

B O R D   N A   M O N A  
S C I E N T I F I C   O F F I C E  
D R O I C H E A D   N U A  
C O .   K I L D A R E

SUBJECT: Distribution and Nature of  
Mineral "Ash" Material in  
a Milled Peat Stockpile .

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SEPTEMBER, 1982.

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DATE RECD. FOR ATTENTION	-3 NOV 1982

DISTRIBUTION AND NATURE OF  
MINERAL 'ASH' MATERIAL IN A  
MILLED PEAT STOCKPILE

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An investigation was carried out on a stockpile in Clonsast (TR 10 SW) to establish the following:-

- a) The distribution of ash in the profile, that is, if the ash content of the peat was uniform throughout the profile or if there was a significantly higher ash content at the lower 'pile levels.
- b) The nature of the mineral material which constitutes ash in milled peat. This was classified and investigated as follows:
  - (i) Pebbles - hard mineral material (i.e. stones) not breakable by hand.
  - (ii) Visible mineral material present as aggregates, grit or fines, the aggregates breakable by hand.
  - (iii) Non-visible inherent mineral material.

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## PROCEDURE

In discussions with the manager, Clonsast, it was decided that stockpile on TR 10 SW was typical of high ash 'piles as the ash ranged from 8.7% to 23.8%. See Table No. 9.

The history of production on this was:-

	1977	-	9 harvests
	1978	-	8 harvests
	1979	-	9 harvests
	1980	-	8 harvests
	1981	-	<u>13 harvests</u>
Total	<u>Total</u>	-	<u>47 harvests</u>

As the number of lifts per harvest was considerably less (~3 fields) than a standard 11 field system, this 'pile was equivalent to ~14 harvests from an 11 field system.

Ditching was last done in the autumn of 1980 and was done each winter prior to that.

From the ash survey done on this pile at 25yd intervals (see Table 9) it was decided to open the 'pile by hymac at 2800S, 3025S, 2625S, that is, where the average ash contents were 9.8%; 15.6%; 17.9%. It was originally intended to investigate the 'pile at 3050S where the ash content was 23.8%, but as the 'pile was very small at this point it was not intensively sampled and point 3025S was selected instead.

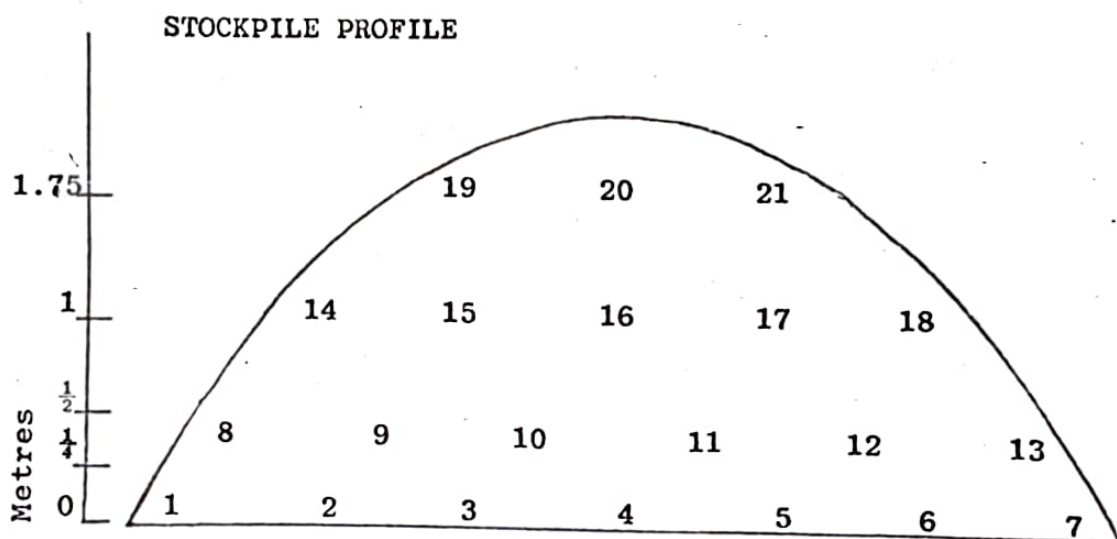
It was decided to sample the two exposed 'pile profiles at each of the yardage points mentioned above, the

distance between the adjacent profiles was approx. 2 m. This provided a complete set of samples from each of 6 profiles.

Samples were taken as per the illustration below using a half cylindrical cowl



which was pushed into the profile at the sampling point and the peat within the cowl was taken as the sample. A total of 21 samples were taken from each profile. From the illustration below, it will be seen that 7 samples were taken from the base or lower  $\frac{1}{4}$  m. of the 'pile; 6 were taken in the  $\frac{1}{4}$  to  $\frac{1}{2}$  m. level; 5 were taken at approx. 1 m. level and 3 from  $1\frac{1}{2}$  - 1.75 m. level.



Sample locations shown 1 - 21 above.

## ANALYSES

- (a) Moisture content (%)
- (b) Bulk density (g/l)
- (c) Ash content - exclusive of pebbles. This includes inherent mineral material in the peat and visible mineral breakable material. See Tables 1 - 7.
- (d) Pebble content per litre of milled peat. Size, number and weight measurements taken. See Tables 1 - 7.
- (e) Visible mineral material. Samples were classified as having zero, small, medium and large quantities of this present i.e. 0, 1, 2, 4 were the classification numbers used. See Tables 1 - 7.

## DEFINITIONS

### Ash Content

This includes inherent invisible mineral material in the peat and visible mineral aggregates, grit and fines. Pebbles are excluded in the ash result in tables 1 - 7.

### Pebbles

Stones which were unbreakable by hand and were mainly of limestone composition.

Size varied from  $> 1\frac{1}{2}$ mm to  $< 63.5$ mm.

### Visible mineral material

Aggregates (breakable by hand) grit or fines.

Sizes were approx. as follows:

Aggregates	$< 25.4$ mm
Grit	$< 1.5$ mm
Fines	$< 850.0$ microns (0.85mm)

### Invisible mineral material

Defined as inherent mineral material in the peat.

## DISCUSSION & RESULTS

Tables 1 - 6 give the results of Ash, Pebbles and Visible mineral contents for each of the 6 profiles.

1N, 1S represent the two adjacent profiles exposed at 2625 S.

2N, 2S represent the two profiles at 2800 S.

3N, 3S represent the profiles at 3025 S.

Table 7 gives a summary of results i.e. averages of ash, pebble and visible mineral material for the 6 profiles 1N to 3S.

Table 8 shows the distribution of pebble sizes.

Table 9 shows results of initial ash survey.

Table 10 gives general results.

## ASH CONTENTS

Tables 1 - 6 show that the ash content was lowest at the base of the 'pile and highest at the middle or top. This may be explained by the fact that the later harvests in the stockpile (i.e. peat in the mid to top region of the 'pile) included a higher proportion of peat from the lower bog 0.5m stratum where the average ash content is approx. 9.0%. Also, ash contents in the 9.0% to 15.0% ash range and higher are due to a higher proportion of mineral sub-soil contamination due to ditching, milling etc. Tables no. 1 - 7 support this view.



### PEBBLE CONTENT

Table 8 shows the distribution in the size of pebble - the highest number was found in the  $\frac{1}{4}$ " -  $\frac{3}{8}$ " interval. The average pebble diameter (excluding 6 stones which were > 1") was 0.9 cms (0.35"). The average pebble weight was 1.0g which gave a pebble density of approx. 2.6g/cc. The large stones gave a density of 2.7g/cc. Chemical tests and density Measurements confirm that these were mainly limestone material.

It will be seen from Tables 1 - 6 and Table 7 that the number of pebbles per litre of peat was lowest at the base and was highest at the middle and top of the stockpile. This was an unexpected finding as it was felt prior to this investigation, that the pebbles and stones would separate during the final lift operation when the peat is dropped onto the 'pile and that the greater number would be found at the 'pile base or the lower regions, but the contrary was the case. The larger numbers at the middle and top are the result of increased sub-soil contamination due to ditching and milling operations.

### VISIBLE MINERAL MATERIAL

Tables 1 - 6 and Table 7 show that the base of the 'pile had the lowest level and the middle and top the highest level of material. There is a close correlation between the distribution of ash and visible mineral material from base to top of 'pile.

An examination of work done on bog profiles in Timahoe, Ballydermot, Clonsast etc. confirms that the following average ash contents are typical of undisturbed raised bog peats for the bog depths quoted.

< 2% ash:- ash content in the poorly decomposed upper stratum of raised bog.

2% - 5% ash:- ash content in the upper to middle region.

5% - 9% ash:- ash content in the middle to lower region.

9% ash:- ash content in the lower 0.5 metre stratum.

> 9.0% ash:- ash content in peat contaminated by sub-soil mineral material due mainly to ditching and milling operations. (this peat would be expected to include a high proportion of peat from the lower 0.5m bog stratum which has an ash content of 9.0%)

Therefore the following ranges are relevant:

<u>Ash Content</u>	<u>Mineral Material</u>
9.0%	Inherent in peat at lower 0.5 m.
11.3%	Includes the above, plus visible mineral material due to ditchings, millings, etc.
11.8%	Includes the above, plus pebbles < 25.4mm.
13.7%	Includes the above, plus stones > 25.4mm. i.e. includes all mineral material.



## CONCLUSIONS

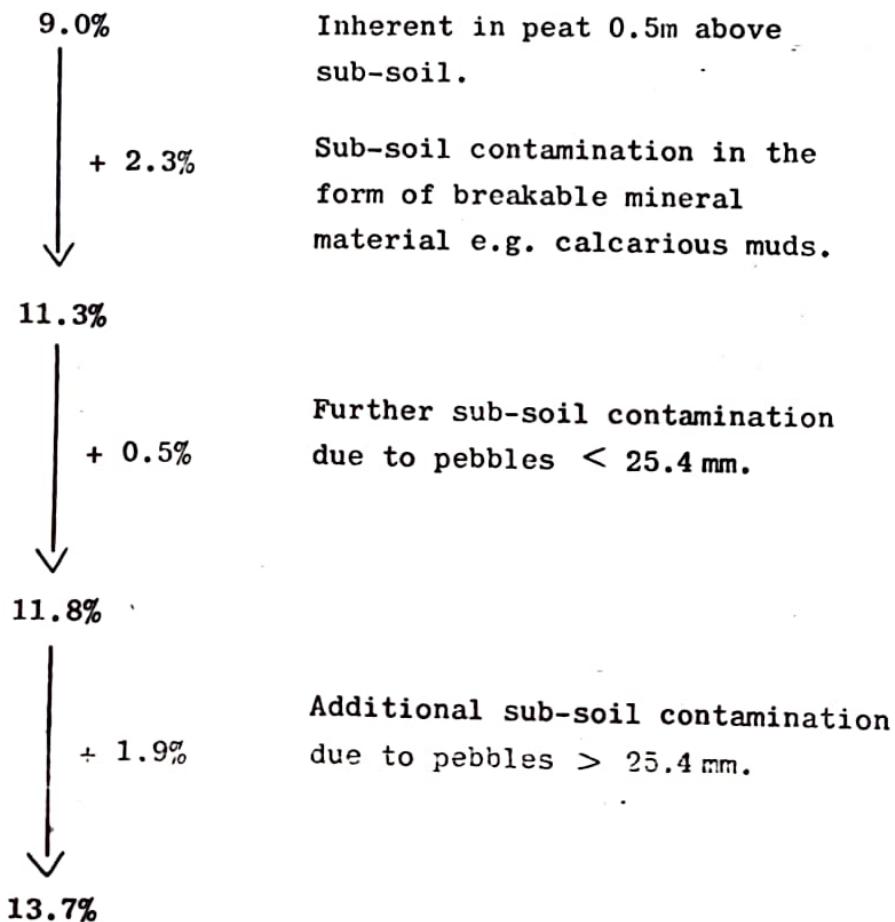
1. The total ash content was lowest at the base of the stockpile and was highest at the middle or top of the 'pile.

The increase in ash in the later harvests is due to the increased quantities of sub-soil mineral material from ditching and milling operations which were harvested onto the stockpile.

2. A breakdown of the ash constituents, such as, inherent ash in the peat, visible mineral contamination and pebbles/stones contents are given together with the contribution each of these makes to the total ash content of milled peat.

### Ash Content

### Origin of Ash



It will be seen from the above that 9.0% ash is the average ash content of peat from the lower 0.5 m stratum without any sub-soil contamination.

A further 2.3% is due to sub-soil contamination due to breakable mineral material which can be in the form of aggregates, grit or fines.

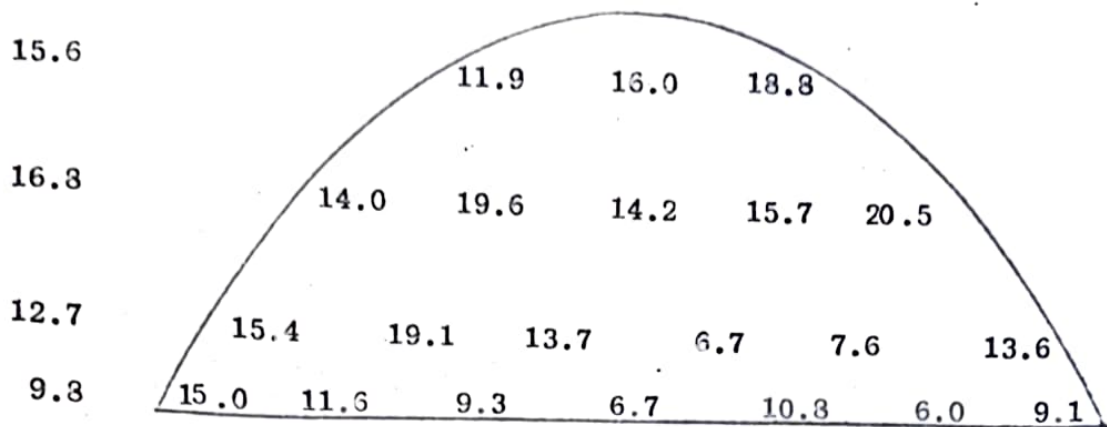
An additional 2.4% ash is due to pebbles and stones.

Hence, uncontaminated lower bog stratum peat will have an ash content as high as 9.0% and sub-soil contamination due to breakable mineral material such as calcareous mud contributes as much to the total ash content (+ 2.3%) as do pebbles and stones (2.4%).

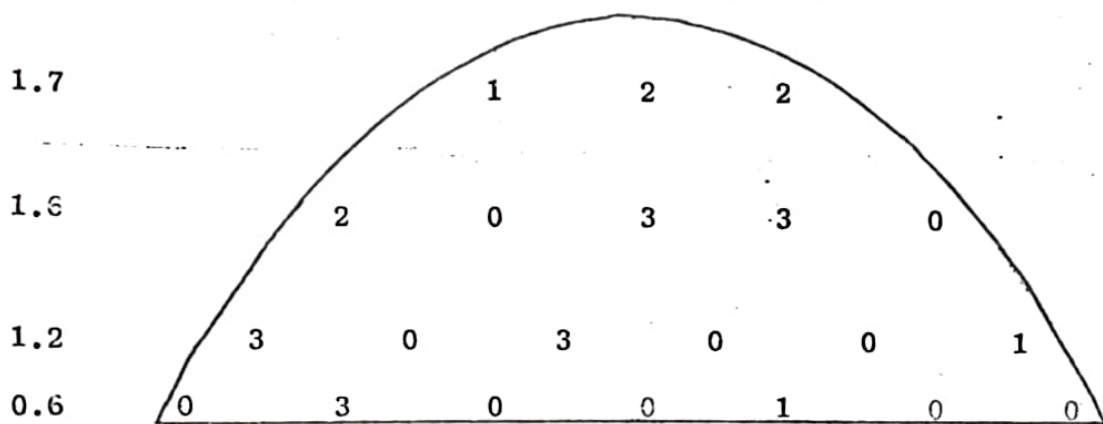
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**TABLE 1**  
IN  
Average  
Per Level

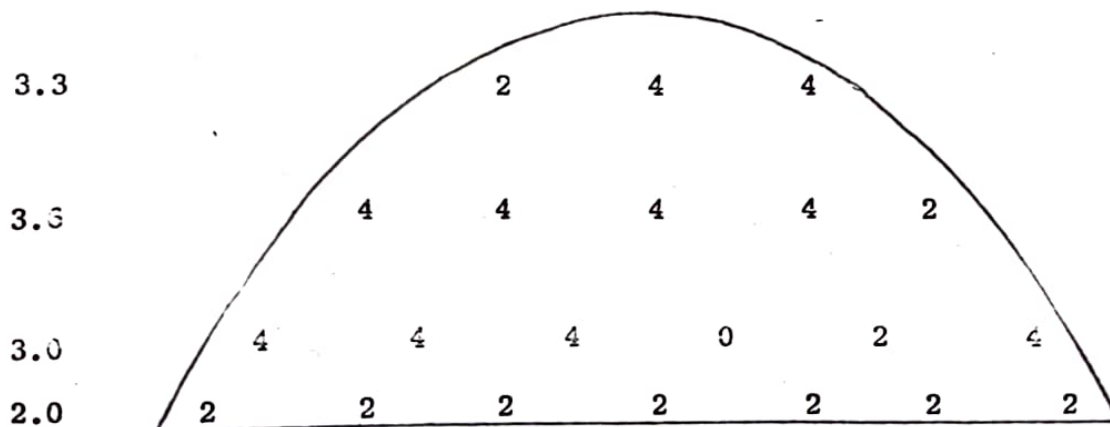
ASH (Exclusive of Pebbles)



PEBBLES (Number per Litre Peat)



MINERAL (Visible)

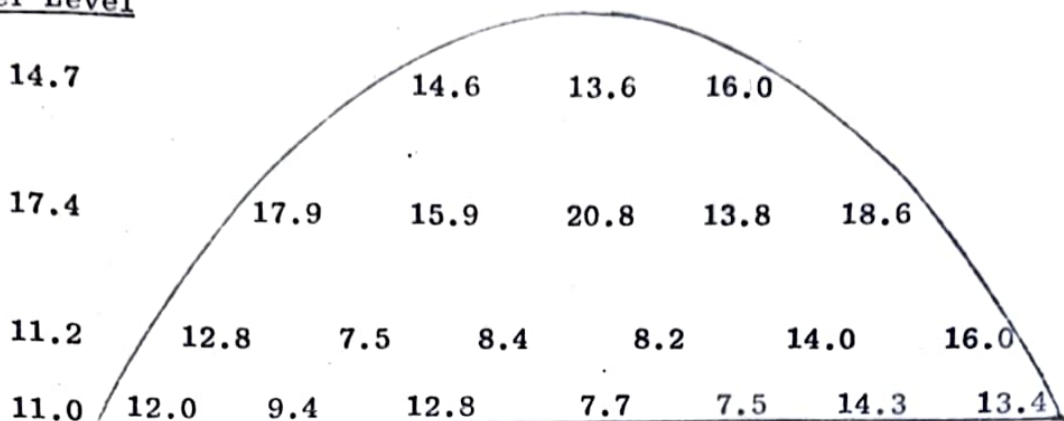


Legend for Visible Mineral Material/litre.

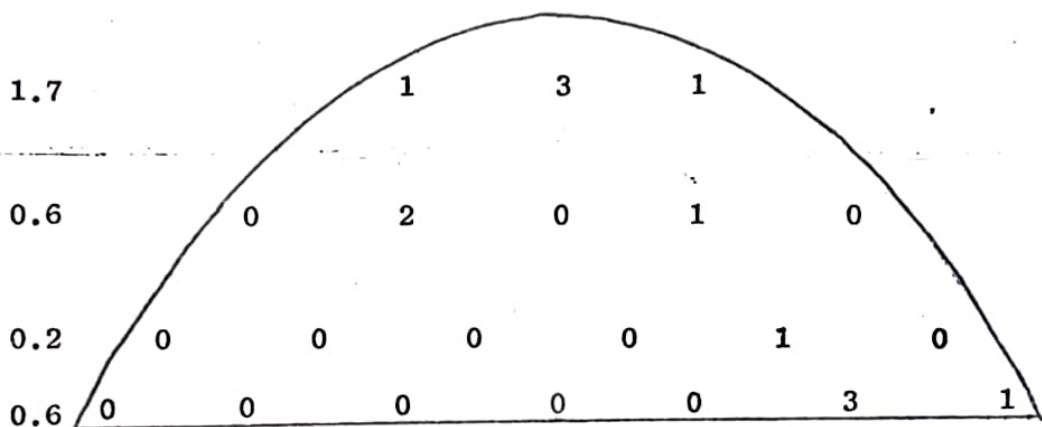
0 = zero in sample of 1 litre. 1 = small; 2 = medium; 4 = large

TABLE 2  
IS  
Average  
Per Level

ASH



PEBBLES



MINERAL

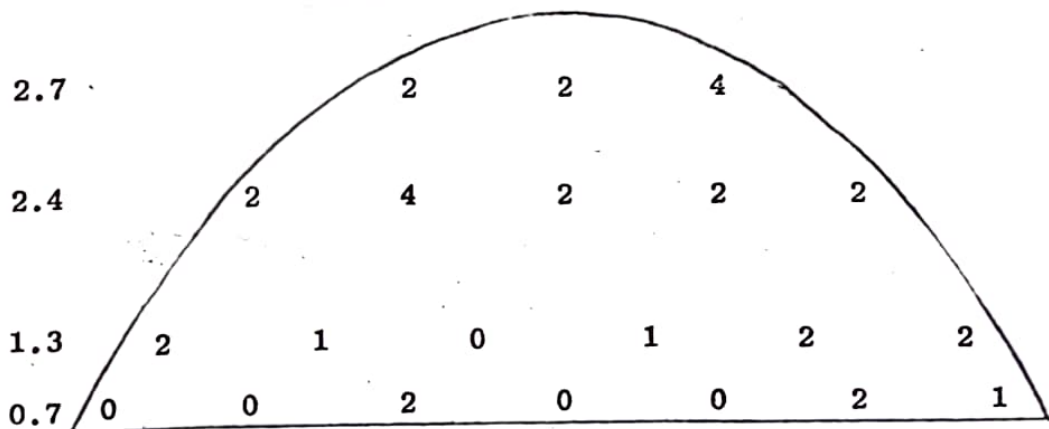
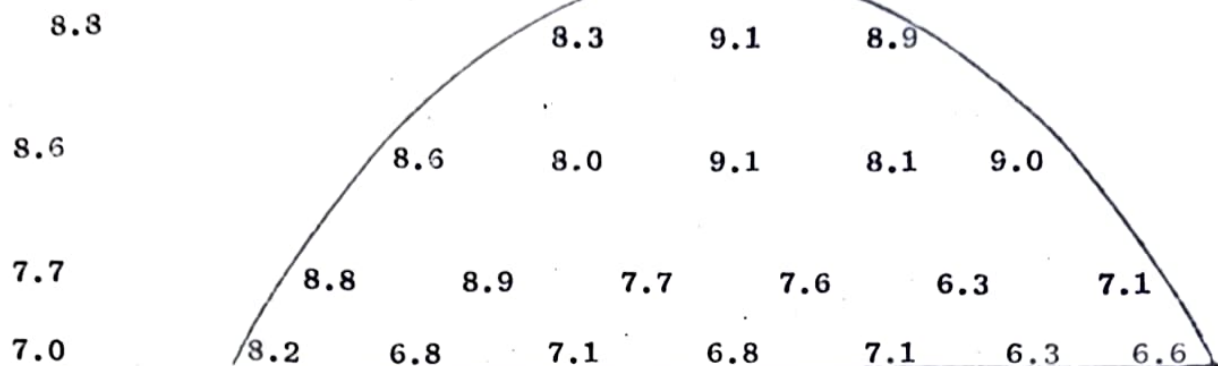


TABLE 3

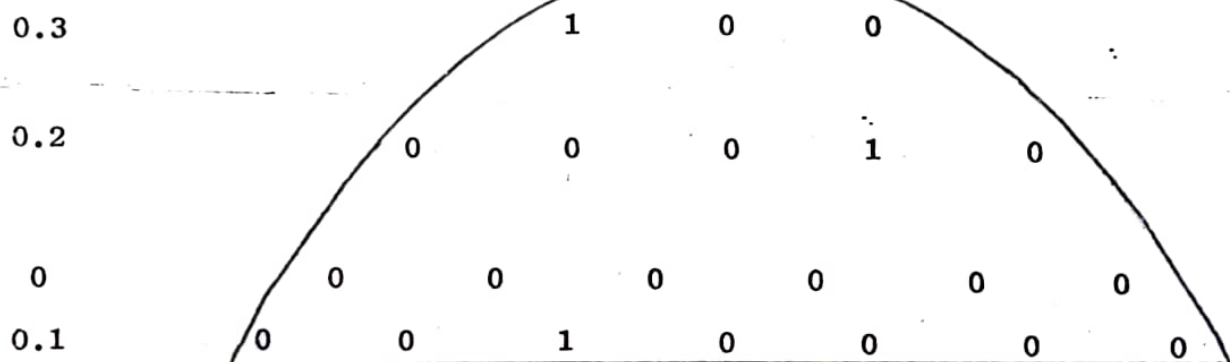
2N

Average  
Per Level

ASH



PEBBLES



MINERAL

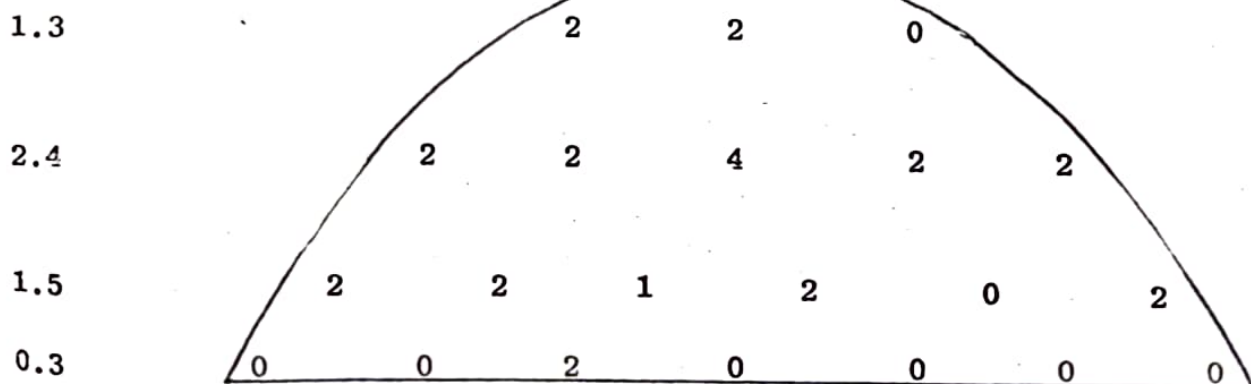


TABLE 4

2S

Average  
Per Level

ASH

8.6

6.6 11.5 7.7

8.6

6.9 9.8 10.2 8.3 7.8

7.5

7.2 6.3 7.1 6.7 9.4 8.2

6.5

7.0 6.6 6.4 7.2 5.3 6.3 6.8

PEBBLES

0.3

0 1 0

0.2

0 0 1 0 0

0

0 0 0 0 0 0 0

0.1

0 0 0 0 0 1 0

MINERAL (Visible)

2.0

2 4 0

2.2

1 2 4 2 2

2.0

2 2 2 2 2 2

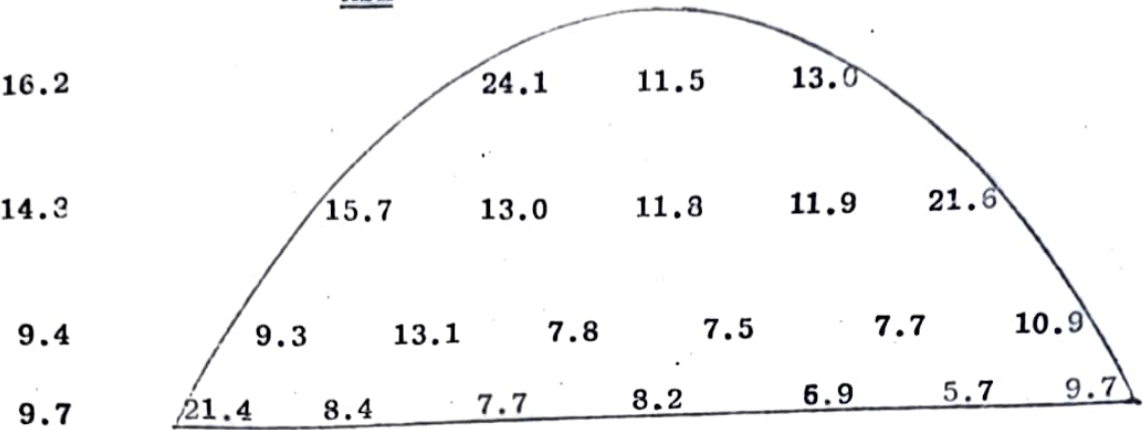
0.7

0 0 2 1 0 2 0

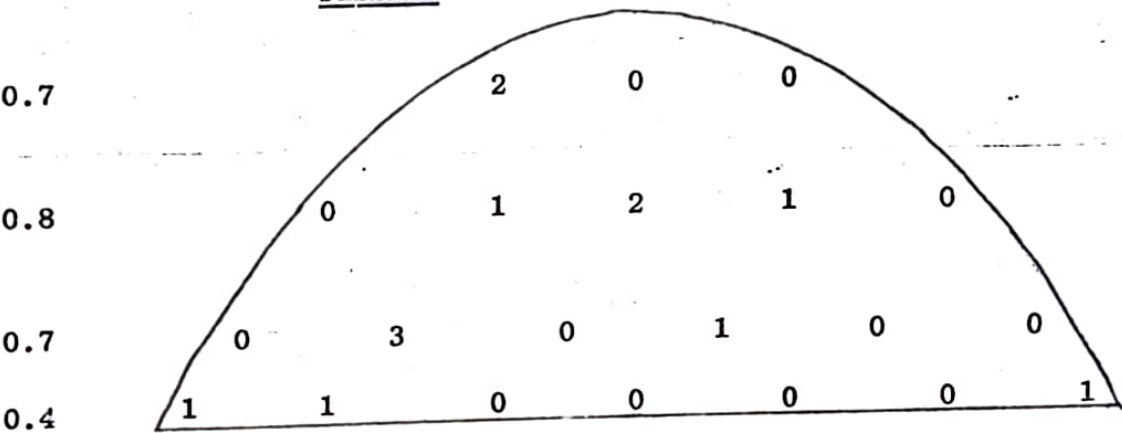


TABLE 5  
3N  
Average  
per Level

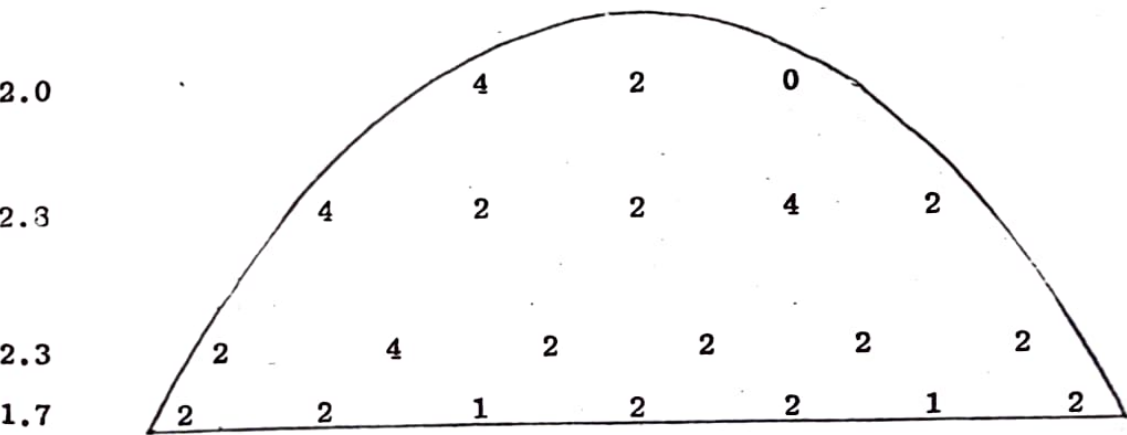
ASH



PEBBLES



MINERAL

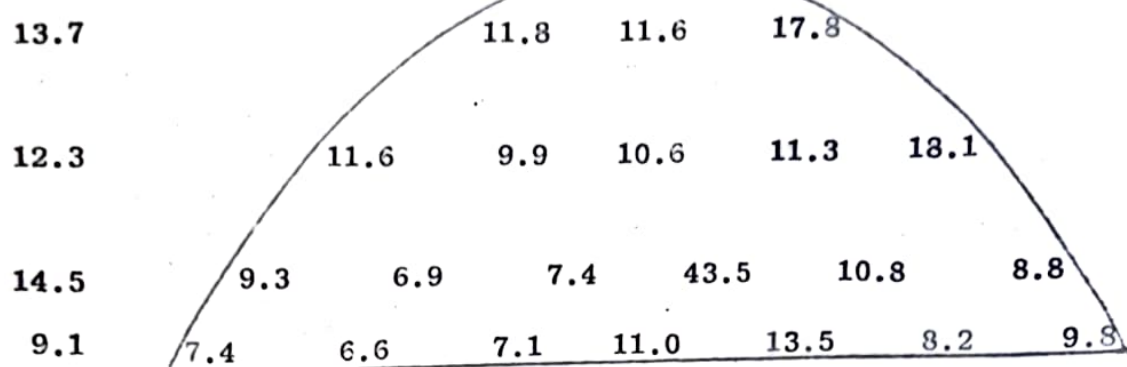


**TABLE 6**

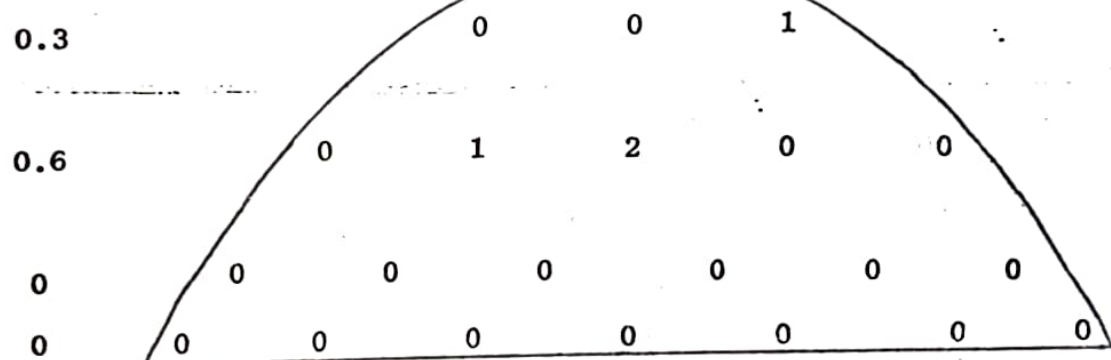
**3S**

**Average  
Per Level**

ASH



PEBBLES



MINERAL (Visible)

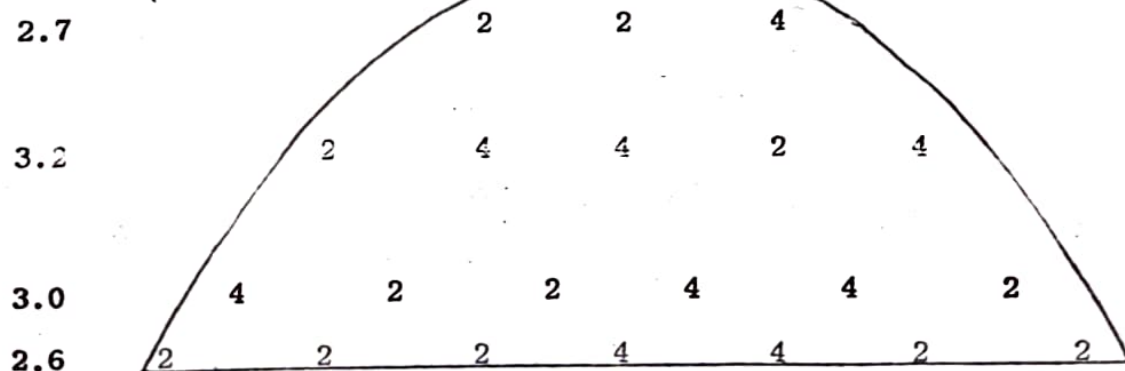


TABLE 7

## SUMMARY OF RESULTS

AVERAGES AT PILE LEVELSASH

## PILE LEVEL

TOP

MIDDLE

UPPER BASE

BASE

P R O F I L E					
IN	IS	2N	2S	3N	3S
15.6	14.7	8.8	8.6	16.2	13.7
16.8	17.4	8.6	8.6	14.8	12.3
12.7	11.2	7.7	7.5	9.4	14.5
9.8	11.0	7.0	6.5	9.7	9.1

PEBBLES

TOP

MIDDLE

UPPER BASE

BASE

IN	IS	2N	2S	3N	3S
1.7	1.7	0.3	0.3	0.7	0.3
1.6	0.6	0.2	0.2	0.8	0.6
1.2	0.2	0	0	0.7	0
0.6	0.6	0.1	0.1	0.4	0

VISIBLE MINERAL

TOP

MIDDLE

UPPER BASE

BASE

IN	IS	2N	2S	3N	3S
3.3	2.7	1.3	2.0	2.0	2.7
3.6	2.4	2.4	2.2	2.8	3.2
3.0	1.3	1.5	2.0	2.3	3.0
2.0	0.7	0.3	0.7	1.7	2.6



TABLE 8

## DISTRIBUTION OF PEBBLE SIZES

NUMBER OF PEBBLES

22  
20  
18  
16  
14  
12  
10  
8  
6  
4  
2  
0 $\frac{1}{16} - \frac{1}{4}$   $\frac{1}{4} - \frac{3}{8}$   $\frac{3}{8} - \frac{1}{2}$   $\frac{1}{2} - 1$   $1 - 1\frac{1}{2}$   $1\frac{1}{2} - 2\frac{1}{2}$ 

SIEVE SIZE

SIEVE SIZE

 $>\frac{1}{16} <\frac{1}{4}$   $>\frac{1}{4} <\frac{3}{8}$   $>\frac{3}{8} <\frac{1}{2}$   $>\frac{1}{2} <1$   $>1 <1\frac{1}{2}$   $>1\frac{1}{2} <2\frac{1}{2}$ 

NO. OF PEBBLES

12

22

11

6

1

5



## MILLED PEAT ANALYSIS.

TABLE 9

FROM: Scientific Officer,  
Droichead Nua,  
Co. Kildare.

TO: Manager,  
Clonsast,  
Portarlinton,  
Co. Laois.

NO. OF SAMPLES: 22			NAME OF BOG:		
DATE RECEIVED: 3.3.82.			AREA NO: T.R. 10. S.W.		
Railway No.	Sample No.	M.C. %	A.C. %	B.D. g/l	P.D. g/l
2550 <sup>S</sup>		47.0	12.9	333	286
2575 <sup>S</sup>		60.5	13.7	384	294
2600 <sup>S</sup>		51.8	14.2	371	306
2625 <sup>S</sup>	2 Profiles Sampled	55.4	17.9	357	283
2650 <sup>S</sup>		56.4	18.8	389	309
2675 <sup>S</sup>		48.1	15.4	349	297
2700 <sup>S</sup>		35.3	12.3	318	307
2725 <sup>S</sup>		51.3	15.3	348	287
2750 <sup>S</sup>		56.0	14.0	393	314
2775 <sup>S</sup>		59.2	9.2	357	272
2800 <sup>S</sup>	2 Profiles Sampled	59.5	9.8	352	267
2825 <sup>S</sup>		60.3	9.2	330	245
2850 <sup>S</sup>		56.0	10.2	309	240
2875 <sup>S</sup>		57.5	8.7	344	266
2900 <sup>S</sup>		49.1	14.1	346	292
2925 <sup>S</sup>		57.7	17.1	356	276
2950 <sup>S</sup>		43.2	13.1	311	279
2975 <sup>S</sup>		57.7	11.9	357	277
3000 <sup>S</sup>		49.9	16.3	358	300
3025 <sup>S</sup>	2 Profiles Sampled	43.3	15.6	342	291
2050 <sup>S</sup>		46.1	23.8	365	317
3075 <sup>S</sup>		56.6	15.2	382	302
MEAN		52.9	14.0	352	287

TABLE 10

GENERAL RESULTS

Average ash content (excluding pebbles)	=	11.3%
Average M.C.	=	45.8%
Average bulk density (g/l)	=	372.7
Average anhydrous solids (g/l)	=	202.0
Total weight pebbles & stones	=	605.6g
Average wt. pebbles per litre	=	4.8g
Ash due to pebbles	=	2.4%
Wt. pebbles per m <sup>3</sup>	=	4.8kg
Number pebbles per m <sup>3</sup>	=	452
Ash due to pebbles 0.9cm diameter excluding stones > 25.4mm	=	0.5%
Wt. stones > 25.4mm	=	479.3g
Wt. pebbles < 25.4mm	=	126.3g
Average wt. pebbles per litre	=	$\frac{126.3}{126} = 1.0g$
Ash due to pebbles $\frac{1.0 \times 100}{202}$	=	0.5%
Hence ash excluding pebbles	=	11.3%
Ash plus 0.9cm pebbles	=	11.8%
Total ash including all pebbles and stones	=	13.7%