

## CHAPTER I

*FORMER NEGLECT OF DRAINAGE WORK. MEASURES OF  
 GOVERNMENT ASSISTANCE*

Under the stimulus of the country's need and the measures taken by the Government to encourage it, drainage work of all kinds has assumed such proportions in this country that the County War Agricultural Executive Committees have sometimes been hard put to it to keep on top of the necessary preliminaries of inspection and approval of the schemes submitted to them for grants-in-aid. It happened that when, in view of the possibility of war, steps were taken to rehabilitate the soil of our countryside as a means of producing the major proportion of our food, attention was at first given only to the lime and phosphate status of the soil, and nothing was done to encourage field draining, in spite of the obvious need for it, and of its fundamental importance.

Attention had been repeatedly drawn to the steady deterioration of field drains during the past generation by many spokesmen of the agricultural industry and by its investigators. The position in 1937 was outlined in an article by the author, reprinted here from *Agricultural Progress* of that year; it should be read in the light of current events.

**THE PRESENT CONDITION OF DRAINAGE AS A LIMITING  
 FACTOR IN PRODUCTIVITY<sup>1</sup>**

That the year 1937 has been a most trying season for farming in England is reflected in all crop reports. Adverse weather and soil conditions during the first half of the year have dominated the situation, particularly in heavy-land areas. These conditions came as a climax to several years of abnormal weather conditions, three drought years being followed by two which were excessively wet. Indeed, the summer of 1936 saw heavy-land drains running vigorously in mid-July. There were no drying periods except in August, so that the land was in poor condition to face the following wet winter. A total of 4 in. of rain sufficed to saturate land which in 1934 had been able to absorb 11 in. without drains running.

<sup>1</sup> Paper read at Oxford, July 1937.

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In light open soils, abnormal and prolonged rises in the level of the water table have been general, with the result that flooded areas have been more widespread and extensive ponds have appeared and persisted in places where standing water has not been seen within living memory.

While it would be fatuous to pretend that all the adverse effects of this wet season might have been avoided by better field drainage, there is little doubt that the drainage properties and conditions of the soil have been decisive factors in the result. The areas to suffer were those where poor drainage conditions prevail. On this class of land field drainage has been neglected for two generations and its area steadily increases.

*Drainage in England and Wales.* In considering the position with regard to drainage in England and Wales as a whole, and looking back over the past hundred years, there is no doubt that field drainage went ahead in a vigorous fashion during 1840–80. Following the Public Monies Drainage Act of 1847, some £9,000,000 was spent on land drainage, about half being advanced by the Government, and subsequently repaid. In 1880, before a Royal Commission on Agriculture, the drainage engineer, Bailey Denton, in his evidence, estimated that 3,000,000 acres had been under-drained during the preceding generation, but in spite of this he put the area of wet land still in need of attention at 15,000,000 acres, rather more than half the total agricultural area of the country. The former figure was based on information provided by tile manufacturers, the latter on the geological map of the country.

No field-to-field survey has ever been carried out, but there do exist pointers on the present-day position. Prior to the passing of the Land Drainage Act of 1930 it was stated (*Journal of the Ministry of Agriculture*, 1927) on official authority that there were 1,250,000 acres urgently needing drainage, due to liability to flooding by reason of defective arterial channels, and 500,000 acres capable of improvement by small drainage schemes, i.e. the cleansing of small streams and main ditches. These figures can, however, only refer to low-lying land, immediately affected by arterial drainage. The statement stressed the fact that it took no account of land capable of improvement merely by under-drainage. It is obvious that the area of such land must be substantial.

Some years ago the National Farmers' Union made an attempt to assess the position by circularising a simple questionnaire to its

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county branches, whose replies indicated that the total area of land capable of improvement by field drainage amounted to about 7,000,000 acres, or one-quarter of the whole. Some branches, as for instance in Beds., Herts., East Sussex, Leicester, Northants. and Worcester, put their estimates at 50–80 per cent of the total; others in Hunts., Cambs., Essex, Bucks., Middlesex, Wilts., Isle of Wight and East Yorks. at 30–50 per cent. The biggest figures were associated with heavy soils and low-lying river valleys.

Data derived from a closer examination of the problem were recorded by R. McG. Carslaw in 1931. He dealt with some 170,000 acres, comprising 1,000 individual farms, spread roughly equally over heavy land, loams, and light soils in the eastern counties. His summary is as under:

Area in need of drainage		Area drained in previous	
		5 years	
Heavy land	26 per cent	8 per cent	
Loams	13 „	4·5 „	
Light land	3 „	0·25 „	
Whole area	14 „	5 „	

The results of a field-to-field survey appear in a report of Hunter Smith and Williams in 1932 on the Barnet and District Grassland Competition. Primarily concerned with heavy London Clay soils, carrying much poor grassland, the report is nevertheless a telling commentary on the significance of field drainage. Without recounting the findings in detail, it may be sufficient to say that the judges found that 51 per cent of 5,800 acres, in 32 holdings, suffered from defective drainage. In a similar fashion, the Herts. county authorities have arrived at figures of 5–12 per cent on the light soils in the middle of the county and 16 per cent on the Boulder Clay in the north.

*Government Assistance for Drainage.* One of the most significant and cheering features of the new national policy for agriculture is that at last attention is being directed to the soil itself and to the fundamental factors of fertility, as witness the amounts to be spent on lime, slag and drainage. The national contribution promised for the last-named is £140,000, described by Mr Lloyd George as ‘preposterous’ in the face of his estimate of 1,000,000 acres of land rotting and souring through lack of drainage. Though the contribution is small, it is to be welcomed as a recognition of the importance of drainage. The Minister rightly says that in drainage

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we must work from the sea up to the hill and only when the main rivers are got into good order can the Government proceed up the hill and do something to help them. This view is presumably based partly on the danger of flooding in the lower reaches and the possible increased risks consequent on improved field drainage.

It is a specious argument that the better the land is drained the easier it is for surplus water to get away and therefore the greater the risk of flooding lower down. But the problem is not so easy as this. It certainly cannot be maintained that the big floods in various quarters in the last generation were due to the improvement of field drainage in the country as a whole. Some of the worst localised floods occur in towns and urban districts where the surface of the earth has been rendered absolutely impermeable by roofs, pavements and roads, and run-off as a result is instantaneous. On a former occasion evidence has been produced of the effect of increased permeability in soils in reducing the peak of field-drain run-off and in spreading out the run-off over a longer period. There are very strong grounds for the opinion that improved field drainage will lessen the risk of dangerous floods in main channels. In any case the importance of arterial channels should not be made an argument for inaction on the land behind them. Arterial drainage can give direct benefit only to a fraction of our ill-drained land.

To return to this £140,000. This, of course, is not all that is being done. As the Minister has pointed out, the Catchment Boards, since their inception in 1930, have accomplished a great deal, and some £6,000,000 has been spent on the main rivers. The £140,000 is a recognition of the next step, to further the work of the small internal drainage boards, county councils, and rural district councils, struggling with the maintenance of subsidiary streams of less importance, but nevertheless public drains vital to agricultural land.

As an instance of this, one might quote the case of the Chesterton Rural District Council, which functions as a drainage authority around the town of Cambridge. Its area covers 112,000 acres with a rateable value of £108,000. Out of the rates the equivalent of 8d., or round about £3,000 per annum, is spent on drainage. Twenty men and a foreman are constantly employed in maintaining some 200 miles of minor streams and ditches. This burden on the locality is by no means a light one, yet it is admitted that much more ought to be done than is in actual fact. Although cases

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such as this are not of common occurrence, it is obvious that there is still a mass of work to be done between the main drains of the Catchment Boards and the field drains of the farmer.

*Field Drains.* And this is where, for the present, Government assistance ends, although we are assured that those responsible are aware of what still lies untouched higher up the hill. There still remain to be considered the field ditches and the actual land drains. Both these concern the farmer immediately, and for most farmers they are of much more vital interest than arterial drainage works. Unfortunately, for over a generation now, there has been an increasing tendency from various causes to neglect them. Wherever agricultural opinion expresses itself on the drainage question, the cleansing of ditches is invariably stressed. There can be no doubt that the neglect of ditches has led more than anything else to the loss of much excellent tile-drainage work of last century. To omit to carry out even the annual clearance of weeds will result in many outfalls being submerged the following winter when the drains begin to run. Further neglect causes accumulations of silt, the blocking of the drains and the water-logging of the land they are meant to serve.

Even to-day, thorough cleaning of ditches would restore many such old drains to efficient service again, particularly in light-land areas. The same is not necessarily true in heavy land, however, as will be seen. Instances are not uncommon in light-land areas where the removal of anything up to 3 ft. of silt and other accumulations have revealed extensive systems of tile drainage, in good order, which have functioned effectively as soon as their outfalls were uncovered.

The different conditions in heavy land may be illustrated by the case of an area of typical Gault Clay taken over by the Cambridge University Farm in 1930. The ground is all low-lying, but not flat, most fields having a moderate fall. It is all dependent on a small stream maintained by the local authority. The area was in a semi-derelict state and was immediately surveyed with a view to drainage. The ditches at that date were in poor condition, but the surveyor found 12 outfalls in a length of 900 yd., some running, some not. The whole area was then mole drained, tile mains and new outfalls were provided, and the ditches were cleaned. The same ditches were cleaned again and deepened by 12–24 in. last spring. The operation revealed 35 separate outfalls.

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This particular cleansing was carried out on a total of 1,232 yd. of ditch, disclosing altogether 55 outfalls, of which only 3 belong to the present drainage system. They occurred at varying depths between 27 and 46 in., but mostly at about 36 in. The type and condition of the outfalls is indicated below:

Diameter	Total number	Silted or otherwise choked	Clear
Less than 2 in.	20	18	2
2-3 „	15	12	3
3-4 „	5	3	2
4-5 „	13	0	13
5-7 „	2	0	2

The facts of this particular case have an important bearing on the whole question of drainage of heavy land. Over what period these many drains have been accumulating is uncertain, but they obviously represent many separate efforts to solve the problem. None of them has achieved more than a temporary mitigation of the evil due to the nature of the clay itself. Clays are impermeable and it is only the surface layer of soil which is endowed with any degree of permeability, which, alas, diminishes rapidly with depth.

One of the factors producing this permeability is seasonal weather changes, and it is common experience that heavy land drains more freely after a drougthy summer than after a moist one. So this natural permeability is primarily a seasonal variant. The different methods of field drainage first of all provide a graded system of channels by which the percolating water can escape, but they also produce a greatly enhanced permeability in the immediate vicinity of these channels due to the inevitable disturbance and opening of the soil which is caused, whether it be by the drainer's spade or by the passage of the mole plough. The value of the original permeability will continue to wax and wane according to the season, but the artificially induced permeability above the channels will steadily decrease.

In drainage work, the tendency is to expect drains to last a long time. Something approaching permanency has been achieved, certainly, in the case of light land, but the heavier the land the less durable has any form of drains proved to be. The same attitude is frequently encountered with respect to mole draining. To some it is a matter of pride that their mole drains last 10, 15 or 20 years.



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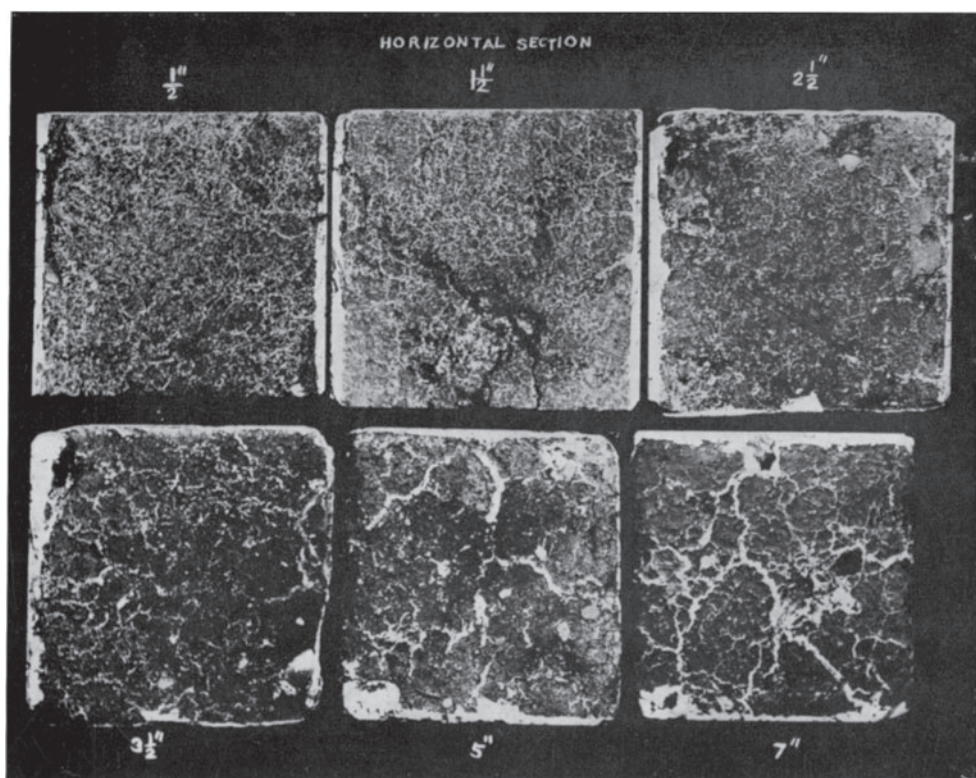


Plate I *a*. Winter flooding. (*See p. 2.*)



Plate I *b*. Some of East Anglia's derelict clay land (arable), in 1939. (*See p. 3.*)

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**Plate II.** Horizontal sections of a block of clay soil from old grassland, in its natural condition, after impregnating it and fixing it with a wax-naphthalene mixture. The sections were 6 in. x 6 in. (*See p. 26.*)



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The channels certainly may still be demonstrable, and the outfalls discharge, but the important point to consider is whether the drains are as effective as they were in the first half-dozen years of their life. If not, then the operation should be repeated as soon as circumstances allow.

Drainage of heavy land should be regarded as a cultivation rather than a permanent improvement. There are still heavy-land farmers who are prepared to indulge in steam cultivations at 25s. to 30s. per acre, and within the last 6 years there has been no lack of experimenters in gyrotilling at 30s. per acre. In these days it is possible to mole drain and provide semi-permanent tiled mains with sound outfalls at 40s. per acre. Moreover, it is possible to re-draw the moles over the same mains at 14s. per acre. If the operation is only effective for 5 years—and it must frequently be effective for more—the cost of the operation surely is such as to justify its wider and more frequent employment.

The position in the country as a whole to-day seems to be that the neglect of ditch cleaning has been responsible for the deterioration of field-drainage conditions in light, medium and heavy land alike. The heavier classes of land, in addition, suffer from their own peculiar drawbacks. Periodical drainage operations have been abandoned, so that the innate impermeability of heavy land has become more and more a limiting factor. Any means of tackling these two problems should be explored. At the moment, in England, the State demurs at giving assistance in drainage beyond the spheres of local drainage authorities, but in Scotland, where arterial drainage is less necessary, the farmer or landowner does receive assistance in field drainage.

It is not so many years ago that a Government scheme was operated successfully and effectively by certain county councils, for the restoration of many miles of the more important ditches. In 1929, for the mitigation of unemployment, the Ministry of Agriculture offered to contribute from 33 to 50 per cent of the cost of tile-drainage operations to landowners willing to undertake such schemes. By July 1930, expenditure of £44,000 had been approved in 421 schemes throughout the country. As things stand, even ditching is an expense of serious dimensions, and remains essentially a task for manual labour. Annual cleaning costs about 2s. per chain, but the thorough removal of silt and falls every 5 or 6 years may cost as much as 7s. 6d. per chain.

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The practice of surface draining might well receive more attention. The use of the common plough, as and when it is needed, is a cheap and efficient way of dealing with surface water.

In East Suffolk, on many soils, it is found to be the only satisfactory method. For the field drainage of most heavy land the mole plough remains the best available means. Present-day tractor performance has reduced the cost of moling to such an extent that it can and should be regarded as a routine operation, and there are good grounds for envisaging its possibilities as a means of renovating existing drainage systems over a wider range of soil conditions than those in which it excels of itself.

Such was the picture as it appeared in 1937. Once the storm had broken, however, it was not long before the position changed, and that rapidly. One measure followed another in quick succession, until a stage was reached at which practically all drainage work qualified for a 50 per cent grant-in-aid, and money could be borrowed for the other 50 per cent on reasonable terms. On January 1st, 1940, the Minister of Agriculture announced his readiness to make grants to owners and occupiers of agricultural land in aid of the cost of approved works of mole drainage, up to 50 per cent of the actual cost of the work, including piped outlets where it was necessary to provide them, with a maximum contribution, however, of £1 per acre. It was made a condition of approval for grant, that the watercourses or ditches which were to receive the output of the mole drains should be properly cleared beforehand—indeed, before approval could be given—with the dual object of ensuring the proper functioning of the proposed mole-drain systems and of uncovering and freeing the outfalls of any former drainage systems, many of which are capable of functioning once more, either on their own or as revived by the use of the mole plough above them. Under this scheme the War Agricultural Executive Committees in the heavy arable-land counties soon got busy and mole draining became a common sight throughout the countryside.

In July 1940 further measures were promulgated to encourage and assist field-drainage work. Where ditches had got into a bad state through years of neglect it was decided to contribute 50 per cent of the cost of thoroughly re-conditioning them, but work of the kind which normally would be carried out every year, such as