APPENDIX 4-16

PECO HARVESTER TESTS 1986

B O R D N A M O N A

R E S E A R C H & D E V E L O P M E N T

D R O I C H E A D N U A

C O . K I L D A R E

PECO HARVESTER TESTS 1986

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CONTENTS

SUMMARY

The objectives of the project were to assess the performance and cost effectiveness of four harvesters at Cloncreen, Derrygreenagh.

The Peco Trailed Paddle Harvester was the best machine of the four tested.

This harvester had a high forward speed, excellent turning capacity, a high output performance and was very reliable.

Preliminary cost analysis showed that the Peco was the most cost effective machine.

The Type VI elevator performed next to the Peco followed by the Type VII elevator and the BnM Trailed unit.

1. OBJECTIVES

1.1 To evaluate the performance of four harvesters:-

(i) Type VI Elevator,

(ii) Type VII Elevator,

(iii) Peco Trailed Paddle. - Tractor Landini (14,500)

(iv) BnM Trailed Screw. - Tractor Landini (14,500) initially.
Ferguson (2720) finally.

The following criteria were used to evaluate the performance of each harvester:-

(a) Forward speed, k/h,

(b) Output, t/h @ 55% m.c.,

(c) Losses, t/km/lift @ 55% m.c.,

(d) Mechanical Reliability,

(e) Limitations,

(f) Cost Analysis

1.2 To identify the most efficient and cost effective harvester using the above criteria.

2. Experimental Design

2.1 Test Location and Layout

Derrygreenagh (i) Cloncreen
- Railway 2W
- Railway 8W

(ii) Ballycon

The design of the tests provided for evaluating the harvesters in poor/medium quality peat in Cloncreen and in good quality peat (peat quality greater than 250g/l p.d.) in Ballycon. However, due to the poor weather encountered in June, July, August, it was decided that the Ballycon tests should be cancelled as the disruption to the harvesting operation and the corresponding production losses could not be countenanced in such a difficult year.

Two clear railways were selected for the tests. These railways were separated sufficiently in the production cycle so as to ensure that harvesting and testing would be done on different days. This plan was most efficient in the use of test equipment, tractors, and manpower.

The two railways selected were similar in peat density and bog condition - hence cross-comparisons could be made between machines being tested on different railways.

The standard of machines (Miller, Harrows, Ridgers, Harvesters) was most satisfactory and the drivers were helpful and co-operative.

The offset milling operation was not carried out during the period when tests were being conducted.

2.2 Layout of Plots

Five 150m plots were set out on each field on 2W and six plots were set out on 8W.

The plots were selected across all 10 fields with the view to achieving the same degree of contour, peat quality and bog condition, but it will be appreciated that due to the differences which occur between high fields and low fields, as well as the variability which occurs in peat across any railway, a high degree of uniformity is difficult to achieve.

2.3 Test Procedure

This is outlined in Fig. 1, page 5, and is similar to the procedure followed in the 1983 Harvester Tests.

The Type VI was tested against the Type VII on railway 2W and the Peco Trailed was tested against the BnM Trailed on railway 8W.

In order that cross-comparisons could be made between a harvester being tested on 2W with a harvester being tested on 8W, it was decided that the Type VII would be tested against the Peco Trailed on railway 8W on at least two harvests.

The test procedure was as follows:- on 2W harvest 1, the Type VI (Harvester A in Fig. 1) was tested on fields 1-5 while the Type VII (Harvester B) was tested on fields 6-10.

To obviate bias occurring in the tests due to differences in peat quality, ridge size, field condition, etc., between fields 1-5 and fields 6-10, the test harvesters were transposed on alternate harvests, i.e. on 2W harvest 2, the Type VI was tested on fields 6-10 while the Type VII was tested on fields 1-5.

The same test procedure was applied to the two trailed harvesters tested on railway 8W.

On 2W, harvest 1, the type VI lifted the ridge on field 1 and was returned to start on field 2 by idle travelling (or lifting) an adjacent production (non test) field; this procedure was repeated for lifts 2, 3, 4 and 5.

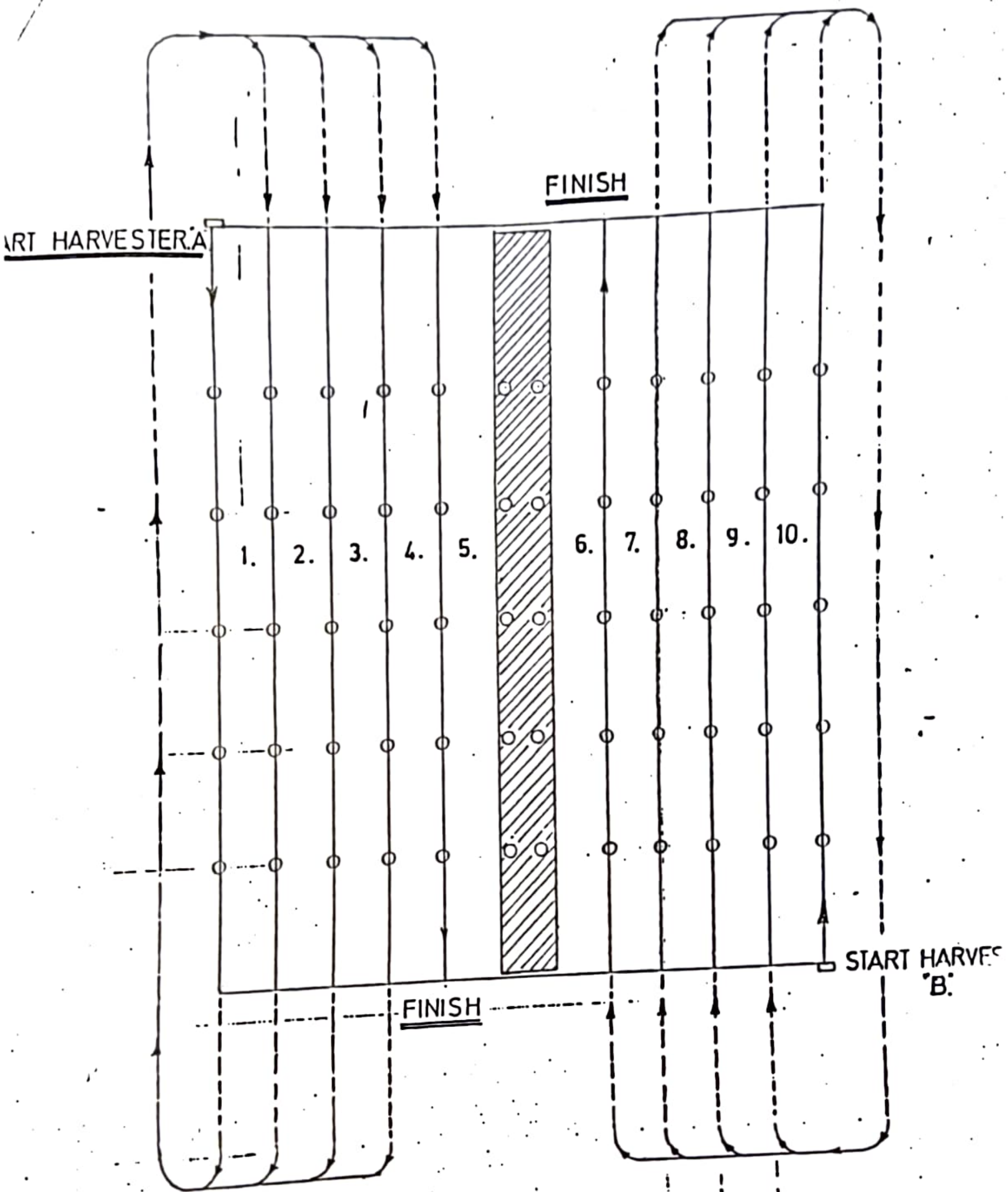
2.4. Work Study Measurements

Work Study personnel travelled in the cabs of the test harvesters during every test and drivers were required to drive their machines at optimum speed - that is, in accordance with standard work-study timing procedures.

The machines were timed through all 150m test plots to give the rate of travel in basic minutes per kilometer.

The turning ability of the four machines was measured to give rate of travel including turns in a standard 1km railway. Turning times measured were valid in assessing and comparing the turning performance of the four test machines,

Fig. 1.



TEST RAILWAY. LENGTH APPROX 1 km.

HARVESTER "A" VERSUS HARVESTER "B."

SAMPLING POINTS – O.

but since the test procedure differed from the standard production harvesting operation, the times measured are not necessarily the same as that measured in the production situation.

3. FIELD WORK

3.1 Sampling Method

(i) Forward and turning speeds for the four test harvesters were measured by Work Study personnel.

(ii) Gross tonnage after milling was determined by selecting two strips across each field and estimating the tonnage per kilometre at 55% m.c. on the field. (A strip consisted of an imaginary 0.5m width extending across each field from drain to drain at a position selected within the plots for sampling).

Four samples were taken from each strip at 3m, 5m, from each drain edge using the $0.25m^2$ frame provided. All the peat within the frame was collected and weighed. The peat was returned to the area sampled and was mixed twice. A random sample of not less than 0.5L was taken and was placed in a plastic bag for moisture content determintion. Hence, four separate estimates of gross after milling tonnage on the field at 55% m.c. was determined per strip.

In order to preserve the validity of comparisons between two test harvesters on a given test railway (e.g. 2W) it was important that there was no real difference between the tonnage milled on fields 1-5 as compared to fields 6-10.

(iii) Ridge Size measurements were taken on plots 2 and 4 on railways 2W and 8W using the ridge divider frame (0.5m long). Two measurements were taken per plot and samples were taken for m.c. and b.d. determinations. From these data the tonnes per kilometre ridge @ 55% m.c. were calculated. These data were used to test if a significant difference existed between the quantity of peat in ridges on fields 1-5 as compared to the quantity on field 6-10 prior to harvesting.

(iv) Output of a test harvester was measured as follows:-

As the harvester travelled on field 1, plot 1, the peat which was transferred to field 2, plot 1 was collected in a specially designed bag, previously placed on the single ridge on field 2. The bag was weighed using the electronic gear fitted to the tractor attachment and a sample of 1.5L was taken from the bag for m.c. and b.d. determination. From these measurements the tonnage per kilometre lift at 55% m.c. was determined. The output was measured in each plot on fields 2, 3, 4, 5 and fields 7, 8, 9 and 10.

Final Lifts - Since the output measurements of final lifts could not be measured by this method as it would have entailed the placing of bags on stockpiles and subsequently weighing the bags (this would have been highly impractical), the following procedure was adopted. Prior to harvesting a test railway, sampling of the single ridge on fields 5 and 6 was carried out on selected plots 1-5 on 2W (and 1-6 on 8W). At each sampling point, a 0.5m length of ridge was separated by a special dividing frame and all the peat within the frame was collected and weighed and a sample was taken for m.c. The surplus peat was returned to the sampled area and the ridge was reformed.

The output for the final lift was determined by adding the 4th lift output to the weight of peat in the single ridge on field 5 and subtracting the losses measured on field 5 (see next section on measurement of losses).

The m.c. of the final lift was taken from the peat transferred to the stockpile.

(v) Losses - Prior to the harvesting operation, the locations to be sampled for harvester losses were selected and a band on either side of the ridge 1.5m wide and 2.0m long was swept clean of ridger losses. This was done so that harvester losses would be accurately determined.

Harvester losses were measured after the harvesting operation was completed, on all plots and on all test fields, where output measurements were carried out.

An $0.5m^2$ frame (0.5m x 1m) was used to collect the losses. The losses from a 0.5m length of lift were transferred to a plastic bin and weighed. The contents of the bin were mixed in the bin and a mimimum sample of 1.5L was taken at random from the mix for m.c. and b.d. determination.

3.2. Equipment

2; $0.5m^2$ frames (0.5m x 1m),
2; $0.25m^2$ frames (0.5m x 0.5m),
2; Plastic bins,
2; Sets of ridge dividers (0.5m long),
2; Sets of special weighing bags 0.75m x 3m and total volume $1.25m^3$,
Bags had metal frames with woven polypropylene fabric attached,
2; Tractors with special attachments for weighing the bags.

All above equipment designed and made by B. Carty, R&D.

2: Sets of weighing scales,
2; Sets of electronic weighing gear designed to weigh the bags.
Designed and fitted to tractor attachment with digital meters fitted in cabs by S. Kindregan and J. Dolan, R&D

3.3 Logistics

(Number of samples and tests per railway per harvest).

	RLY 2W	(RLY 8W)
After Milling	80 weighings	(120)
	80 m.c's	(120)
Ridge Size	40 weighings	(40)
	40 m.c.'s & B.D's	(40)
Harvester Output	40 weighings	(48)
	50 m.c.'s & B.D's	(60)
Losses	50 weighings	(60)
	50 m.c.'s & B.D's	(60)
Total per railway per harvest	170 weighings	(228)
	170 m.c's	(228)
	90 B.D.'s	(108)

3.4 Manpower

1 Engineer
2 Work Study
6 Assistants.

3.5 Other Equipment

2 tractors - complete with cabs and transport boxes for transporting personnel and samples.
1 Bog Hut.

3.6 Supporting Machines

Milling on 2W and 8W was done exclusively by the flexi miller.

4. DISCUSSION AND RESULTS

4.1 Statistical Analysis

The method used was the analysis of variance with two sources of variation. The SPSS statistical package wasn't able to handle ANOVA with three sources of variations as required in the project.

Statistical Analysis was done on:-

After milling tonnes per km @ 55% m.c. on fields 1-5 and fields 6-10,

Ridge sizes in tonnes per km ridge at 55% m.c., on fields 1-5 and fields 6-10.

All harvester speeds, output, and losses data

4.2 Design of Tests

The design of the tests was satisfactory.

Five full tests were done between the Type VI and Type VII harvesters. However, one of the tests (harvest 9) had to be eliminated from the final evaluation because there was a real difference in the quantity of peat on fields 1-5 as compared to fields 6-10, prior to harvesting.

One double test was done on railway 2W, harvest 7 using the Type VI harvester - this was done due to breakdown of the Type VII machine.

Two tests were completed between the Peco Trailed and BnM Trailed harvesters - (See sub-section 4.3 below).

Two tests were done in the comparison of the Peco Trailed and Type VII harvesters but one of these tests was elimінted (harvest 10) because there was a real difference between the quantities of peat on fields 1-5 as compared to 6-10, prior to harvesting.

Two double tests were done on railway 8W where the Peco Trailed was used to harvest the full railway (harvests 5, 9) - this was due to the non-availability of the BnM Trailed because of breakdown. Even though significant differences were found between quantities of peat on fields 1-5 as against fields 6-10 prior to harvesting (both harvest 5, 9) the average speed, output and losses were found per harvest and these data were used in the final evaluation.

4.3 Prototype Machines

The Bnm Trailed Screw Harvester was unsatisfactory as a test machine as it was unavailable for many of the tests and in some cases it wasn't sufficiently reliable to complete the five lifts necessary for a full test.

It is our opinion that, in future, such machines should be developed to the production stage before they are included in a full scale test against production machines.

4.4 Tests in Good Quality Peat

As stated earlier (2,1), the design of tests provided for the testing of the four harvesters on two railways of good quality peat in Ballycon. It had been agreed with the Manager, Derrygreenagh that when the tests in Cloncreen were completed the test machines would be transferred to two railways in Ballycon. However, due to the production difficulties experienced in 1986, it was decided that the tests on good quality peat should be cancelled.

The results of the harvester tests in 1986 are therefore valid for machines operating on poor to medium quality peat.

4.5 Forward Speed (B.mins/km)

Type VI and Type VII

There was no significant difference between the Type VI and Type VII through the test plots (i.e. excluding turns) on lifts 1 and 2, but the type VI was significantly faster on lifts 3, 4 and 5. (See Table 1, page 21).

However, analysis of forward speed, including turns (see table 2A below), showed the Type VII was significantly faster on lifts 1 and 2, there was no difference between the speeds of the two machines on lifts 3 and 4, but the Type VI was significantly faster on lift 5. (Also see table 2, page 21).

Table 2A. Average forward speed on lifts 1 to 5.

	Lift Number					
	1	2	3	4	5	Average
Type VI	11.17	11.36	11.74	12.39	13.19	11.97 B.mins/km
Type VII	9.69	10.14	11.52	13.83	18.26	12.69 B.mins/km

The above results show that the Type VII harvester is basically a faster machine during the early lifts but could not be driven to its optimum forward speed on lifts 4 and 5 as the driver was constrained to a reduced belt pump pressure to avoid jamming of the conveyor belt. This problem was caused by increased friction between belt and jib on the heavier lifts. Examination of the early lift data shows that the type VII and Type VI are equally fast on straight forward speed but the Type VII is much faster when turning speed is included.

The overall results of the tests show there is no real difference between the average speeds of the Type VI and VII machines (11.97 versus 12.69 basic mins per km respectively). However, the Type VI was very much faster over the final lift (13.19 versus 18.26 B.min/km).

Peco Trailed Vs BnM Trailed

The Peco was significantly faster than the BnM harvester both in straight forward speed and when turning speeds were included (See Tables 3 and 4, page 22).

The slowness of the BnM Trailed Harvester is probably attributable to the fact that it is a heavier machine and also the spiral consumes more power than the paddle.

Peco Trailed Vs Type VII

The available data was limited due to the fact that harvest 10 was eliminated from the analysis. The one valid comparison of these two machines showed that the Peco and Type VII were equally fast on lifts 1 and 2 but in lifts 4 and 5 the Peco was by far the faster machine. (See Table 5 and 5A, page 23).

Peco Trailed Vs Type VI

Even though these machines were not compared on the same test railway the fact that the Type VII was tested on both 2W and 8W and showed no real difference in speed shows that bog characteristics were similar in the two railways. This provides a basis for comparing the speeds per lift of the peco and type VI machines. See table 6A below which shows that speeds of both machines are similar. (See also table 6, page 24).

Table 6A. Forward Speed (including turns)

	Lift Number					
	1	2	3	4	5	Average
Peco	10.09	10.15	11.94	11.94	12.79	11.38 B.mins/km
Type VI	11.19	11.31	11.86	12.37	13.39	12.02 B.mins/km

4.6 Output (t/h)

Type VI Vs Type VII (t/h)

There was no real difference between the output of these harvesters on lift 1 but the type VI had a higher output on lifts 4 and 5 (See Table 7 on page 25).

Peco Trailed Vs Bnm Trailed (t/h)

The output of the Peco Trailed Machine was equal, or superior, to the BnM on almost all lifts (See Table 8 on page 25).

Peco Trailed Vs Type VII (t/h)

Even though only one valid comparison is available, the results show no real difference between these machines on the early lifts, but there is a highly significant difference in favour of the Peco on lift 5. (See Table 9 on page 26).

Type VI Vs Peco (t/h)

As stated earlier in 4.5 the bog characteristics of the two railways were similar. Hence the outputs per lift of the two machines can be compared (see table 10A below).

Table 10A. Harvester Output (t/h)

	Lift Number					Average
	1	2	3	4	5	
Type VI	177	285	353	462	523	360 t/h
Peco	139	280	351	450	534	351 t/h

No significance tests were carried out on the above data but the figures show there is no real difference between the outputs of the type VI and Peco machines (see also table 10, page 26).

4.7 Losses t/km @ 55% m.c.

Type VI Vs Type VII

The type VI had lower losses than the Type VII. The averages are given below:- (See also Table 11, page 27).

	Av. Losses t/km @ 55% m.c.
Type VI	5.5
Type VII	8.2

Since both harvesters have elevator collectors this represents a very big difference in pick up efficiency.

It was observed during the tests that the losses from the Type VI were low, while those from the Type VII appeared to be much higher. The photographs fig. 2, page 30 show the high level of losses left by the Type VII which was largely due to poor sealing between the two side wings and the base of the elevator.

Peco Trailed Vs BnM Trailed

The Peco had lower losses than the BnM machine. The averages are given below (See also Table 12, page 27).

	Av. Losses t/km @ 55% m.c.
Peco	7.5
BnM	16.1

Since the BnM harvester is a prototype machine, it probably is not surprising that the losses are exceptionally high. Also it would have been expected that the screw collector would be less efficient than the Paddle.

The Peco Paddle had higher losses than the type VI harvester. In photograph fig. 3, page 31 it will be seen that there is a considerable space between one of the side wings and the paddle which resulted in a ridge of losses from this area - improved sealing would reduce losses. Also it will be seen in photograph fig. 4, page 32, that the belt sealing can be improved as there is a continuous loss of peat falling on the return belt and contributing to overall losses.

Type VI Vs Peco

Even though these machines were not tested on the same railway, it is interesting to compare the average losses per lift for both machines (See table 13A below) see also Table 13, page 28).

Table 13A.

Losses t/km @ 55% m.c.					
	Lift Number				
	1	2	3	4	5
Type VI	4.6	4.4	5.8	5.9	5.3
Peco	9.2	6.0	7.4	9.5	7.7

It will be seen that the Type VI is by far the better machine on all lifts. However, as stated on the previous page, losses from the Peco can be reduced if the sealing is improved.

4.8 Performance

The performance of the four test harvesters is based on net output (including turns) and mechanical efficiency (i.e. mechanical hours over worked plus mechanical hours).

Performance of Harvesters

	Net output t/h (Av. of 5 lifts)	Mech. Efficiency %	Performance Index t/h
Type VI	360	87	313
Peco	351	88	309
Type VII	287	78	224
BnM	221	70 *	155

* This figure is inaccurate as it doesn't represent all modifications to this prototype machine.

The above table shows there is no difference in the performance of the type VI and Peco harvesters while the type VII performed poorly by comparison.

4.9 Reliability

The mechanical performance of the four test machines is given, together with performance data from Boora and Blackwater of production machines:-

MACHINE PERFORMANCE						
Machine	Worked		Mechanical		Performance (%)	
	Test m/cs	Boora/ B.water	Test m/cs	Boora/ B.water	Test m/cs	Boora/ B.water
VI	521	339	81	135	87	72
VII	453	322	131	194	78	62
Peco Trailed	557	544	76	96	88	85
BnM Trailed	55	343	24	141	70	71

The Peco trailed was marginally the best of the test machines and also performed best in the Boora/Blackwater returns.

4.10 Limitations

Peco

- Tracks, The plates used to bolt the swamp shoes onto the tractor tracks were of poor design resulting in breakage of shoes from the machine.

- Sharp turns, when turning sharply to the right, the roller on the machine frame occasionally caught the right hand track of the tractor causing swampshoes to be broken from the track.

- Belt Seal, Peat was lost due to inadequate sealing of the belt for a length of approximately 2m.

- Paddle Seal, There was a considerable space between the side-wing and paddle which resulted in a ridge of losses from this area.

Type VI - Very slow to turn.

Type VII

- Belt, In heavier lifts the driver was constrained to drive at reduced speed to avoid jamming of the belt. This was due to excessive friction between the belt and seal.

- Castor wheel - The outside castor wheel occasionally twisted and was dragged along the bog resulting in field damage.

- Elevator Seal - There was a considerable space between the side-wings and the base of the elevator - this resulted in excessive losses from this area.

BnM Trailed Unit

- Bellhousing, The driver experienced great difficulty in controlling the level of the bellhousing. This resulted in losses which were excessively high in some places, to tearing raw bog in other parts of the field.

- Sinkage, This harvester was prone to sinkage.

4.11 Cost Analysis

Preliminary costings are presented for the four harvesters. However, variable costs are not available and would take considerable time to extract at the different works as harvesters are considered as a group rather than individual types.

In the absence of these data it has been assumed that fuel, labour and maintenance (including overhaul) costs are similar for the four harvesters. This assumption would appear to be biased against the Peco machine as the maintenance costs of this harvester would be expected to be significantly lower than the type VI and type VII as it is a far less complex machine.

The table below gives capital costs of the four machines which have been written off over a ten-year period. The speed and reliability of the type VI, VII and Peco machines have been taken as being the same (this is favourable towards the type VII as this was a less reliable machine).

The cost per hectare and per tonne per annum are presented:

COST ANALYSIS £

Capital Costs	Type VI	Type VII	Peco Trailed	BnM Trailed
Trailed Unit			42,800	34,000
Tractor			27,500	27,500
Cantone Tracks			10,500	10,500
Total	104,800	110,300	80,800	72,000
Cost/ha	55	57	42 (32)	90 (66)
Cost/t	0.30	0.31	0.23 (0.17)	0.49 (0.36)

Data in brackets exclude costings for 50% of tractor and cantone outlay.

The above table clearly shows that the Peco is the more cost effective machine. The Peco becomes even more attractive if half the cost of tractor and cantone tracks are apportioned to this machine on the basis that the tractor can be utilised on other work for half of each year.

5. Conclusions

5.1 The Peco Trailed Paddle Harvester was the best overall machine.

This harvester had a high forward speed, excellent turning capacity and had a high output performance. It was a very reliable machine (most problems were caused by cantone tracks) and was the most cost effective of the four harvesters tested.

Losses were relatively high but these can be reduced by improved sealing along the conveyor belt and in the area between the paddle and side-wing.

5.2 The Type VI elevator performed next best to the Peco Trailed unit.

This machine had a high forward speed but had a poor turning capacity. It had a high output performance and the lowest level of losses of the machines tested. The test harvester was very reliable but was much less cost effective than the Peco.

5.2 The Type VII elevator is a very fast machine with excellent turning capacity. It had more mechanical problems than the Peco or Type VI and the friction problem between the belt and jib affected its performance (speed and output) on the heavier lifts.

Losses were relatively high but these could be reduced by improved sealing between the two side-wings and the base of the elevator. Preliminary cost analysis showed this machine to be marginally less cost effective than the Type VI harvester.

5.4 The BnM Trailed Screw performed very poorly in all respects. Such machines should be developed to a more advanced stage before they are included in field-scale tests.

Acknowledgements

The contribution made by personnel or groups listed below, in setting up the project, designing equipment, implementing the tests, analysing the samples, data analysis and report preparation, is much appreciated.

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	-	Mr. N. Hickey - Production Asst.
	-	Line Management
	-	Machine Drivers
	-	Field Sampling team
Work Study	-	S. O'Reilly
	-	S. Behan
	-	J. O'Riordan
	-	C. O'Reilly
R&D	-	B. Carty
	-	S. Kindregan
	-	J. Dolan
	-	J. McNiff
	-	Laboratory Staff
	-	A. Bracken
	-	S. McCormack

M. GILL

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APPENDIX

TABLE 1

FORWARD SPEEDS (EXCLUDING TURNS)

TYPE VI v TYPE VII (BMs/KM)

HARVEST		LIFT NUMBER					
		1	2	3	4	5	AVERAGE
8	VI	8.8	9.01	9.23	9.55	10.95	9.5
	VII	7.93	9.37	11.15	13.03	18.48	11.99
10	VI	8.55	8.77	9.71	10.67	10.61	9.66
	VII	8.49	9.41	9.87	13.19	17.25	11.64
11	VI	8.61	8.83	9.07	9.33	10.27	9.22
	VII	8.85	8.47	9.64	10.8	16.84	10.92
12	VI	8.56	8.67	8.77	9.85	10.76	9.32
	VII	8.88	8.71	10.83	13.69	15.88	11.6
Av.	VI	8.63	8.82	9.20	9.85	10.65	9.43
	VII	8.54	8.99	10.37	12.68	17.11	11.54
		NS	NS	S	HS	HS	

TABLE 2.

FORWARD SPEEDS (INCLUDING TURNS)

TYPE VI v TYPE VII (BMs/KM)

HARVEST		LIFT NUMBER					
		1	2	3	4	5	AVERAGE
8	VI	11.34	11.55	11.77	12.09	13.49	12.05
	VII	9.08	10.52	12.30	14.18	19.63	13.14
10	VI	11.09	11.31	12.25	13.21	13.15	12.21
	VII	9.64	10.56	11.02	14.34	18.40	12.79
11	VI	11.15	11.37	11.61	11.87	12.81	11.76
	VII	10.00	9.62	10.79	11.95	17.99	12.07
12	VI	11.10	11.21	11.31	12.39	13.30	11.86
	VII	10.03	9.86	11.98	14.84	17.03	12.75
Av.	VI	11.17	11.36	11.74	12.39	13.19	11.97
	VII	9.69	10.14	11.52	13.83	18.26	12.69
		HS	HS	NS	NS	HS	NS

TABLE 3.

FORWARD SPEEDS (EXCLUDING TURNS)

PECO TRAILED V BNM TRAILED (BMS/KM)

HARVEST		LIFT NUMBER 1	2	3	4	5	AVERAGE
4	P	8.44	8.43	10.95	10.63	10.93	9.87
	BNM	10.8	17.12	17.55	21.67	-	16.78
8	P	8.62	8.77	10.86	10.72	10.75	9.94
	BNM	17.75	18.53	22.42	27.63	30.83	23.43
AV	P	8.53	8.60	10.91	10.68	10.84	9.91
	BNM	14.28	17.83	19.98	24.65	30.83	21.51
		NS	HS	HS	HS	HS	

TABLE 4

FORWARD SPEEDS (INCLUDING TURNS)

PECO TRAILED V BNM TRAILED (BMS/KM)

HARVEST		LIFT NUMBER 1	2	3	4	5	AVERAGE
4	P	9.58	9.57	12.09	11.77	12.07	11.02
	BNM	12.39	18.71	19.14	23.26	-	18.38
8	P	9.76	9.91	12.01	11.91	11.89	11.10
	BNM	19.34	20.12	24.01	29.22	32.42	25.02
AV	P	9.67	9.74	12.05	11.84	11.98	11.06
	BNM	15.87	19.42	21.58	26.24	32.42	23.11
		HS	HS	HS	HS	HS	HS

TABLE 5

FORWARD SPEEDS (EXCLUDING TURNS)

PECO TRAILED v TYPE VII (BMS/KM)

HARVEST		LIFT NUMBER					
		1	2	3	4	5	AVERAGE
11	P	8·65	8·79	11·18	10·64	12·55	10·36
	VII	7·95	8·92	12·58	14·93	19·75	12·83
		HS	NS	S	HS	HS	

TABLE 5A

PECO-TRAILED V TYPE VII (BMS/KM) (INCLUDING TURNS)

HARVEST		LIFT NUMBER					
		1	2	3	4	5	AVERAGE
11	P	9·79	9·93	12·32	11·78	13·69	11·50
	VII	9·10	10·07	13·73	16·08	20·90	13·98
		NS	NS	S	HS	HS	

Table 6

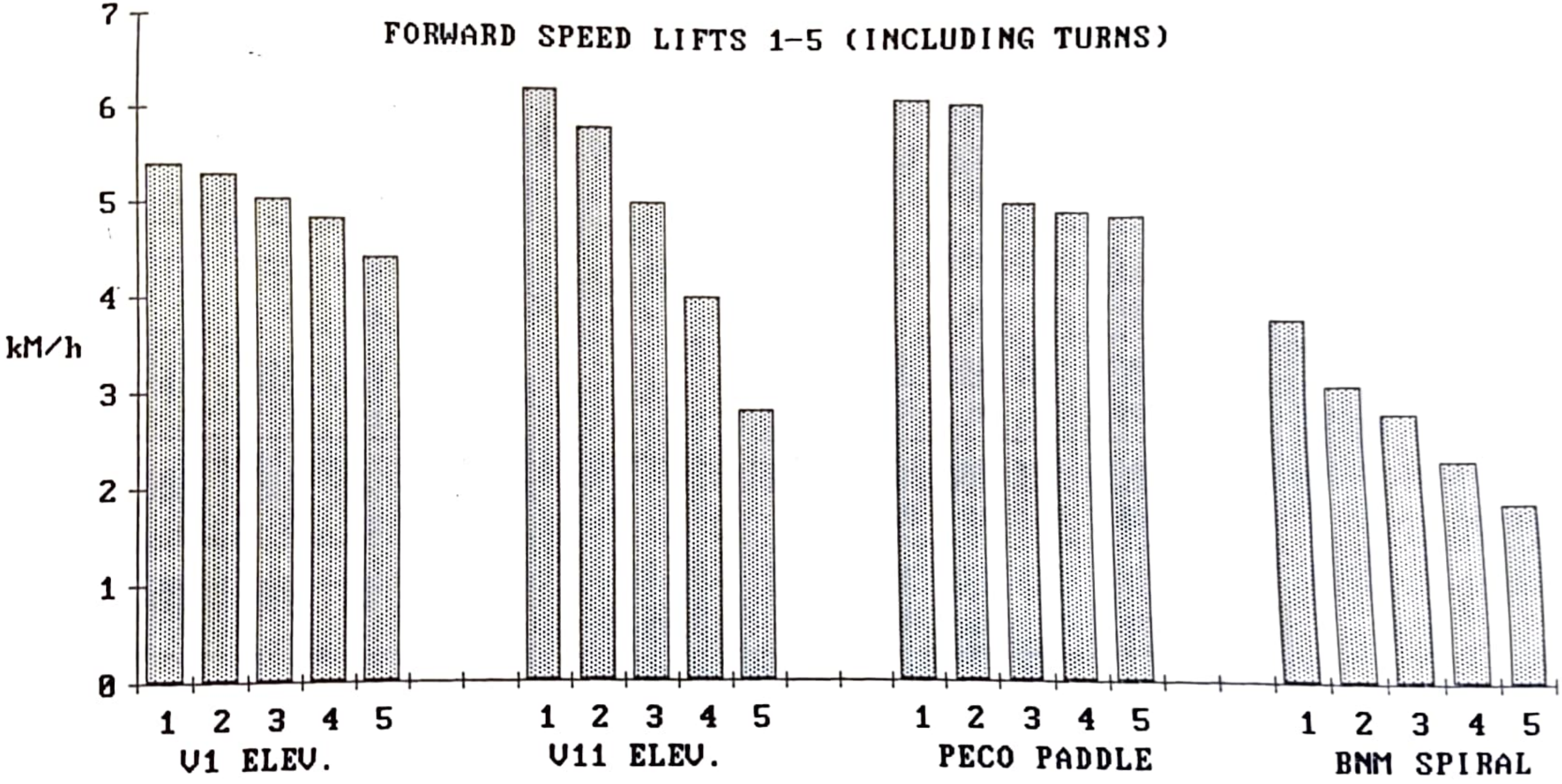
FORWARD SPEED LIFTS 1-5 (INCLUDING TURNS)
kM/h
0
1
2
3
4
5
6
7
1 2 3 4 5
V1 ELEV.
1 2 3 4 5
V11 ELEV.
1 2 3 4 5
PECO PADDLE
1 2 3 4 5
BNM SPIRAL

TABLE 7.

HARVESTER OUTPUT - T/H AT 55% M.C.

TYPE VI v TYPE VII

HARVEST		LIFT NUMBER 1	2	3	4	5	AVERAGE
8	VI VII	219 NS 267	326 NS 210	384 NS 271	393 NS 413	477 NS 322	360 300
10	VI VII	137 NS 165	284 NS 241	324 NS 273	429 HS 313	513 HS 276	337 254
11	VI VII	140 NS 159	217 NS 247	339 NS 373	464 NS 396	501 HS 374	332 310
12	VI VII	200 NS 163	349 S 276	440 HS 328	555 HS 320	608 HS 349	430 287
AV.	VI VII	174 NS 188	294 S 245	377 S 311	461 HS 360	525 HS 330	366 287

TABLE 8

HARVESTER OUTPUT - T/H AT 55% M.C.

PECO TRAILED v BNM TRAILED

HARVEST		LIFT NUMBER 1	2	3	4	5	AVERAGE
4	P BNM	109 HS 220	257 NS 215	332 NS 271	520 HS 284	566 -	357 247
8	P BNM	173 NS 103	340 NS 172	365 HS 208	468 HS 245	627 250	395 196
Av	P BNM	141 NS 161	299 HS 192	349 HS 239	499 HS 265	596 HS 250	376 221

TABLE 9.

HARVESTER OUTPUT - T/H (INCLUDING TURNS)

PECO TRAILED V TYPE VII

HARVEST		LIFT NUMBER					AVERAGE
		1	2	3	4	5	
11	P VII	147 NS 130	257 NS 290	273 S 314	386 NS 441	476 S 383	310 312

TABLE 10

OUTPUT (T/H) (INCLUDING TURNS)

PECO V TYPE VI

HARVEST		LIFT NUMBER					
		1	2	3	4	5	AVERAGE
4	P	109	257	332	520	566	357
5	P	131	244	368	452	502	339
7	VI VI	139 225	209 327	295 335	446 487	476 560	313 387
8	P VI	173 219	340 326	365 384	468 393	627 477	395 360
9	P	136	291	418	422	498	353
10	VI	137	284	324	429	513	337
11	P VI	147 140	267 217	273 339	386 464	476 501	310 332
12	VI	200	349	440	555	608	430
Av.	P VI	139 177	280 285	351 353	450 462	534 523	351 360

TABLE 11.

- HARVESTER LOSSES (T/KM AT 55% M.C.)

TYPE VI v TYPE VII

Harvest		Lift Number 1	2	3	4	5	Average
8	VI VII	5.3 12.4	4.4 8.4	9.2 7.7	9.2 9.4	5.3 11.2	6.2 9.8
10	VI VII	2.2 8.2	2.6 9.0	6.4 6.7	- -	- -	3.7 8.0
11	VI VII	3.5 5.0	4.8 5.8	6.7 12.2	4.9 15.2	6.6 4.8	5.3 8.7
12	VI VII	7.1 6.7	3.5 5.6	5.6 4.8	4.5 6.6	6.2 7.5	5.4 6.2
Av.	VI VII	4.5 HS 8.1	3.8 HS 7.2	6.4 NS 8.0	6.2 HS 10.4	6.0 7.8	5.5 8.2

TABLE 12

HARVESTER LOSSES - T/KM AT 55% M.C.

PECO TRAILED v BNM TRAILED

Harvest		Lift Number 1	2	3	4	5	Average
4	P BNM	- -	5.4 -	7.9 19.3	9.0 12.9	8.4 16.2	8.4 16.1
8	P BNM	- -	3.9 12.3	5.6 13.9	12.7 21.8	4.2 16.2	6.6 16.1
Av.	P BNM	- -	4.6 HS 12.3	6.8 HS 16.6	10.8 NS 17.4	6.3 HS 16.2	7.5 16.1

TABLE 13

HARVESTER LOSSES T/KM AT 55% MOISTURE CONTENT

TYPE VI v PECO TRAILED

HARVEST		LIFT NUMBER					
		1	2	3	4	5	AVERAGE
4	P	–	5·4	7·9	9·0	8·4	7·7
5	P	9·3	7·5	8·1	6·2	6·8	7·6
7	VI	4·7	5·0	5·5	4·0	2·9	4·4
	VI	4·5	6·3	3·9	7·1	5·6	5·5
8	VI	5·3	4·4	6·9	9·2	5·3	6·2
	P	-	3·9	5·6	12·7	4·2	6·6
9	P	11·5	7·6	8·0	12·9	11·1	10·2
10	VI	2·2	2·6	6·4	-	-	3·7
11	VI	3·5	4·8	6·7	4·9	6·6	5·3
	P	6·8	5·6	7·6	6·5	8·0	6·9
12	VI	7·1	3·5	5·6	4·5	6·2	5·4
Av.	VI	4·6	4·4	5·8	5·9	5·3	5·1
	P	9·2	6·0	7·4	9·5	7·7	7·8

TABLE 14

AVERAGE PRESS DENSITY (G/L) OF BOTH TEST RAILWAYS
(AVERAGES TAKEN OVER3 HARVESTS).

RAILWAY	FIELD										
	1	2	3	4	5	6	7	8	9	10	Av.
RLY 2W	226	221	220	208	204	197	188	184	188	214	205
RLY 8W	223	206	203	193	178	162	157	146	145	189	180