DRAINAGE INVESTIGATION ON BOGLAND

The Effect of Drain Spacing on Ground Water Levels

W. Burke

An Foras Taluntais, Soil Physics Department, Kinsaley, Co. Dublin

ABSTRACT

Drains installed in blanket peat have a very localised effect. A lowered ground water level is found only to a distance of 5 or 6 feet from the edge of the drain. Hence with drain spacings of 25, 50 and 100 feet, the areas remaining undrained were respectively 60, 80 and 90 per cent. There was a maximum seasonal fluctuation of 12 inches in the water table, but no permanent drainage effect.

INTRODUCTION

The reclamation of peatland for agriculture has been practised for centuries, and has been attempted in all countries where peat deposits occur. In Ireland there are approximately three million acres of peat. In many districts peatland is the only land available for agriculture (1). Most of the peat reclamation work done has been by farmers using traditional methods. Drainage then was mainly achieved by covered sod drains.

Recently, Bord na Mona (The Irish Peat Board) have developed methods for the large-scale drainage of peat. These methods are satisfactory for industrial purposes, but have not proved adequate for agriculture.

The drainage of blanket peat presents a special problem, since it is usually more gelatinous and less permeable than the Irish midland peats.

Peat Drainage In Other Countries

Information on peat drainage from other countries is often contradictory and there is disagreement on exact drainage requirements. In Russia, Yangal recommended spacing not greater than 40 metres between mole drains for a peat composed chiefly of sedges, moss and reeds (2). German practice recommended drain spacings of 20-30 metres for tillage and 25 to 40 metres for grass in deep low bog. For deep raised bog, spacings of 12-20 metres for tillage, and 15-25 metres for grass were advised. Kramer in Bavaria recommended a spacing of 20-25 metres for low bogs and 8-10 meters for high bogs (4). Venier Bog, in France, had drains 0.75 metres deep spaced at an average of 50 meters.(5) In the Florida Everglades where very large acreage of

peat and muck soils have been reclaimed, drains are spaced at 660-1000 feet with internal mole drains 30 inches deep at 12-15 feet spacings (6). In New Zealand good results have been obtained on peat by spacing mole drains at 10 feet (7). This system gave a ground water level of 10 inches in winter and 24 inches in summer. At Nephin Beg in Ireland, drains 20 inches deep spaced at 10 feet were used for forestry work (8).

Ground Water Levels and Crop Yields

Experiments to correlate the depth to ground water level with crop yields have been done in many countries on mineral soils but information on this aspect of peat land utilisation is limited. Such a study was carried out at the University of Minnesota in the early 1930's (9). For grass, best results were obtained with a $1\frac{1}{2}$-2 feet depth to ground water level. This depth was also found satisfactory for many crops in the Everglades region, while grasses did well at appreciably shallower depths (6). The effect of ground water level on crops on Fen peat has been studied in England by Nicholson and Firth (10). Their results indicated an optimum depth to ground water level of $2\frac{1}{2}$ to 3 feet for most crops with good results from potatoes and celery at a depth of 2 feet.

EXPERIMENTAL

Drainage Investigations at Glenamoy

Glenamoy, in County Mayo, on the west coast of Ireland, has an average annual rainfall of 50 inches (270 rain days) and the peat type there is representative of blanket bog in the western part of the country. Drainage and related problems at Glenamoy have been studied as follows: (a) the collection of data on the physical properties of drained and undrained peat; (b) method of drainage; (c) cultural treatments; (d) effect of drainage and soil structure on plant growth. Records of moisture content, drainage water run-off, bog shrinkage, ground-water levels, and moisture pressures above and below ground-water level were obtained.

Ground Water Level Assessment

Because of the physical characteristics of blanket peat—high water content, extremely low permeability and massive structure—it was necessary to determine whether the ground water level, as found in observation wells, coincided with that within the peat mass. For this test, the true level was taken as the locus of those points at which the water in the peat was at atmospheric pressure. It was assumed that moisture movement in the peat was sufficiently slow to approximate equilibrium conditions. Tensiometers were inserted at various depths and records were kept of tensions and observed ground-water levels over a period of several months. These records showed approximate agreement between the two methods of ground-water level determination. Thus, the well method of observation was regarded as sufficiently accurate for this study.

RESULTS

Effect of Drain Spacing

The effect on ground water level of open drains 3 feet deep spaced at 25, 50 and 100 feet apart was studied. A uniform area with a slight slope was selected. For each spacing three lines of wells at right angles to the drains were installed. Each well was 6 feet deep, 4 inches in diameter and lined with 6 field drainage clay tiles, placed

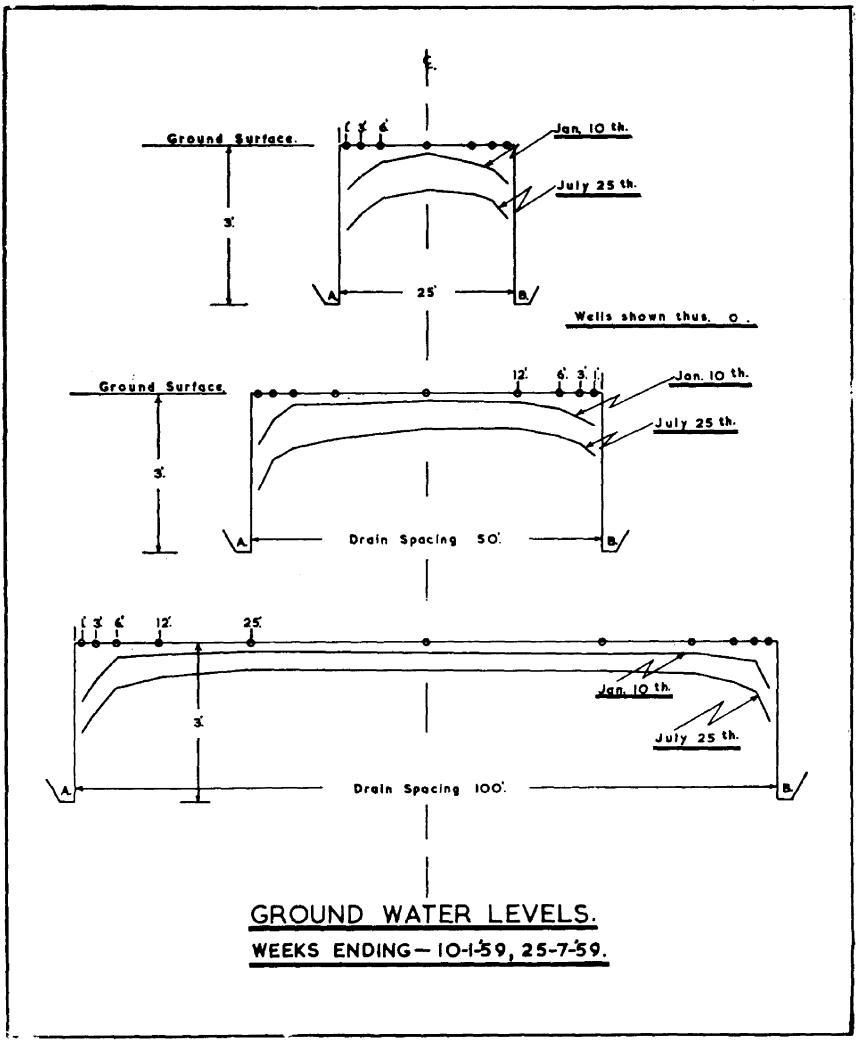

Fig. 1—Effect of drain spacing on average ground water levels for selected winter and summer weeks.

vertically one above the other. Depth to ground water level was measured from the upper end of the top tile which was made to coincide exactly with the surface. Readings were taken daily in all wells except on very wet days. There were a total of 81 observation points from which over 20,000 readings per annum were obtained. The position of observation wells and the water level in relation to drain spacings for winter and summer periods are shown (Fig. I). It will be noted that, irrespective of drain spacing, ground water level commenced to fall at a point approximately 6 feet from the drain edge. Elsewhere it remained parallel to the surface and at the same height as in the undrained condition. Additional data on this point are presented (Table I). Average ground water levels for selected weeks in 1958 and 1959 in wells 6 feet and 12 feet from drain edge (and rainfall for each period) are given.

TABLE I

Average depth to ground water, and rainfall, for typical weeks, winter and summer, 1958-9

Week ending	1 Feb. 1958		19 July 1958		10 Jan. 1959		25 July 1959	
Rainfall (inches)	0.85		0.34		1.14		0.65	
Distance from drain (feet)	6	12	6	12	6	12	6	12
Drains 25 ft. apart	3.7*	1.7	12.7	10.3	3.7	2.0	12.3	10.0
Drains 50 ft. apart	2.3	2.3	11.3	10.3	2.7	2.3	12.0	10.7
Drains 100 ft. apart	2.3	2.3	12.6	9.7	3.6	3.0	10.3	8.0

* = All depths expressed in inches.

A further series of tests is in progress (begun in 1959) with drains spaced at 8, 12, 16 and 20 feet by means of a plough specially developed for peat drainage (12). Early results show that a drain spacing of 10 to 12 feet is necessary for overall lowering of ground water level.

REFERENCES

1. Walsh, T. W., O'Hare, P. J. and Quinn, E., *Advanc. Sci.*, **57**: 405, 1958.
2. Yangal, A. N., *Dokl. Vsesou. Akad. S. Kh. Nauk.*, **12**: 26, 1940.
3. "*Drainage of Bog Soil*," German Standard (DIN 1185), Berlin, 1950.
4. Kraemer, O., *Internat. Peat Symp., Sect. F2*, Dublin, Bord na Mona, 1954.
5. Ferroniere, Y., *ibid., Sect. F2*, 1954.
6. Clayton, B. S., Neller, J. R. and Allison, R. V., "*Water Control in the Peat and Muck Soils of the Florida Everglades*," Bull. 378, Univ. Florida Agric. Expts. St., 1942.
7. Van der Elst, Hupkens, F. E. C. Information Ser. No. 12, N.Z. Dept. Sci. Ind. Res., 1956.
8. McEvoy, T. F., *Internat. Peat Symp., Sect. F2*, Dublin, 1954.
9. "*A Study of Ground Water Levels on Yields of Crops Grown on Peatland*," Bull. 330, Univ. Minn. Agric. Expts. St.
10. Nicholson, H. H. and Firth, D. H., *J. Agric. Sci.*, **50**: 243, 1958.
11. Walsh, T. and Barry, T. A., *Proc. Roy. Irish Acad.*, 59b: 15, 1958.
12. Armstrong, J. J., Burke, W. and Quinn, E., *J. Dept. Agric. Eire*, **57**: 149, 1960.