the annual depreciation of these machines was all written off against the single cut. With the fourth outfit, the Mower, the operating cost per hour was lower due to the annual depreciation being halved because of the reduced acreage (see Page 4) and the very much lower level of repairs to this machine in 1955 compared to 1954.

Comparing the actual rates of working per hour this season with the corresponding figures for the first cut last season, it was found that the outfits were working at a slightly faster rate with the exception of the Holt outfit.

Summary

Although all the information on the costing side of the trials is now to hand, it is not proposed to draw any conclusions as to the most effective and economical machine until all the botanical and husbandry aspects are considered. The effects of this year's treatment on the grazing will not be apparent until the surviving fronds appear next spring.

In this interim report it will be sufficient at this stage to show the operating costs per acre each year since the trials began.

Table 5
Operating Costs per Acre
Seasons '52, '53, '54 and '55

<u>Season</u>	<u>Holt Breaker</u>	<u>Cuthbertson Crusher</u>	<u>Henderson Slasher</u>	<u>Ferguson Mower</u>
1952	19/6d	20/4d	20/10d	30/10d
1953	12/5d	17/8d	17/6d	20/5d
1954	9/-	13/11d	14/-	21/8d
1955 [≠]	5/7d	9/-	6/9d	9/3d
TOTAL	<u>46/6d</u>	<u>60/11d</u>	<u>59/1d</u>	<u>82/2d</u>

≠ N.B. Cost of a single treatment in 1955.

To reduce the bracken growth to the stage where it is now under control and not interfering to any extent with the grazing has cost £2.6/-, £3.1/-, £2.19/- and £4.2/- per acre for the four machines under trial. No account has been taken of grants received for this work.

Over the four seasons - 7 cuts in all - there was a fall in operating costs per acre each year except with the Ferguson Mower outfit which, due to a high repairs and maintenance bill, had a slightly higher operating cost in 1954 than it had in 1953.

This decline in operating costs each year is not unexpected in an experiment of this nature, where the bracken growth is being progressively reduced annually.

The position of each machine relative to the others is fairly constant each year. Every year the Holt Breaker had the lowest, while the Ferguson Mower had the highest operating costs per acre. The Cuthbertson Crusher and Henderson Slasher costs per acre were very close each season except for the single cut in the final year which, from a purely cost point of view, swung the final total in favour of the latter machine. However, no final comparison of the machines can be made until the evaluation of the benefits on the four treated areas has been carried out.

SECTION 3

BOTANICAL ASPECTS - 1955

Botanical Assessment

The method of assessment was the same as that adopted in previous years.^x The eight observation plots for each machine had had, at June 1955 one annual "double-cut" treatment for three years. When the bracken was examined in June this year, prior to cutting, it was decided to cut only those parts of the Mower area where the bracken was approximately one foot high. In the other three areas the 1954 acreage was all retreated but once only.

As far as the present scheme is concerned the trials area will not be cut or bruised again. As most of the observation plots were on the area treated this year, a final assessment of the effect of the machines on the bracken cannot be made until counts have been done in 1956. It is intended to carry out counts on the plots over the next few years to follow up the effects of cutting and to determine when maintenance cuts may be necessary.

Results

The results presented represent three years "double-cut" treatment. Figures for the height and the density of fronds are given in Table 1. It should be noted that the 1952 figures represent the original condition of the bracken before treatment.

For the area covered by each machine, two control plots were chosen. These control plots were in situations which were inaccessible to the machines but as near to the treated plots as possible. Due to this, however, the bracken in the control plots was not necessarily similar to that on the treated areas. The fronds in these plots were counted to ascertain if there were any year-to-year changes for the duration of the experiment. The counts show a general reduction in height and there appears to be a slight reduction in density of the control bracken. This may be due partly to seasonal difference and partly to the fact that the control bracken is more exposed to wind and the fronds tend to be weakened due to large areas of bracken growth being reduced close by.

Table 1

	<u>Height</u>				<u>Density</u>			
	<u>In inches</u>				<u>No. of fronds per sq.yd.</u>			
	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>
<u>Holt</u>								
Treated	27	20	10	7	28	25	25	8
Control	36	34	28	23	31	23	25	16
<u>Cuthbertson</u>								
Treated	20	18	11	10	18	20	23	10
Control	36	30	28	23	26	26	33	25
<u>Henderson</u>								
Treated	25	19	10	7	20	20	19	7
Control	38	31	28	22	23	19	31	21
<u>Ferguson Mower</u>								
Treated	28	15	7	5	36	29	29	5
Control	30	31	33	27	33	23	30	17

Height of Fronds

There has been a general reduction in height over the three years and the average height of the bracken is now between 5 and 10 inches. This height has been shown to be the critical one for the machines. Counts on

^x Bracken-Cutting Trials, 1952, 1953, 1954. West of Scotland Agricultural College.

treated plots in 1953 and 1954 showed that as the height of the bracken decreased, the percentage of "missed" fronds increased and that a critical height of about 6 to 8 inches for the machines was reached. If these short fronds are not treated they may be the advance guard of a new bracken invasion.

Density

There is a marked reduction in the overall density of the treated areas. This is more noticeable for the last two years ('54 and '55). Taking the reduction of height into consideration, it would appear that three years "double-cut" treatment by machines will not eradicate bracken completely, but will reduce it to a density of 5 to 10 fronds at a height of 5 to 10 inches. Bracken in this condition will allow a sward to develop and give access to stock.

General Observations

Colonisation of Bare Patches

Where the bracken had been very dense, there was little vegetation below and in some plots, patches of nettles and thistles were reported. With continued cutting, these patches of weeds have been reduced but with the cessation of treatment, however, they could increase. Perhaps judicious "spot treatment", either mechanical or chemical, would keep them in check.

On some bare patches, plants of native grasses, such as the Bents and Fescues, are now establishing themselves and eventually a grassy sward should develop replacing the weedy plants, such as Speedwell and Sheep's Sorrel, which were amongst the first colonisers.

Stock

Due to reduction in both density and height, stock have gained access to the area and trampling, especially by cattle, will also have a detrimental effect on the remaining bracken. Through stock grazing on the area, the developing herbage will benefit from the urine and the dung.

Ploughing

As was shown in the 1954 report, one of the plots in the Holt section was in an area which the farmer had enclosed, ploughed and direct reseeded in 1954. Before ploughing there had been 35 fronds per sq.yd. For 1955, after ploughing, there was less than 1 frond per sq.yd. The "take" of young seeds had been very good and the rhizomes which had been exposed were all withered and dead. This demonstrates once again that the ploughing up of bracken infested land, where possible, is the best method of control.

Salient Points brought out in the Scheme

1. Three years' treatment has caused a substantial reduction in both the height and density of the bracken.
2. With a decrease in height and density, the percentage of fronds missed increases, i.e. the efficiency of the treatment is impaired.
3. From the botanical results obtained so far, it is difficult to compare the effectiveness of the individual machines.
4. Colonisation of nettles and thistles, if not controlled, may create a problem.
5. Small patches of bracken around rocks and in other places inaccessible to the machines, if not "mopped up" by hand scythe or other means, will remain as points of future re-infestation of the treated areas.

APPENDIX

In former reports it has been customary to include in an appendix the actual operating costs using the actual tractor depreciation, the amounts of fuel used, tractor repairs, etc. Due to the change over in 1955 from the D.O.A.S. Machinery Service to a private contractor, it was not feasible to give corresponding figures this season.