Land clearing

MARCH, 1954

ECONOMIC REPORT NO. 28

ECONOMICS OF BRACKEN ERADICATION, 1951, 1952 AND 1953.

(An Interim Report on Trials in Bowmont and Kale Valleys).

by

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BRACKEN ERADICATION TRIALS IN BOWMONT AND KALE VALLEYS.

1951, 1952 AND 1953. - AN INTERIM REPORT.

INTRODUCTION

As the two interim reports* previously prepared by this Department are now out of print it has been thought advisable to incorporate in this present report statistics dealing with all three years of the Bracken Eradication Trials in Bowmont and Kale Valleys in south-eastern Roxburghshire. Here the performances of two bruising machines - A Holt Breaker and a Cuthbertson Crusher, and two cutting machines - A Henderson Slasher and a modified Ferguson Mower, are being compared on bracken-infested hill country at elevations nowhere below the 500 foot contour line and rising to 1,250 feet above sea level. As all the machines are tractor drawn, the two cutting machines being driven by the tractor power-take-off it is obvious that the main limiting factor to the amount of bracken treated each year is its inaccessibility, with the result that each machine has been forced to tackle many, often small irregularly-shaped areas of bracken. These are true hill conditions, typical of much of the land where bracken is to be found.

Before we discuss the costing technique employed in this investigation it should be emphasised that the summer of 1953 was so wet in the south-east of Scotland that bracken even on untreated areas did not grow so strongly as in the previous two years. This, allied to the fact that 1953 was the third year of treatment, resulted in the work of three of the machines being stopped before the complete acreage covered during the first cut was treated a second time. During each of the two previous years treatment had been continued until the area covered during the first cut was completely gone over a second time but during 1953 the treated bracken was so short and sparse during the second cut that treatment was suspended before the first cut acreage was completely retreated. This leads to complications in the costing of the work done in 1953 when we try to give figures of (a) cost per acre (b) acreage treated per hour and (c) fuel consumed per acre (all twice treated) comparable with 1951 and 1952 but the methods in which these difficulties are overcome are fully explained later on.

This experiment is being duplicated in the West of Scotland College area though treatment did not commence there until 1952. To give a fair comparison between the four machines in both areas it has been decided to maintain tractor charges in the costs at a fixed figure each year at both trials. Hence the calculations made in Economic Report No. 22 have been re-adjusted for 1951 to bring them into line.

COSTS AND PERFORMANCES

Once again for reasons indicated below, certain basic assumptions have been made in compiling these costs etc. tables.

(1) /

* Economic Reports Nos. 18 and 22 "Economics of Bracken Eradication 1951 and 1952".

(1) Tractor Work After close consultation between the college economists concerned and Mr. W.J. West, Director of the Scottish Machinery Testing Station, who is in charge of the trials, the following rates per hour have been charged each year for the use of the tractors concerned (exclusive of the tractor driver's wage) :-

Wheeled Tractors (Ford-Fergusons)	4/6d. per hour
Fordson Major half-track tractor	5/-d. " "

The latter type of tractor was used to haul the Cuthbertson Crusher while the former types were used for the other three types of machine.

(2) Working Hours

The number of working hours charged in the costs both for the tractors and for the tractor drivers' wages consists of :-

(a) actual "cutting" time i.e. time spent actually working at the cutting face, plus

(b) travelling time i.e. time spent travelling between the fuel centre and the "cutting" face.

To give a fair comparison between the actual working of the four machines, other time spent on the job has been omitted. Time lost through tractor and machine breakdowns has been left out on the assumption that if these happened on a normal farm the driver would be put to some other task. Idle time has also been omitted from the calculations because it is mainly due to bad weather, moving the machines from one site to another and time lost by tractors hauling each other out of ditches, soft patches etc.

(3) Depreciation

The two cutting machines (the Henderson Slasher and the Ferguson Mower) have been depreciated at 25 per cent per annum in the costs while the two bruising machines (the Holt Breaker and the Cuthbertson Crusher) have been depreciated at 15 per cent per annum. All four machines were new at the commencement of the trial in 1951 but no Initial Allowance has been charged nor has the additional quarter, added to the standard rates permitted by the Inland Revenue authorities, been charged.

(4) Repairs and Maintenance

The final item of cost, i.e. repairs and maintenance of the machines, covers all repairs carried out during the "cutting" season plus charges for maintenance carried out by the staff of the Scottish Machinery Testing Station between the end of one season and the commencement of the next.

(5) Management Salary

No charge has been made in the costs for the managerial work of the resident technical manager as his duties are largely of an experimental nature. However, where he replaced a tractor driver at the "cutting" face his time has been charged though at the tractor driver's rate of wages.

Tables I and II which follow show the operating costs for 1953 and for the three years 1951-53 respectively (1) for each cut, (2) for the season and (3) per cent for (A) the Holt Breaker, (B) the Henderson Slasher, (C) The Cuthbertson Crusher and (D) the Ferguson Mower.

TABLE I /

TABLE I.(A) OPERATING COSTS OF THE HOLT BREAKER : 1953 SEASON

	1st Cut	2nd Cut	Total for season	Per Cent
	£ s. d.	£ s. d.	£ s. d.	%
Tractor Charges @ 4/6d. per hour	24. 2. 8	14.15.10	38.18. 6	58.7
Wages of Tractor Driver	13.12. 7	8. 7. 2	21.19. 9	33.2
Depreciation of Machine	2. 1. 8	1. 7. 9	3. 9. 5	5.2
Repairs and Maintenance of Machine	-.19. 3	-.19. 3	1.18. 6	2.9
TOTAL OPERATING COSTS	£40.16. 2	£25.10. -	£66. 6. 2	100.0%

TABLE I.(B) OPERATING COSTS OF THE HENDERSON SLASHER : 1953 SEASON

	1st Cut	2nd Cut	Total for season	Per Cent
	£ s. d.	£ s. d.	£ s. d.	%
Tractor Charges @ 4/6d. per hour	20.11. 9	15.18. 5	36.10. 2	46.9
Wages of Tractor Drivers	12. -. 2	9. 5. 9	21. 5.11	27.3
Depreciation of Machine	3.11. -	2.13. 3	6. 4. 3	8.0
Repairs and Maintenance of Machine	6.13. 5	7. 4. 2	13.17. 7	17.8
TOTAL OPERATING COSTS	£42.16. 4	£35. 1. 7	£77.17.11	100.0%

TABLE I.(C) OPERATING COSTS OF THE CUTHBERTSON CRUSHER : 1953 SEASON

	1st Cut	2nd Cut	Total for season	Per Cent
	£ s. d.	£ s. d.	£ s. d.	%
Tractor Charges @ 5/-d. per hour	29.15. -	19. 3. 9	48.18. 9	41.0
Wages of Tractor Driver	15. 2. 6	9.15. 1	24.17. 7	20.8
Depreciation of Machine	12. 7. 1	8. 4. 8	20.11. 9	17.2
Repairs and Maintenance of Machine	12.10. -	12.10. -	25. -. -	21.0
TOTAL OPERATING COSTS	£69.14. 7	£49.13. 6	£119. 8. 1	100.0%

TABLE I.(D) OPERATING COSTS OF THE FERGUSON MOWER : 1953 SEASON

	1st Cut	2nd Cut	Total for season	Per Cent
	£ s. d.	£ s. d.	£ s. d.	%
Tractor Charges @ 4/6d. per hour	24. 2. 8	17. 9.10	41.12. 6	40.8
Wages of Tractor Driver	13.12. 7	9.17. 8	23.10. 3	23.1
Depreciation of Machine	6. 4.11	4. 3. 3	10. 8. 2	10.2
Repairs and Maintenance of Machine	13. 3. 1	13. 6. -	26. 9. 1	25.9
TOTAL OPERATING COSTS	£57. 3. 3	£44.16. 9	£102. -. -	100.0%

TABLE II.(A) OPERATING COSTS OF THE HOLT BREAKER : 3 YEARS' TOTAL

	1st Cuts	2nd Cuts	Total for 3 Seasons	Per Cent
	£ s. d.	£ s. d.	£ s. d.	%
Tractor Charges @ 4/6d. per hour	60. 7. 1	46. 8. 1	106.15. 2	58.4
Wages of Tractor Driver	33. 7. 3	25.13. 2	59. -. 5	32.3
Depreciation of Machine	6.17. 4	5. 9. 8	12. 7. -	6.7
Repairs and Maintenance of Machine	2. 7. 2	2. 8. 5	4.15. 7	2.6
TOTAL OPERATING COSTS	£102.18.10	£79.19. 4	£182.18. 2	100.0%

TABLE II.(B) OPERATING COSTS OF THE HENDERSON SLASHER : 3 YEARS' TOTAL

	1st Cuts	2nd Cuts	Total for 3 Seasons	Per Cent
	£ s. d.	£ s. d.	£ s. d.	%
Tractor Charges @ 4/6d. per hour	63. 1. 2	49.10. -	112.11. 2	45.0
Wages of Tractor Driver	35.18. 1	28. 2. 4	64. -. 5	25.6
Depreciation of Machine	13. 4. 2	10.13. 3	23.17. 5	9.5
Repairs and Maintenance of Machine	18.18. 3	30.15. 7	49.13.10	19.9
TOTAL OPERATING COSTS	£131. 1. 8	£119. 1. 2	£250. 2.10	100.0%

TABLE II.(C) OPERATING COSTS OF THE CUTHBERTSON CRUSHER : 3 YEARS' TOTAL

	1st Cuts	2nd Cuts	Total for 3 Seasons	Per Cent
	£ s d.	£ s. d.	£ s. d.	%
Tractor Charges @ 5/-d. per hour	87. 7. 6	57.15. -	145. 2. 6	45.0
Wages of Tractor Driver	43. 5. -	28.10. 1	71.15. 1	22.2
Depreciation of Machine	43.19. 9	29. 6. 6	73. 6. 3	22.8
Repairs and Maintenance of Machine	16. 3. 3	16. 3. 3.	32. 6. 6	10.0
TOTAL OPERATING COSTS	£190.15. 6	£131.14.10	£322.10. 4	100.0%

TABLE II.(D) OPERATING COSTS OF THE FERGUSON MOWER : 3 YEARS' TOTAL

	1st Cuts	2nd Cuts	Total for 3 Seasons	Per Cent
	£ s. d.	£ s. d.	£ s. d.	%
Tractor Charges @ 4/6d. per hour	57. 9.10	47.19. 6	105. 9. 4	39.8
Wages of Tractor Driver	31.18. 3	26.12. 4	58.10. 7	22.0
Depreciation of Machine	22. 8. 8	20. 7. -	42.15. 8	16.1
Repairs and Maintenance of Machine	28. 2. 5	30.11.10	58.14. 3	22.1
TOTAL OPERATING COSTS	£139.19. 2	£125.10. 8	£265. 9.10	100.0%

From both tables it will be noticed there are very small differences between the main items of cost of the three machines drawn by wheeled tractors i.e. The Holt Breaker, The Henderson Slasher and the Ferguson Mower while the heavier charge for the half-track tractor for the Cuthbertson Crusher raises its annual costs. The main differences in the costs between the machines lie in the repair bills and the depreciation of the machines. The cheaper Holt Breaker has the advantage here with low initial cost (£82) leading to low depreciation charges; it also has almost negligible repair bills even after three years' working. The other bruising-type machine, the Cuthbertson Crusher, with its high initial cost (£190) leading to comparatively large depreciation charges had quite small repair bills until after the third year of working, appears as the most expensive machine to operate under this method of costing. Over the three years there is little difference between the costs of the two cutting machines, depreciation of the costlier Ferguson Mower costing £74 when new (cf. £37.10/- for the Henderson Slasher) making it slightly dearer to operate while its repair bills slightly exceeded those of the Henderson Slasher.

Except in the first year's costs the same order has been maintained throughout, i.e. the Holt Breaker being the cheapest to operate for the season. This is followed by the Henderson Slasher, the Ferguson Mower, and the Cuthbertson Crusher, the last-named being the costliest for the reasons stated above. However, these annual costs must be considered in conjunction with the acreages treated per machine before a true comparison can be made. This is attempted in Tables VIII (A) and (B) on pages 11 and 12.

Treatment in 1953 started on 15th June and continued for some $3\frac{1}{2}$ weeks to finish the first cut. Ten days later the second cut was commenced and this lasted for approximately $2\frac{1}{2}$ weeks. Table III shown opposite sets out in full detail the complete breakdown of the time spent per machine both in 1953 and for the 3 years' working. From the table it will be seen that the actual time spent at the cutting face i.e. when the bracken is actually being treated constitutes only about 50 per cent of the total time spent on the job, the remainder being mainly idle time due to bad weather and transport from site to site, while tractor and machine breakdowns used up the bulk of the remaining hours. In the category of machine breakdowns it is interesting to compare the bruising-type machines with the cutting-type machines. In the former cases only 5.6 per cent (Holt) and 3.5 per cent (Cuthbertson) of the total time spent over the three years was lost by machine breakdowns whereas 18.8 per cent (Henderson) and 18.3 per cent (Ferguson) were lost by the two cutting machines. This is a very strong point in favour of the bruising-type machines especially on these hill areas so far from civilisation and a blacksmith's or an engineer's shop. Tractor breakdowns have not been serious except in the case of that hauling the Holt Breaker in 1953 when 20.7 per cent of the total time was lost through this cause.

A further and more informative subdivision of the number of hours spent and lost each year is set out in Tables IV (A) to (F). From (A) can be seen the utilisation of the time spent on bracken eradication during the three years by all four machines. Almost a quarter of the time was lost in the form of idle time while a further 18.4 per cent was lost owing to tractor and machine breakdowns. Just over half of the total time spent was utilised in treatment at the cutting face i.e. in really productive work. As would be expected with the decreasing size and density of the bracken and a better knowledge of the terrain, the percentage of time spent at the cutting face has increased year by year. This is shown in (B) but the increase would have been less pronounced but for the "teething troubles" of the Ferguson Mower in 1951. Travelling time i.e. to and from the fuel centre, does not vary from year to year - see (C). However, there has been a definite increase in the proportion of time lost through tractor breakdowns - see (D). On the whole the tractors were fairly old though, of course, the same tractors were not used each year and the work they did during the remainder of the year could easily affect their performances in the bracken trials. The most interesting section of this table is (E) showing the time lost through machine breakdowns per year. Each year the proportion of time lost from this cause/

TABLE III. ANALYSIS OF TIME SPENT PER MACHINE

		HOLT BREAKER				HENDERSON SLASHER				CUTHBERTSON CRUSHER				FERGUSON MOWER			
		1953		3 Years' Total		1953		3 Years' Total		1953		3 Years' Total		1953		3 Year's Total	
		Hours	%	Hours	%	Hours	%	Hours	%	Hours	%	Hours	%	Hours	%	Hours	%
Actual "Cutting" Time	- 1st Cut	97¾	-	238	-	85	-	257¾	-	112½	-	326½	-	99	-	221¾	-
	- 2nd Cut	58	-	184	-	64½	-	201½	-	72	-	215½	-	68¾	-	185	-
	Total	155¾	49.7	422	51.5	149½	52.2	459¼	49.3	184½	60.8	542	62.7	167¾	57.0	406¾	44.8
Travelling Time	- 1st Cut	9½	-	30¼	-	6½	-	22½	-	6½	-	23	-	8¼	-	33¾	-
	- 2nd Cut	7¾	-	22¼	-	6¼	-	18½	-	4¾	-	15½	-	9	-	28¼	-
	- Total	17¼	5.5	52½	6.4	12¾	4.4	41	4.4	11¼	3.7	38½	4.5	17¼	5.9	62	6.8
Tractor Breakdowns	- 1st Cut	23¼	-	43	-	18	-	34½	-	6	-	16¾	-	8¾	-	31¼	-
	- 2nd Cut	41¾	-	45¼	-	6¼	-	20½	-	4¼	-	14¾	-	2¼	-	25½	-
	- Total	65	20.7	88¼	10.8	24¼	8.5	55	5.9	10¼	3.4	31½	3.6	11	3.7	56¾	6.2
Machine Breakdowns	- 1st Cut	3¾	-	23½	-	8	-	59½	-	3	-	15¼	-	10¾	-	95½	-
	- 2nd Cut	3½	-	22	-	14½	-	115¼	-	2	-	14¾	-	8½	-	70½	-
	- Total	7¼	2.3	45½	5.6	22½	7.8	174¾	18.8	5	1.6	30	3.5	19¼	6.5	166	18.3
Idle Time (including Transport time)	- 1st Cut	51½	-	132¾	-	39¼	-	105½	-	51	-	119¾	-	53¾	-	127¼	-
	- 2nd Cut	17	-	77¾	-	38¼	-	95¾	-	41¾	-	102½	-	25¼	-	89¾	-
	- Total	68½	21.8	210½	25.7	77½	27.1	201¼	21.6	92¾	30.5	222¼	25.7	79	26.9	217	23.9
TOTAL TIME SPENT	- 1st Cut	185¾	-	467½	-	156¾	-	479¾	-	179	-	501¼	-	180½	-	509½	-
	- 2nd Cut	128	-	351¼	-	129¾	-	451½	-	124¾	-	363	-	113¾	-	399	-
	- Total	313¾	100%	818¾	100%	286½	100%	931¼	100%	303¾	100%	864¼	100%	294¼	100%	908½	100%

TABLE IV. ANALYSIS OF TIME SPENT ON TREATMENT AFTER 3 YEARS

(A) 3 years Totals for 4 Machines

	Hours	Per Cent
Actual Cutting or Bruising Time	1830	51.9
Travelling Time	194	5.5
Tractor Breakdowns	231½	6.6
Machine Breakdowns	416¼	11.8
Idle Time	851	24.2
TOTAL TIME SPENT	3522¾	100.0%

(B) Actual Cutting or Bruising Time per Machine per Season

	1951	1952	1953
Holt Breaker	110½ hours	155¾ hours	155¾ hours
Henderson Slasher	144½ "	165¼ "	149½ "
Cuthbertson Crusher	178 "	179½ "	184½ "
Ferguson Mower	85¾ "	153¼ "	167¾ "
Total Cutting or Bruising time spent	518¾ "	653¾ "	657½ "
Total time spent on the job	1056¼ "	1268¼ "	1198¼ "
Cutting time as percentage of Total	49.2%	51.5%	54.9%

(C) Travelling Time per Machine per Season

	1951	1952	1953
Holt Breaker	12¾ hours	22½ hours	17¼ hours
Henderson Slasher	12½ "	15¾ "	12¾ "
Cuthbertson Crusher	15¾ "	11½ "	11¼ "
Ferguson Mower	15¼ "	29½ "	17¼ "
Total Travelling Time spent	56¼ "	79¼ "	58½ "
Total time spent on the job	1056¼ "	1268¼ "	1198¼ "
Travelling time as percentage of Total	5.3%	6.3%	4.9%

(D) Hours lost by Tractor breakdowns per Machine per Season

	1951	1952	1953
Holt Breaker	19¾ hours	3½ hours	65 hours
Henderson Slasher	11 "	19¾ "	24¼ "
Cuthbertson Crusher	8¼ "	13 "	10¼ "
Ferguson Mower	13 "	32¾ "	11 "
Total Tractor Breakdown Hours	52 "	69 "	110½ "
Total time spent on the job	1056¼ "	1268¼ "	1198¼ "
Tractor breakdown hours as percentage of Total	4.9%	5.5%	9.2%

(E) Hours lost by Machine breakdowns per Machine per Season

	1951	1952	1953
Holt Breaker	18½ hours	19¾ hours	7¼ hours
Henderson Slasher	94 "	58¼ "	22½ "
Cuthbertson Crusher	25 "	Nil "	5 "
Ferguson Mower	96¼ "	50½ "	19½ "
Total machine breakdown hours	233¾ "	128½ "	54 "
Total time spent on the job	1056¼ "	1268¼ "	1198¼ "
Machine breakdown hours as percentage of Total	22.1%	10.1%	4.5%

(F) Idle Time (including Transport Time) per Machine per Season

	1951	1952	1953
Holt Breaker	46 hours	96 hours	68½ hours
Henderson Slasher	52¼ "	71½ "	77½ "
Cuthbertson Crusher	60¾ "	68¾ "	92¾ "
Ferguson Mower	36½ "	101½ "	79 "
Total idle time	195½ "	337¾ "	317¾ "
Total time spent on the job	1056¼ "	1268¼ "	1198¼ "
Idle time as percentage of Total	18.5%	26.6%	26.5%

cause has been halved, falling from 22.1 per cent in 1951 to 10.1 per cent in 1952 to 4.5 per cent in 1953. However, when one considers the individual machines it is interesting to compare the small number of hours lost by the two bruising-type machines, the Holt Breaker and the Cuthbertson Crusher with the bigger losses of the two cutting-type machines, the Henderson Slasher and the Ferguson Mower. Idle time (F) has accounted for quite a large proportion of the total time spent and has been much greater in 1952 and 1953 than in the first year of treatment.

As was mentioned earlier, operating costs must be considered alongside the acreages treated each year and an attempt to carry this out is made in Table V set out below.

TABLE V. OPERATING COSTS PER ACRE TREATED

	1951		1952		1953	
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut
(A) HOLT BREAKER						
Operating Costs	£27.11.11	£21.10. 9	£34.10. 9	£34. 1. 1	£40.16. 2	£25.10. -
Acreage treated (acres)	149.5	149.5	181.7	181.7	183.0	152.7
Operating Cost per acre	3/8¼	2/10½	3/9½	3/8¾	4/5½	3/4
(B) HENDERSON SLASHER						
Operating Costs	£43.14. 2	£41. 8. 7	£44.11. 2	£42.11. -	£42.16. 4	£35. 1. 7
Acreage treated (acres)	125.8	125.8	141.0	141.0	150.7	150.7
Operating Cost per acre	6/11¼	6/7	6/3¾	6/-½	5/8¼	4/8
(C) CUTHBERTSON CRUSHER						
Operating Costs	£58.17.10	£42. 2. -	£62. 3. 1	£39.19. 4	£69.14. 7	£49.13. 6
Acreage treated (acres)	102.2	102.2	125.8	125.8	151.1	125.0
Operating Cost per acre	11/6¼	8/3	9/10½	6/4¼	9/2¾	7/11¼
(D) FERGUSON MOWER						
Operating Costs	£40.13. 1	£31. 3.11	£42. 2.10	£49.10. -	£57. 3. 3	£44.16. 9
Acreage treated (acres)	56.2	56.2	88.0	88.0	100.0	76. 6
Operating Cost per acre	14/5½	11/1¼	9/7	11/3	11/5¼	11/8½

During 1951 and 1952 the acreages treated per machine in the second cuts exactly equalled the areas treated in the first cuts but for reasons previously stated a smaller acreage was treated in the second cut in 1953 than in the first cut except in the case of the Henderson Slasher. Hence in the table the operating costs per cut per machine per annum have been divided by the actual acreages treated per cut. In every case except the Ferguson Mower in 1952 and /

and 1953 the second cut was cheaper per acre than the first cut. From the table it will easily be seen how much cheaper per acre to operate according to this method of costing were the Holt Breaker and the Henderson Slasher than the other two machines. However, a clearer comparison can be obtained from Table VIII (A) and (B) when all the main totals are brought together.

A comparison between the speeds of treatment of the four machines per cut and per season can be made from Table VI, which follows.

TABLE VI. ACREAGE TREATED PER HOUR WITH AND WITHOUT STOPPAGES

i.e. OVERALL AND 100% EFFICIENCY

	1951		1952		1953		3 Years' Total	
	Over :all	100% Effic- :iency	Over :all	100% Effic- :iency	Over :all	100% Effic- :iency	Over :all	100% Effic- :iency
(A) HOLT BREAKER								
- 1st Cut	1.12	2.47	1.22	2.28	0.99	1.87	1.10	2.16
- 2nd Cut	2.00	2.99	1.22	2.39	1.19	2.63	1.38	2.63
SEASON'S TOTAL	0.72	1.35	0.61	1.17	0.53	1.08	0.61	1.18
(B) CUTHBERTSON CRUSHER								
- 1st Cut	0.63	1.00	0.78	1.13	0.84	1.34	0.76	1.16
- 2nd Cut	0.81	1.35	1.13	1.85	1.00	1.74	0.97	1.64
SEASON'S TOTAL	0.36	0.57	0.46	0.70	0.45	0.75	0.42	0.68
(C) HENDERSON SLASHER								
- 1st Cut	0.78	1.63	0.87	1.48	0.96	1.77	0.87	1.62
- 2nd Cut	0.82	1.88	0.83	2.01	1.16	2.34	0.92	2.07
SEASON'S TOTAL	0.40	0.87	0.43	0.85	0.53	1.01	0.45	0.91
(D) FERGUSON MOWER								
- 1st Cut	0.39	1.29	0.48	1.11	0.55	1.01	0.48	1.10
- 2nd Cut	0.55	1.33	0.48	1.19	0.67	1.11	0.55	1.19
SEASON'S TOTAL	0.23	0.65	0.24	0.57	0.30	0.53	0.26	0.57

In the above table, figures set out in columns headed "Overall" indicate the performance of the four machines in terms of acres per hour when all breakdowns and idle time are brought into the calculation, while "100% Efficiency" indicates the rate of work in acres per hour of the machines only when actually working at the "cutting" face i.e. without any stoppages for breakdowns etc. The season's totals concern the speeds in acres per hour twice treated. Here again the same two machines take pride of place, namely the Holt Breaker and the Henderson Slasher followed by the Cuthbertson Crusher and the Ferguson Mower. It is interesting to note and often impossible to account for the lack of unison in the various working speeds per cut and per year. One would expect second cuts to be carried out at faster rates than first cuts and succeeding year's working speeds to be faster than the previous year's but such is not always the case. In fact the Holt Breaker worked at a slower rate as the years progressed, possibly because of a change of driver in 1953 and because of the fact that in 1951 it was felt that many fronds were missed by the sections of the machine bumping over the clumps of bent grass when going at high speeds. Changes of drivers in 1953 for the other machines could also account for the lack of uniformity of performance.

Fuel /

Fuel consumption per machine per annum is considered in Table VII set out below in terms of gallons of T.V.O. per acre (twice treated per season).

TABLE VII. FUEL CONSUMPTION - T.V.O. CONSUMED PER ACRE 1951-53 (OVERALL)

	1951		1952		1953		3 Years' Total	
	Gallons	Acres	Gallons	Acres	Gallons	Acres	Gallons	Acres
(A) HOLT BREAKER								
- 1st Cut	81	149.5	132½	181.7	133	183.0	346½	514.2
- 2nd Cut	78	149.5	136	181.7	92	152.7	306	483.9
SEASON'S TOTAL	159	149.5	268½	181.7	225	167.85	652½	499.05
T.V.O. consumed per acre.(Galls).	1.06		1.48		1.34		1.31	
(B) CUTHBERTSON CRUSHER								
- 1st Cut	147	102.2	201	125.8	175	151.1	523	379.1
- 2nd Cut	115	102.2	133	125.8	119	125.0	367	353.0
SEASON'S TOTAL	262	102.2	334	125.8	294	138.05	890	366.05
T.V.O. consumed per acre(Galls.)	2.56		2.66		2.13		2.43	
(C) HENDERSON SLASHER								
-1st Cut	116	125.8	154	141.0	98	150.7	368	417.5
-2nd Cut	107	125.8	111	141.0	68	150.7	286	417.5
SEASON'S TOTAL	223	125.8	265	141.0	166	150.7	654	417.5
T.V.O. consumed per acre(Galls.)	1.77		1.88		1.10		1.57	
(D) FERGUSON MOWER								
- 1st Cut	73	56.2	127½	88.0	97	100.0	297½	244.2
- 2nd Cut	50½	56.2	157	88.0	77	76.6	284½	220.8
SEASON'S TOTAL	123½	56.2	284½	88.0	174	88.3	582	232.5
T.V.O. consumed per acre(Galls.)	2.20		3.23		1.97		2.50	

As the exact amount of fuel consumed at the cutting face is not known accurately Table VII takes into account all the fuel consumed on the job including transport from site to site and from fuel centre to cutting face i.e. Overall. The Cuthbertson Crusher is at a disadvantage here by needing a half-track tractor to haul it, as against wheeled tractors for the other three machines. However, according to the table the Holt Breaker and the Henderson Slasher once again lead the way with the Ferguson Mower bringing up the rear. Of course, it must be remembered that the Holt Breaker is simply a haulage task to the tractor whereas the two cutting machines are driven by the tractor power-take-off. It is interesting /

TABLE VIII (A) COMPARATIVE COSTS AND PERFORMANCES OF TWO CRUSHING MACHINES

		HOLT BREAKER				CUTHBERTSON CRUSHER			
		1951	1952	1953	3 Years' Total	1951	1952	1953	3 Years' Total
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Total Tractor Charges		27.14. 7	40. 2. 1	38.18. 6	106.15. 2	48. 8. 9	47.15. -	48.18. 9	145. 2. 6
Wages of Tractor Driver		14. 7. 7	22.13. 1	21.19. 9	59. -. 5	22.12. 1	24. 5. 5	24.17. 7	71.15. 1
Depreciation of Machine		4.16. -	4. 1. 7	3. 9. 5	12. 7. -	28.10. -	24. 4. 6	20.11. 9	73. 6. 3
Repairs and Maintenance of Machine		1. 2. -	1.15. 1	1.18. 6	4.15. 7	1. 9. -	5.17. 6	25. -. -	32. 6. 6
TOTAL OPERATING COSTS		£48. -. 2	£68.11.10	£66. 6. 2	£182.18. 2	£100.19.10	£102. 2. 5	£119. 8. 1	£322.10. 4
Operating Cost per acre (from Table V)		6/6¾d	7/6¼d	7/9½d	21/10½d	19/9¼d	16/2¾d	17/2d	53/2d
Actual Crushing Time	(hours)	110½	155¾	155¾	422	178	179½	184½	542
Travelling Time to and from Fuel Centre	(do)	12¾	22½	17¼	52½	15¾	11½	11¼	38½
Time lost through Tractor breakdown	(do)	19¾	3½	65	88¼	8¼	13	10¼	31½
Time lost through Machine breakdown	(do)	18½	19¾	7¼	45½	25	NIL	5	30
Idle Time due to bad weather etc.	(do)	46	96	68½	210½	60¾	68¾	92¾	222¼
TOTAL TIME SPENT ON JOB		207½	297½	313¾	818¾	287¾	272¾	303¾	864¼
Acreage bruised per hour (100% Efficiency)≠	(acres)	1.35	1.17	1.08	1.18	0.57	0.70	0.75	0.68
Acreage bruised per hour (Overall)	(do)	0.72	0.61	0.53	0.61	0.36	0.46	0.45	0.42
Operating Cost per hour (100% Efficiency)≠	approx.	8/8d	8/9½d	8/6d	8/8d	11/4d	11/4½d	12/11d	11/10½d
T.V.O. consumed per acre (Overall)	(galls.)	1.06	1.48	1.34	1.31	2.56	2.66	2.13	2.43
Initial Value of Machine at start of season		£32 (new)	£27. 4. -	£23. 2. 5	-	£190 (new)	£161.10. -	£137. 5. 6	-
Annual Rate of Depreciation charged in costs		15%	15%	15%	-	15%	15%	15%	-

≠ 100% Efficiency indicates the performances of the machines when there are no stoppages whatever.

TABLE VIII (B) COMPARATIVE COSTS AND PERFORMANCES OF TWO CUTTING MACHINES

		HENDERSON SLASHER				FERGUSON MOWER			
		1951	1952	1953	3 Years' Total	1951	1952	1953	3 Years' Total
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Total Tractor Charges		35. 6. 6	40.14. 6	36.10. 2	112.11. 2	22.14. 6	41. 2. 4	41.12. 6	105. 9. 4
Wages of Tractor Driver		18.19. 5	23.15. 1	21. 5.11	64. -. 5	11.15.10	23. 4. 6	23.10. 3	58.10. 7
Depreciation of Machine		9. 7. 6	8. 5. 8	6. 4. 3	23.17. 5	18.10. -	13.17. 6	10. 8. 2	42.15. 8
Repairs and Maintenance of Machine		21. 9. 4	14. 6.11	13.17. 7	49.13.10	18.16. 8	13. 8. 6	26. 9. 1	58.14. 3
TOTAL OPERATING COSTS		£85. 2. 9	£87. 2. 2	£77.17.11	£250. 2.10	£71.17. -	£91.12.10	£102. -. -	£265.9. 10
Operating Costs per acre (from Table V)		13/6¼d	12/4¼d	10/4¼d	36/2¾d	25/6¾d	20/10d	23/1¾d	69/6½d
Actual Cutting Time	(hours)	144½	165¼	149½	459¼	85¾	153¼	167¾	406¾
Travelling time to and from Fuel Centre	(do)	12½	15¾	12¾	41	15¼	29½	17¼	62
Time lost through Tractor breakdown	(do)	11	19¾	24¼	55	13	32¾	11	56¾
Time lost through Machine breakdown	(do)	94	58½	22½	174¾	96¼	50½	19¼	166
Idle time due to bad weather etc.	(do)	52¼	71½	77½	201¼	36½	101½	79	217
TOTAL TIME SPENT ON THE JOB		314¼	330½	286½	931¼	246¾	367½	294¼	908½
Acreage cut per hour (100% Efficiency)≠	(acres)	0.87	0.85	1.01	0.91	0.65	0.57	0.53	0.57
Acreage cut per hour (Overall)	(do)	0.40	0.43	0.53	0.45	0.23	0.24	0.30	0.26
Operating Cost per hour (100% Efficiency)≠	approx.	11/9d	10/6½d	10/5d	10/10d	16/9d	11/11½d	12/2d	13/0½d
T.V.O. consumed per acre (Overall)	(galls.)	1.77	1.88	1.10	1.57	2.20	3.23	1.97	2.50
Initial Value of Machine at start of season		£37.10 (new)	£33. 2. 6*	£24.16.10	-	£74 (new)	£55.10. -	£41.12. 6	-
Annual Rate of Depreciation charged in costs		25%	25%	25%	-	25%	25%	25%	-

≠ 100% Efficiency indicates the performances of the machines when there are no stoppages whatever.

* Includes £5 being cost of replacement in excess of part replaced.

interesting to note that there was an all-round increase in fuel consumption in the second year of the trial and an all-round drop in consumption per acre during the third year.

All the main points brought out in the previous tables are brought together in Tables VIII (A) and (B) for more accurate comparison.

Annual operating costs per machine according to this method of costing make the Holt Breaker at £182.18. 2 for three years or 21/10½d. per acre (approximately six times treated) the cheapest machine to operate, followed by the Henderson Slasher at £250. 2.10d. for three years or 36/2¾d. per acre (six times treated). While the total operating cost of the Cuthbertson Crusher at £322.10. 4d. for three years exceeds that of the Ferguson Mower at £265. 9.10d. for the same period its faster rate of work brings it into third place when considered on a cost per acre basis. At 53/2d. per acre for approximately six treatments the Cuthbertson Crusher works out at rather less than the Ferguson Mower at 69/6½d. per acre (approximately six times treated) though the teething troubles of the Mower in 1951 must not be forgotten entirely. The comparatively large parts played by repairs and maintenance of the two cutting-type machines and the depreciation of the costlier Cuthbertson Crusher and Ferguson Mower must not be lost sight of when considering the operating costs of the four machines.

As to the utilisation of the time spent on the job by the four machines the differences between the hours lost on machine breakdowns of the bruising-type machines and of the cutting-type machines are most pronounced, totalling in the three years 30 hours for the Cuthbertson Crusher, 45½ hours for the Holt Breaker, 166 hours for the Ferguson Mower and 174¾ hours for the Henderson Slasher. Idle time, travelling time and tractor breakdown hours vary but little from machine to machine but it should be noted that the Cuthbertson crusher spent a larger proportion of its time actually at the cutting face than any of the other three machines.

The acreage treated (twice per season) per hour, overall and with no stoppages and the fuel consumption in gallons of T.V.O. per acre twice treated per season have already been dealt with and point to the fact that the Holt Breaker appears to be the most economical machine of the four to utilise. Next in order seems to be the Henderson Slasher with the Cuthbertson Crusher and the modified Ferguson Mower bringing up the rear. Of course, even though the Holt Breaker is the most economical to use it does not necessarily mean that it is the most efficient machine of the four under trial. Hence until the operating costs and performance statistics are considered in conjunction with the botanists' figures of bracken heights and densities per annum and the Scottish Machinery Testing Station's reports on the technical performance of the four machines, no definite order of priority can be given here as to which is the best machine of the four. It is even possible that the perfect combination may be to use a bruising machine for two years and a cutting machine during the third year.

For the benefit of any farmers, factors or students reading this interim report it should be stressed that the Bowmont and Kale Valley bracken trials, duplicated at Comrie in Perthshire have been run mainly as a comparison between the four machines under consideration under typical hill conditions. It is not expected that the bracken will be completely eradicated by mechanical means since there are many small patches surrounding boulders, dykes, ditches, etc. where it is impossible for the machine to work. Hence, before 100 per cent eradication can be expected those areas would need to be hand cut by scythe; to obtain complete eradication the costs would be much higher than those quoted in this report.

ACKNOWLEDGMENT /

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We in this department are greatly indebted to Mr. W. J. West and his colleagues of the Scottish Machinery Testing Station for all their help and courtesy shown us and to the farmers and tractor drivers concerned for their whole-hearted co-operation.