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SOIL and water

THE JOURNAL ON **SOIL** CONDITION AND FERTILITY

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THE MAGAZINE ON SOIL CONDITION AND FERTILITY

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SOIL AND WATER is the Journal of the Soil and Water Management Association. The views expressed in this publication are those of the contributors. The publishers disclaim any responsibility whatsoever arising from the use of the information contributed. The Association is a charity whose main objective is to promote the highest standards in the care of the soil: Britain's basic asset.

The editor welcomes offers of editorial material and advertising requests; details an application. Copy date for the July issue is mid-May. Except where used far promotional purposes, Soil and Water is available only to members of SaWMA. The annual membership subscription is £11.50 including VAT.

COMMENT

"Under New Management"

SOIL and Water again has an Editor. I hope I shall prove a worthy successor to Mike Saull whose able hand in the early 1980's greatly enhanced the readability and readership of our journal. I welcome the challenge and I look forward to serving you, the members and readers, and to producing for you a journal of high quality and interesting content.

Soil and Water clearly has an important part to play as an independent journal offering farmers unbiased reports on the latest practices.

For example, as regards farm drainage, two points made by drainage contractors at the Stratford Workshop are, firstly, that the farmer has to be convinced of the benefits he will derive from a drainage installation and, secondly, the farmer has often to assess the relative merits of possible alternative plans and schemes being put forward by competing contractors.

Soil and Water aims to provide the information to help the right decisions to be made.

Also at the Drainage Workshop we received the first public announcement of the formation of the Land Drainage Contractors Association. We welcome the formation of this new association, and look forward to working with them. The LDCA is to be essentially a trade association to further the commercial interests of drainage contractors. Among its activities, however, the plan to re-establish meaningful statistics on drainage installations will be of benefit to all concerned with following, or guiding the progress of the industry.

A brief word about the future. I am already pleased to take account of points made to us in recent months by members as to items of special interest to them. The July issue will be concerned particularly with tillage, straw disposal and land restoration; whilst the October issue will be on the themes of pollution and soil erosion. As usual, of course, we shall continue to provide in these issues, information on other current topics as it becomes available.

The 1985/86 programme for SaWMA has now been finalised and more details are presented on page 22. Members are invited to note particularly the date of our Pollution Conference.

As editor, I shall look forward to meeting you, the members, at these various events and I shall be particularly keen to hear your views directly on how we can hest serve your interests.

Front Cover–The River Wylye, Wiltshire

Soil and Water is instituting a system whereby space, at the discretion of the Editor. can bedonated by members and advertisers as an alternative to straight advertising. it is felt that this will make the magazine more attractive and it is hoped that this opportunity will be taken up. This issue's front cover, donated by Dr A N Ede, shows the River Wylye in Wiltshire.

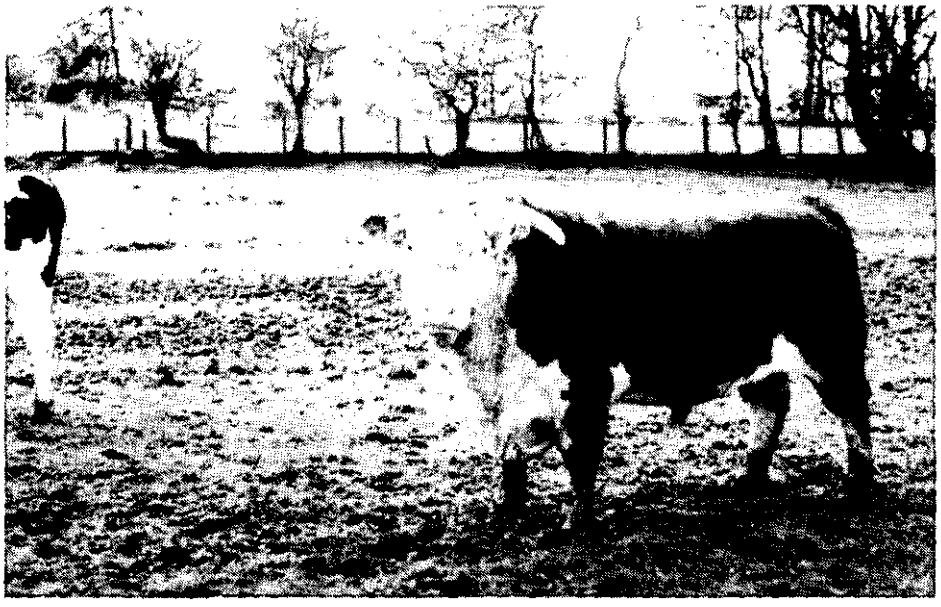
A note about the Wylye project is on page 11.

CONTENTS

Videos: Films

"Down to Earth"

A new video programme (VHS) about land drainage is available on free loan to farmers from the British Clayware Land Drainage Industry, Federation House. Stoke-on-Trent ST4 2TS. Entitled "Down to Earth': the programme deals with advances in tile handling systems in recent years and with drainage scheme design services offered by member companies.



Grassland needs drainage is the message in this "still" from a new video programme produced by British Clayware

"Bluebell Walk"

Another free loan film is "Bluebell Walk" produced by the N.F.U. Every year farmer John McCatchan opens his "Bluebell Walk" to the public who come to enjoy the carpet of wildflowers. They also become acquainted with the working life of his farm and see some of the many excellent conservation projects he has undertaken. The film (17 minutes. Catal No.320-2410-1) is available on 16mm from Guild Sponsor Film Library, Guild House, Peterborough PE2 9PZ.

Reading matter on sewage sludge

Particularly useful for the new-comer to the world of sewage sludge and its application on agricultural land. is a recently published "Directory of Equipment" produced by the Water Research Centre, Medmenham, Bucks, in close consultation with Silsoe College and the N.I.A.E.

The directory describes equipment under the general headings of road tankers, field tankers, tractor drawn tankers, muck spreaders, sub-surface injection equipment and irrigation equipment, with a special review of spreader devices and tyres now available.

Each section gives recommendations on the specifications for the various pieces of equipment and then goes on to say where they can be obtained. A comprehensive list of manufacturers and suppliers is indexed.

Also available from the Water Research Centre is their booklet "The agricultural value of sewage sludge—A farmer's guide!'

This small booklet first describes the various kinds of sludge available, covering liquid undigested sludge, liquid digested sludge and cake sludge. It then looks further into the available nutrients supplied and continues by suggesting the best uses for each type.

The booklet is a valuable introduction to the use of sludge, but as the authors state. farmers should seek advice from the MAFF and their local Water Authority before taking action on their own land.

High technology and trench diggers

A turbocharged Volvo diesel, a computer and a laser beam are key components in a moden 7/12 trenchdigger, manufactured by John Mastenbroek Ltd, Boston, Lincs, for special purpose work on a fruit and vegetable farm in Saudi Arabia.

Apart from trenching at rates of up to 15m per minute, say the makers, the digger can maintain an accuracy of 0.1 per cent in depth, due to the laser/computer combination.

The 7/12 trench digger was selected to assist in steam sterilisation system pipe laying partly because the work was carried out in greenhouses, where a low level of noxious exhaust fumes, output and quiet running were important.

Other Mastenbroek machines, used in European. markets are also powered by Volvo diesels. A Model 36/30 Trench Digger, for example, is currently working in France on wider and deeper trenching projects.

Water Meadows

With some reference to our article this issue on Border Dyke Irrigation, we note that the Countryside Commission is funding a major study of river valleys in England and Wales. It will examine the changing character of river landscapes since the war and assess the effects of land drainage and flood control schemes.

An article on the history and management of water meadows appears in the Winter/Spring issue of Natural World, the magazine of the Royal Society for Nature Conservation.

New Professor of Soil Science

The University of Newcastle-upon-Tyne announce the appointment, from January 1986, of Professor J K Syers to the Chair of Soil Science in the Faculty of Agriculture. Professor Syers graduated with Honours in Soil Science at Durham in 1960. He is currently Professor and Head of the Department of Soil Science at Massey University, New Zealand.

Atmospheric sulphur fails to meet crop requirements

An international seminar on Sulphur in Agriculture, co-sponsored by the Asociacon de Mineros de Huelva and the Sulphur Institute, was held in Madrid in September last year.

Papers were presented on different aspects of the subject. M D Murphy speaking on sulphur deficiency on forage crops and pastures in Ireland acknowledged that this deficiency is a fairly new phenomenon arising particularly from a change to high analysis compound fertilisers. Unlike several European countries where depositions of sulphur from the atmosphere are sufficient to meet crop requirements, the low level of emissions from industrial sources in Ireland creates problems of inadequate soil sulphur during the growing season.

A similar problem was recognised by N M Scotr, Macauley Institute for Soil Research, who stated that work done at the Institute had contradicted the earlier belief that industrial emissions were high enough to provide adequate sulphur for most crops. Many soils in the UK are seen to have low levels of plant available sulphur.

Soil survey funds slashed

CATASTROPHIC is the view of the Soil Survey of England and Wales on the decision of the Minister of Agriculture to reduce funding by 50 per cent for the year 1986/7 and with no commitment as to any level of funding beyond that.

The Ministry has recognised the benefit of the broad scale national soil map already produced by the SSEW but appears now to have decided that the further work, to produce maps giving information at field level (1:50,000 scale) are not needed.

The large reduction in funding and the very short time scale of its implementation are creating great difficulties for SSEW forward planning. Other fund sources are urgently being explored, such as the Department of Education and Science, the Department of the Environment and other Government agencies.

Computer controlled flood control system

Essex Telecommunications Ltd announce the first radio and computer controlled land drainage and flood control system in Europe, and probably the world, is now in operation in the Fens. More than 80,000 acres of Fenland are being given a system in which instant action is guaranteed as soon as there is danger of flooding. The previous mechanical system with control by regular manual inspection was prone to failure in bad weather, and often resulted in an act-after-event correction. The new system, using set parameters, forecasts action to be taken—and carries it out before trouble happens.

Irrigation—mismatch between machine application and soil infiltration rates

The new Zealand Agricultural Engineering Institute reports a study started in late 1983 by the Soil and Water team investigating the application performance of travelling irrigators. The project is supported by the National Water and Soil Conservation Organisation.

It is known that some irrigators can apply water at faster rates than the soil can absorb. This results in surface redistribution due to run-off so that too little ends up on the high spots and too much in low areas.

Field tests on four different machines have been completed. Another six or seven are still to be tested.

The eventual results, together with information on the water absorbing capacities of various soil types will be very useful for farmers "shopping around" for irrigation plant.

An essential piece of equipment for this study is a time/intensity gauge to measure the volume of water deposited over a given time. Many irrigators throw drenching bursts of water onto the soil rather than an even application. This new gauge allows any such uneven performance to be measured and recorded.

Electrode Troubleshooting

Corning Limited, Halsread, Essex CO9 2DX offer free on request a comprehensive and fully illustrated "Guide to Electronic Troubleshooting". This new guide deals with both pH and ion selective electrode systems and provides a logical check list of tests to perform in order to identify and correct a wide variety of problems.

Also available free from Corning are three new wallcharts dealing with ion selective electrodes in Foodstuffs, Water and Agriculture.

Wavin pipe in restoration project

Several hundred metres of Wavin pipe are being used as part of an extensive project to restore a 200 year old canal in Worcestershire.

The Droitwich Canal Trust has recently received a donation of WavinCoil—a flexible uPVC pipe—from Wavin Industrial Products. The pipes are to help alleviate serious water-logging of an area of surrounding land—a problem caused by leakages in the canal bed.

The pipes have been laid in deep trenches at the foot of an embankmenl to collect and drain the escaping water into the nearby River Salwarpe. Insufficient funds and technical difficulties prevent the canal from being completely drained and re-built in order to halt the embankment problem. WavinCoil, therefore, presents an ideal alternative by preventing the leaking water from flooding the adjacent land.

Wavin pipe in *restoration project*

The pipes are being used along another section of the canal to the west, this time to drain water-logged soil. Dredging operations are producing large quantities of wet soil which need to be dried out efficiently before levelling out next summer for return to agricultural use. The excess water which is drained off by laying the pipes before the dredgings are tipped leaves behind it one of the best and most fertile soils.

WavinCoil is a continuous corrugated and perforated uPVC pipe designed specifically for the drainage of agricultural land.

Kaskad D110/300 Hose reel irrigator

Irrigation systems

Kaskad Irrigation Ltd, Ripon, North Yorkshire, have lately moved into new offices and are ready to meet increased demand for their products in 1985.

The company originally supplied equipment imported from Sweden but, since 1979, have been offering re-designed equipment built at Ripon.

Kaskad offers hose-reel irrigators together with ancillary equipment and a comprehensive service from their technical department in all watering engineering fields, irrigation schemes, surface and underground mains supply.

Farmland – the vanishing hedge

No – not another complaint against the activities of our arable farmers but the heading to the Lloyds Bank Economic Bulletin for December 1984! The Bulletin recalls that five years ago they were calling farmland an inflation hedge. Today, although values have multiplied 40 times in the last 40 years (an average of 2.6 per cent a year above inflation rate), the picture for the last ten years is one of a fall in value in real terms of 35 per cent. Farmland can no longer be regarded as an inflation hedge.

The effect of Agri-SC on Iowa soils

The Iowa State University have carried out work under Prof Stewart W Melvin to evaluate a soil conditioner, 'Agri-SC', marketed by Four Star Agricultural Services and used extensively in the Midwest.

Increases were noted in hydraulic conductivity of soils tested (Webster and Nicollet soils). Soil penetration resistance was reduced and there was an increase in intake rate with the use of the soil conditioner.

Artificially produced soil conditioners which can aid in soil and water management can have many benefits. Improved hydraulic conductivity values will aid in more rapid and efficient soil drainage. Lower soil shearing strength will result in lower machine-soil friction which will, in turn, improve workability of soils and decrease draft requirements for tillage implements.

Move by Dow Chemical

The Laboratories at Letcombe Manor, being vacated at the end of March by the Agricultural Research Council will not remain empty. The Dow Chemical company has announced plans to move in with its European Agricultural Research and Development facility. The move is seen as a response to the further growth potential of Agricultural chemicals both in the European region and globally.

RESEARCH

Readers who looked for the conrinuation on page 11 of the January issue Research column will be interested to read the item as follows:

Soil and crop responses to wheeling

Exoeriments to measure the cumulative effects of wheeling by agricultural machinery in successive seasons on soil properties and crop growth were in the early stages. On a clav soil, wheeling by combine harvester and a tractor repeated for a second season on a wet soil impaired growth of winter oats and lowered yield by 27 per cent compared with unwheeled land.

In contrast. in the first vear of an experiment on a silt loam soil, four passes of a medium-sized tractor caused differences in soil conditions and restricted early root growth but grain yields of winter wheat were little affected (9.1 t/ha compared with 9.3 t/ha on unwheeled land).

V12-4

The Hanslope Series

Soil assessment – M G Jarvis, Soil Survey of England and Wales

LARGE areas of the east Midlands and East Anglia are covered by chalky till (Chalky Boulder Clay) in which clayey Hanslope soils are developed. They are the dominant soils over 3,634 km' of land (2.4 per cent of England and Wales) and are associated with other soils over a further 2,340km^2. Their distribution is shown on Sheets 3, 4 and 6 of the National Soil Map. Hanslope topsoils are slightly stoney clays or heavy clay loams over brown, slightly mottled, well structured clay subsoils containing chalk stones. The amounts of grey mottling and chalk stones increase with depth so that below 1m the soil is often a grey very chalky clay. The following is a brief profile description.

cm	
0-25 Ap	Dark greyish brown, slightly stony clay or clay loam; slightly calcareous.
25-60 Bw(g)	Light olive brown, slightly mottled, slightly stony clay; moderate medium subangular blocky structure; calcareous.
60-100 BCg	Yellowish brown, mottled, slightly to moderately stony clay; moderate medium angular blocky or prismatic structure; calcareous.

The deep clay subsoils are only slowly permeable and the upper parts of the profile are periodically waterlogged in the winter months. The topsoils are also water retentive and they can only be worked satisfactorily over a narrow range of moisture content so cultivations need to be timely. But the heaviness of these soils is offset to some extent by their chalky nature and they weather to a good tilth. In addition, the structure of the upper subsoils is stable and these layers are moderately permeable. Consequently much of the excess water can be removed by drainage and Hanslope soils are then moderately easy to work and are valued highly for cereal growing. Drains are usually placed at 75-90cm depth and spaced 40-80m apart, the wider spacing being satisfactory on sloping ground or in dry districts. Permeable backfill is essential. Mole channels drawn in the clay have proved to be stable and long lasting. Occasional subsoiling may be beneficial especially where untimely cultivations have created pans just below plough depth.

Available for land work

The number of days on which the land can be cultivated without causing damage to the soil structure varies with rainfall and the length of time the soil is at field capacity. This is illustrated by Figure 1 which is taken from the Soil Survey publication Soils and their use in *Eastern* England (Hodge et *al* 1984), where there is a full explanation of the models used to derive the data on which the diagram is based. In the relatively dry district west of Cambridge, represented by the village of Caldecote, there are ample opportunities for tillage in average autumns continuing into December. In spring the period is much shorter and it is unwise to get onto the land much before April. In wet years the number of days is correspondingly less. By contrast, cultivation of Hanslope soils around Walgrave in Northamptonshire, is much more restricted. In wet seasons there may be few occasions after mid-October when landwork can be safely undertaken, and in spring none at all.

Most suitable crops

With the constraints on spring landwork, Hanslope soils .are best suited to winter cereals and oilseed rape. Incorporation of crop residues is likely to be fairly difficult in these heavy soils but if burning is possible and with good management, the yields of direct drilled winter cereals are likely to be similar to those of crops grown by conventional cultivation methods. Root crops are less successful and autumn harvesting can be difficult especially in wet seasons although in the dry district between Bedford and Cambridge some potatoes are grown together with brassicas, beans and peas. Grassland production is seriously limited in summer by drought and in winter there is a significant risk of poaching, particularly in the Midlands. Because there are usually large amounts of chalk in Hanslope subsoils, acidity problems are uncommon and dressings of lime not required. Potassium and magnesium status is generally good and trace element problems are rarely reported.

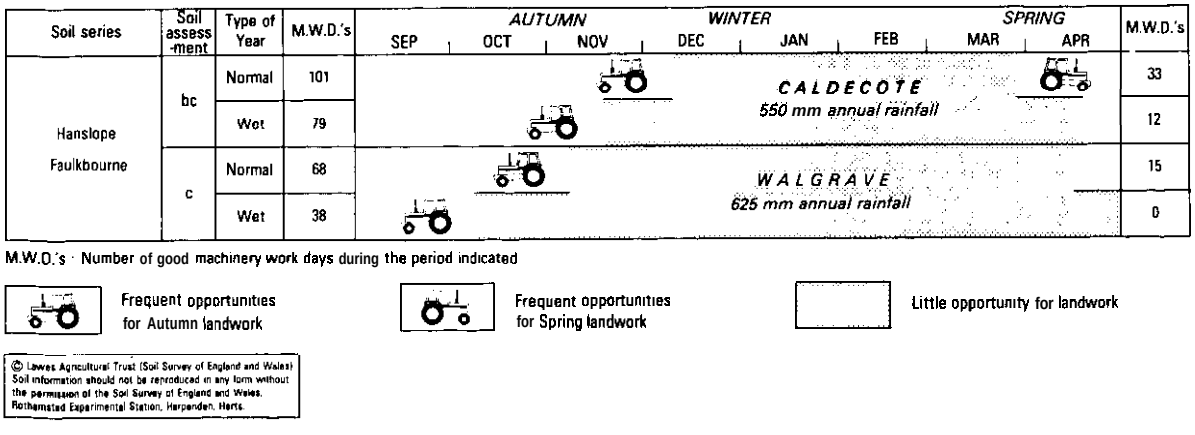
Suitable trees for farm woodlands include ash, oak, cherry, alder, poplar, beech and sycamore. Corsican pine can also be grown but conifers are susceptible to chlorosis and there is likely to be severe weed competition. Ground conditions are wet in winter and may hinder forestry operations.

Reference

HODGE, C A H, BURTON, R G O, CORBETT, W M, EVANS, R and SEALE, R S (1984). Soils and their use in Eastern England. Bull. Soil Surv. Gt Br.

This publication and the National Soil Map are available from the Soil Survey of England and Wales, Rothamsted Experimental Station, Harpenden, Herts AL5 2JQ.

Fig 1. The effects *of soil* and *climate* on *landwork*



Managing a Profitable Drainage Contractor's

The Drainage Workshop, Stratford-upon-Avon – January 1985 –

THIS Drainage Workshop was the third such event organised by SaWMA. Working this year together with the LDCA (the new Land Drainage Contractors Association, formed specially to cover the interests of drainage contractors), the organisers had put together a programme of papers of current and vital interest to the industry.

The backdrop to the Workshop this year was the decline in recent years in the number of drainage installation projects. This decline, coupled now with the reduction in grant aid to drainage projects, means that many drainage contractors are now particularly concerned as to how to maintain the volume of business and how to keep costs down whilst still offering a high standard of quality and service.

The Workshop organisers had three concerns very much in mind and the theme this year was "Planning for Profit and Aiming for Quality".

A total of over 170 delegates attended the Workshop and all the speakers found themselves supported by a large and attentive audience. Besides the range of UK interests represented–farmers and contractors, consultants, manufacturers of materials and machines, research and development engineers, soil scientists–we were also pleased to welcome several overseas visitors–from France, Holland, Eire, Canada and the USA.

Besides the considerable time and effort put into organising this event by SaWMA and LDCA the organisers were also pleased to acknowledge (with names listed in the programme) the support and generous sponsorship of a large number of manufacturers and other establishments towards the running costs and the hospitality arrangements of the workshop.

The new Land Drainage Contractors Association

Delegates to the Workshop assembled on the Tuesday afternoon and were soon hard at work in the Conference Hall. Dr Ede conveyed a message of good wishes from the Chairman of SaWMA, Mr John Roddan, and Mr Fry spoke briefly about the setting up of the new Land Drainage Contractors Association–now quite separate from the NAAC. Mr Fry stressed that the LDCA is , unashamediy a contractors associationcommitted to the well being and commercial interests of its members. Already, according to Mr Fry, the membership of the LDCA represents over half the acreage of agricultural land drained annually in the UK–and that, less than two weeks after the new Association had been formally instituted.

Introductions completed, delegates were soon prompted into detailed discussion by Dr Brian Trafford, Deputy Director of the Ministry of Agriculture's Land and Water Service. He reviewed the present position of UK farm drainage and the progress that had been made in the last 100 years.

Dr Trafford pointed out that with the termination of requirement for land drainage schemes to be approved for grant aid (in 1980), there ceased to be any basis for collecting accurate figures on annual land drainage installations. The peak of drainage activity had been in the late 1970's, with up to 120,000 ha. being drained annually, (Fig.1).

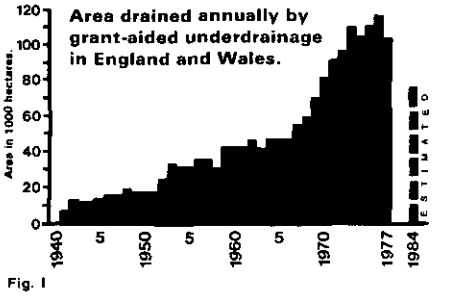


Fig. 1

Today, Dr Trafford assessed that the present annual rate is around 80,000 ha. and there may still be some further decline on this figure. However, we should see this stabilising at around 60,000-70,000 ha. per year.

A notable feature of the drainage installations over the last thirty years has been the growth in trenchless schemes at the ex-Dense of the continuous trencher and the backacter. Dr Trafford estimated that trenchless schemes now account for 75 per cent of current farm drainage.

In the last thirty years, field drainage costs have shown a sharp fall in constant money terms (Fig.2) and the relative costs of field drainage to land value has moved dramatically in favour of economic drainage installation (Fig.3). From a ratio of 1 to 2 in 1950, the relationship is now that a field drainage installation only costs one sixth of the value of the land.

Field drainage costs in constant money terms.

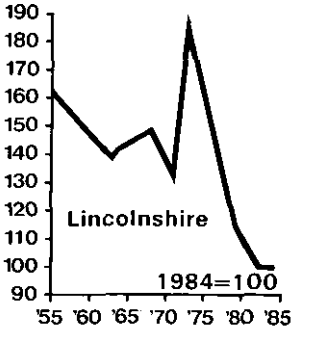


Fig. 2

50,000 ha. per year base

For the future. Dr Trafford sees the efficient farmer still surviving, though–with prospect of still increasing crop yields not offset by comparable cash returns–he will find it progressively more difficult to make money. He will concentrate production on the most easily worked land–the land already with good drainage. However, half our arable land is not usable if it is not kept properly drained and there must be a 'base' figure of 50,000 ha. of earlier drainage needing renewal every year.

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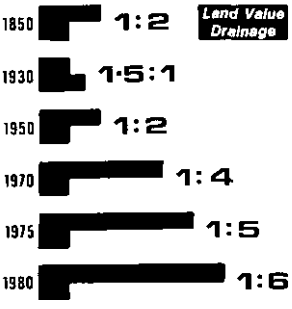
Business

Geoff Baldwin reports

Speaking from the floor, Dr Ede supported this view that as long as production is required at present levels then drainage too will be required at present levels. He stressed, however, that Britain must not be parochial in her approach to farm production. With so much of the world short of food it would be a nonsense to cut back on production in a country such as the UK where crops can be grown so efficiently. We must strive to influence world opinion so that British crop production is increased – not decreased.

Ratio of land value to drainage cost.



Mr Paul Wiles (J W Vickers and Sons) asked what support might be forthcoming from the Ministry in the future. Dr Trafford felt such support will continue to diminish – farmers will be expected more and more to makr their own assessments of requirements. To this end he was particularly pleased to see the formation of the LDCA specifically devoted to the interests of land drainage. Mr Brian Bayley, Chairman of the new LDCA, spoke of how desperately short of information the farm contractor, and the farmer, have become as to what amount of drainage is being carried out and by what methods. It is one of the aims of LDCA to collect such data and disseminate it for the benefit of its members.

Marketing, Cost Control and Management

With these forecasts of continiied lower levels of activity, it was in a mood of some keen concern that delegates assembled the following morning for the first full session of the Conference and the chance to hear experts' views on marketing, cost control and business management.

Mr Ian Crawford, Director of Marketing Services at Silsoe College, gave some useful leads. He began by postulating that when growth in a business seems to have come to an end, it is rarely because the market is saturated – it is much more likely that the management is short sighted; that the management has not recognised the wider business they are in. As an example of narrow-minded management he cited British Rail, who had regarded themselves as only in the railway business rather than in the transportation business.

How then, Mr Crawford asked, should a business be defined? Is the definition based around the equipment presently owned or the skills and expertise possessed by the employees? Alternatively, is the business defined in terms of the set of benefits which thecompany is able to meet? Is the business organised in such a way that, if the means by which the customers' needs are presently met alter, then is it able to respond to the new opportunities?

It is important to view the business in terms of the benefits it is capable of providing; not just the products or services it currently offers. Think in broad terms. Mr Crawford urged the delegates, about your business capabilities.

Once you have determined what business you are in then you can consider how best to extend your activities and reach your customers.

Recognise also the difference between promotion and advertising. Promotion is normally employed to achieve some short term objective, say, for example, to stimulate drainage work during seasons of the year when demand is traditionally low. The contractor may, for example, offer special rates for the work if it is commissioned by the farmer during a specified period.

Advertising, in contrast, is generally recognised as having an effect long after the specific ad or advertising campaign has itself ended. The objectives of advertising are longer term, eg. building up customer loyalty, keeping the company's name in the

customer's mind, persuading the customers of the superiority of the product or service.

Advertising–objectives

All advertisements should carry a unique selling proposition. Keep them simple and to the point. The only effective way of ensuring that only the essential information is carried is to have an explicit statement of the objective of the advertisement. Therefore, there is needed a single selling Proposition which is to stand out above all else in the advert.

Advertising objectives should be stated in terms of expected results, not in terms of activities. For example, "to persuade 20 farmers to undertake trenchless drainage work through standing crop" or "to increase Winter turnover by 10 per cent on last years figure". Too often advertisements' objectives are stated in meaningless terms, eg. "to increase sales': Certain basic questions need to be answered when setting advertising objectives. These are–

Whom do we want to reach?

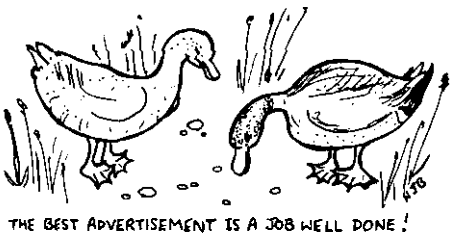
- How many of them are there?
- How many can we expect to reach?
- What do they need to know aobut our product or service?
- What position do we want to establish for the product/service in the prospects' mind?

Further help in answering these questions was provided by Mr Richard Warburton, Agripower Land Drainage Contractor, speaking on the subject of "Managing a Drainage Contractors Business". He shared the general view that there is now overcapacity in the industry–not only amongst machinery manufacturers and contractors but also amongst material suppliers–but the future need only be as gloomy as we allow it to become. There are many new areas of work that may be opened up. Hard work and a flair for business can still ensure survival.

On this theme Mr Warburton stressed the advantages to the business of having a satisfied and responsible work force. The interchange of ideas between men and management–both ways–must be encouraged. If you have good people, then seek opportunities to keep them employed through the year. A higher basic wage is better than a bonus system.

Mr S Crowther (ADAS Land and Water Services, Lincs) in his talk on costings, had emphasised the importance of a tidy and efficient gang and he went into some alarming details on the costs of making good bad work. Mr A H Rose, (Rose of Kenton Land Drainage) speaking from the floor made the same point, "that the best advertisement is a job well done and where your men will be acceotable on the place again". The word gets around':

Continuing his theme, Mr Warburton urged the importance of good work scheduling–keep down-time to a minimum; encourage farmers to include drainage as part of their farming programme–to anticipate drainage operations by sowing fields to crops such as grass, winter barley or rape or at least be prepared to clear straw early. Keep the, farmer involved–call and ensure he is ready for you to move in and knows what it will entail. Encourage him to come and look at work when it is progressing. Mr Crawford had earlier pointed out how machinery manufacturers now seek to bring farmers in to get to know them–"selling the company"–contractors could do similarly.



THE BEST ADVERTISEMENT IS A JOB WELL DONE!

New areas of business

Taking up another point introduced by Mr Crawford, Mr Warburton spoke of the new areas of activity where contractors can look for business. He cited:

- Advice and Design– In many areas land and water service personnel are thin on the ground. In the present political and economic climate this situation is unlikely to improve. Contractors are ideally placed to perform a more commercially based Advice and Design service. Most already offer free advice and drainage design–hoping to recoup the cost if the tender is successful. Often, however, considerable time and effort is wasted when some other contractor may submit a lower tender based on the same plan and design. It should not be unreasonable for contractors to charge for design services. Not only would that avoid duplication of effort amongst contractors it would also give the farmers an accurate comparison of prices based on the same bill of quantities.
- Water Supply and Irrigation– Many contractors already carry out a significant amount of this type of work. There are, however, areas outside agriculture, such as the smaller scale water supply work for Water Authorities and Housing Developments. Civil Engineering contractors could be competed against and outbid.
- Leisure–Amenity projects–sportsfields, landscaping are all within the scope of many agricultural contractors. Some specialist equipment may be required but this can often be hired or made. Travelling further afield will generally be necessarv since the amount of such work in one year in one locality is likely to be limited. It may also be necessary in many areas to try and improve the public image of agricultural contractors.
- Civil Engineering–Much of the machinery used for agricultural drainage has applications in Civil Engineering either on a plant hire basis or with operators and attendant supervision. In many areas the rates obtainable are far higher (more realistic) then in the agricultural market-place.
- Machinery Hire–This could be another area in which to extend profitable use of resources through the year. For example, there could be scope for renting out a large tractor after harvest.

Mr Wiles (J W Vickers & Sons (Lincs) Ltd.), Chairman of the session, invited the industry to consider whether there is now, more than ever, a case for a standard form of presentation of plans and quotations. Now that the Ministry is cutting down on its activities the farmer will be-having to

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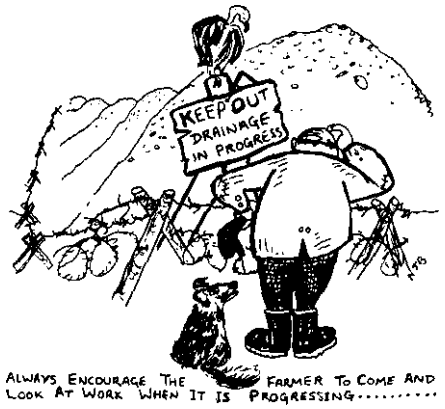
find other ways of checking the validity of a drainage proposal. Consultancies are not necessarily the answer—they are not without criticism—a lot of contractors have been let down through them. Mr Chris Stansfield (MAFF, London) explained that the Ministry has not completely withdrawn their support—there are still 150 advisers in the field—it is just that they are being moved to other projects.

Where SaWMA can help

Speaking for SaWMA, Dr Ede welcomed the concept that the industry will be exploring and determining the best line for it to take. Farmers will still need to form their own assessment of the relative merits of alternative schemes or projects. They will look to independent reporters such as SaWMA to make their assessments. There are clearly already a number of issues on which work can be pursued together to help farmers decide correctly on the projects they need. A starting point might be on the advantages of draining through a standing crop. This point was echoed by Mr Fry who pointed out that the new stronger association of agricultural drainage contractors and machinery manufacturers must now be doing all it can to promote mutual interests—they must be knocking on doors, at, for example, the NIAE, to encourage research and experimental work of practical use to the industry.



ALWAYS ENCOURAGE THE FARMER TO COME AND LOOK AT WORK WHEN IT IS PROGRESSING.....

The Workshop continued with papers and valuable discussion on a range of other topics concerned with quality and cost control. There will be more coverages of these in our July issue of Soil and Water.

The message from Mr Roddan to the delegates included an announcement that already SaWMA is planning the next Drainage Workshop. There is still much to talk about within the industry and he looked forward to delegates' continuing participation and involvement at the next event.

The River Wylye project – Dr A N Ede

The River Wylye is a trout river rising in the chalk hills in Wiltshire near Kingston Deer. The upper reaches are being studied by the land and water consultancy firm of Dr A N Ede, of Cambridge, in conjunction with University colleagues. Environmental influences affecting siltation are being analysed and include the largescale ploughing up of old grassland in the catchment, the villages' absence of main drainage, farm effluents and the presence of cressbeds and fish farms depending upon powerful springs.

Other current work of Dr Ede's includes the restoration of old mineral workings in the Denham area to forestry and farming, the agricultural monitoring of the Shropshire Groundwater Scheme, hydrological studies relating to irrigation and nature conservation in the area of Martham Broad, Norfolk, and studies of the Dorset Heathlands. Dr Ede also co-ordinated opposition to a scheme for dumping water onto Lincolnshire farmland which led to a Public Inquiry and a negotiated settlement.

Importance of soil moisture when incorporating straw

Straw disposal has been one of the major interests studied at the Ministry of Agriculture's Boxworth Experimental Husbandry Farm near Cambridge. Mr J. S. Rule, of the Boxworth EHF explains a comparative study on incorporation during two contrasting seasons; one wet and one dry.

TILLAGE experimenrs on a heavy chalky boulder clay of the Hanslope series at Boxworth EHF have studied reduced cultivation methods and direct drilling as alternatives to ploughing during the past decade. Where straw was burnt, direct drilling normally gave yields as good as, or rather better than, other cultivation methods, notably in dry seasons. Benefits from direct drilling at Boxworth have been attributed to better soil moisture retention and increased water storage, due to the fine porosity throughout the soil profile. Water infiltration rates have been increased, due to natural fissuring and worm channels, and as a result of crop root residues remaining undisturbed. Worm numbers tended to increase. Improved traffic ability resulted from the increased density and fine porosity of the surface layers. Results of an experiment comparing direct drilling and tined cultivation in which these advantages were experienced are shown in table 1.

The results in 1976 and 1979 demonstrate advantages in yield approaching 20 per cent from non tillage and moisture conservation in dry seasons.

The recent return to conventional cultivation and ploughing due to difficulties with brome grass control, and more recently to incorporate chopped straw, puts in jeopardy some of the advantages of direct drilling. How the disadvantages of more extensive cultivation to incorporate straw and the possible adverse physical effects of straw can be minimised is the object of current investigations at Boxworth and other EHFs and at regional sites throuehout the countrv.

Incorporation methods

A range of implements are being tested at Boxworth to incorporate straw in quite different ways:—

- Shallow or surface incorporation, leaving a surface mulch of chopped straw and soil.
- Uniform mixing of straw to a depth of about 20cm by a rotary cultivator.
- Plough based inversion, leaving little or no surface trash. Ploughing with and without tined incorporation before ploughing is being tested.

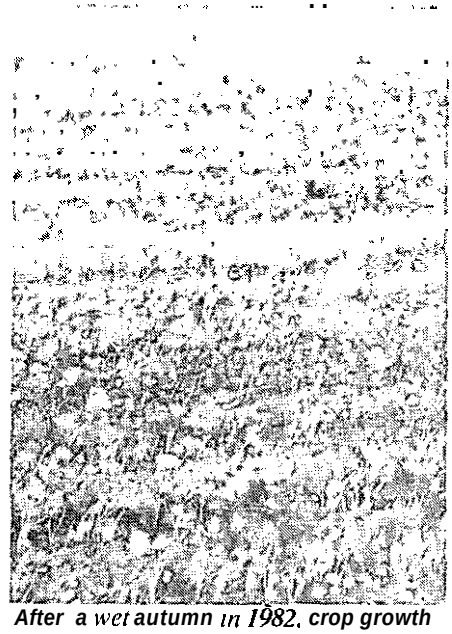
Additional treatments in 1984 included two combination implements which both have deep tines, followed by a rotary cultivator and crumbler roll.

Table 1. Comparison of direct drilling or cultivation to 15cm 1976-79.

	Yield t/ha		
	Cultivation	*Direct drilling*	*Difference*
1976 dry preceding summer and winter	3.59	4.29	+0.70 or 19%
1977	6.25	6.35	+0.10 or 2%
1978	6.83	6.55	−0.28 or 4%
1979 autumn 1978. very dry	5.63	6.68	+1.05 or 19%

Results of straw incorporation in two contrasting autumns

In autumn **1982,** various cultivation methods to incorporate straw were used during the last week in August and the first week in September. Soil conditions were ideally moist, and cultivations were followed by rolling and an overall discing to settle and firm up the seedbeds before drilling. The onset of exceptionally wet conditions in October delayed sowing and necessitated slug control and a paraquat spray to control volunteers before drilling with a single disc drill on 22 October. Establishment was good, with very little difference in plant populations between the various treatments.



After a wet autumn in 1982, crop growth following straw incorporation by ploughing was good.

In contrast, exceptionally dry autumn conditions in 1983 required extra cultivations to incorporate straw by tined and disc implements, or to get drillable seedbeds after ploughing. All cultivations exacerbated moisture losses and a much

After a dry autumn in 1983, crop growth following straw incorporation was inconsistent and poor.

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	1982/83	1983/84
Straw burnt (mean direct drill and 5cm cult)	9.74	11.26
Tines +disc 10cm	9.49 (−0.25)	10.18 (−1.08)
Tines +disc 15cm	9.49 (−0.25)	10.31 (−0.95)
Rotadigger	9.49 (−0.25)	10.67 (−0.59)
Plough	9.55 (−0.19)	10.84 (−0.42)
15cm incorporation × plough	—	— 10.76 (+0.50)
Mean reduction	−0.24	−0.71

Table 2. Comparison of straw incorporation treatments 1982183 and *1983/84. Yield* tlha (reduction compared with straw burnt).

After a dry *autumn* in 1983, crop growth *following* slraw *incorporation by 10cm* shallow tines was very poor.

more variable establishment, and slow emergence, reulted from the sowing which was delayed until 11 October to avoid the worst risks from Take-all in a second wheat, and to reduce the risk of meadow brome, present in the preceding crop. Both these objectives were realised, but emergence from October sowing in 1983 was slow and variable compared with earlier September sowings.

Results obtained in these two contrasting seasons are shown in Table 2.

Establishment following shallow surface incorporation treatments in autumn 1983 was most adversely affected by the dry conditions, and yield reduction compared with results after burning was about four times greater than in the previous autumn.

Ploughing in 1983 resulted in the best establishment and final yield, but even so. the yield reduction compared with results after burning was more than twice that of the previous season.

The results in 1982, reinforced by our experiences in autumn 1984, show that when soil moisture is present at the time of the initial cultivations, and if this is supplemented with rainfall before drilling, establishment has been little affected by the presence of straw residues. In 1982/83, yields also were only slightly affected, with a 1 to 3 per cent mean reduction in yield, compared to 4 to 10 per cent reduction in the drier year, with the poorer establishment.

After a ,"e' *autumn* in 1982, crop *growth following straw incorporation by 10cm shallow tines was good.*

Conclusions

On heavy soils, in very dry autumns, straw incorporation is more difficult and costly than when the soil contains adequate moisture. In two contrasting autumns in terms of soil moisture, ploughing has been a relatively consistent and fail-safe method for straw incorporation at Boxworth and on other heavy land sites, but methods of minimising the secondary cultivations that are required after ploughing have yet to be resolved in very dry seasons.

For incorporation by surface cultivation and no subsequent inversion of the soil, the earliest possible thorough incorporation of well chopped straw, with minimum amounts of long stubble. is important, although for ploughing, chop length is less critical.

Methods of seedbed consolidation to get good soillstraw contact and to avoid moisture loss require further investigation both for surface cultivations where straw is left on or near the surface. and after ploughing.

Drills with different coulter types are also being tested in seedbeds where straw has been incorporated at shallow depth.

The physical problems associated with the presence of straw residues when not completely buried seem of more importance than the straw toxicity attributed to acetic acid production in anaerobic conditions; this problem does not seem to occur very frequently. However, other aspects of straw toxicity, pests, diseases and nitrogen requirement for soils with straw residues present, and variations caused hy seasonal effects, will continue to be investigated.

Brimstone

Mike Jarvis summarises

A LONG-TERM detailed investigation into the effects of mole drainage on clay land that has been ploughed or direct-drilled was started in 1978 jointly by the AFRC Letcombe Laboratory and the MAFF Field Drainage Experimental Unit at Brimstone Farm near Faringdon, Oxfordshire A series of papers summarizing some of the results over the first two years has recently been published in the Journal of Agricultural Science (full references are given below) and the following is a resumé.

Objectives

The first paper identifies the objectives of the work, describes the site and the details of the experiments. The objectives were to investigate: i) the effects of drainage in a heavy soil on crops established by direct drilling or shallow cultivation compared with those on ploughed land; ii) the loss of nitrogen and other major nutrients by field drainage systems; iii) the relative amounts of rainfall lost by surface run off, interflow (corresponding to movement in the cultivation layer) and through the pipe drainage system, and the effects on catchment hydrology.

The site was chosen to ensure the widest possible relevance of the results for agriculture and environment. To achieve this the soil and slope needed to be relatively uniform, the climate within the likely range of arable farming in Britain and no recent pipe drainage system should be present. After a lot of searching for suitable land, the Brimstone Farm site appeared to satisfy these criteria. It has clayey Denchworth soils over Oxford Clay typical of many on which winter cereals are grown. The site hydrology is generally uniform and preliminary assessments indicated it was little affected by the presence of subsoil drainage schemes dating from the 19th century.

Drainage Conditions

The experiments combine two intensities of drainage – no secondary drainage, and intensive drainage with pipes at 0.9m depth, 46m apart, permeable back-fill and mole drains, with two cultivation treatments – mouldboard ploughing and secondary cultivation, and direct drilling or shallow-tine cultivation. The drained and the undrained plots were hydrologically separated to about 1m depth by a continuous polythene membrane, interceptor drains and surface gutters. Equipment was installed to measure surface run off, interflow at the bottom of the cultivated layer and deep drainage from the mole and pipe system.

The second paper describes the soil water regimes and water balances. In both seasons much of the undrained soils became saturated in winter almost to the surface but on the drained land, after disrupting a residual cultivation pan which limited the effects of the mole drains in the first season, the depth to the water-table was about 20cm greater. The differences are illustrated in Figure l. Surface flow, water movement at the depth of the plough layer and deep drainflow from mole and pipe drains responded rapidly to winter rainfall events. During both winters the mole and tile system removed most of the rainfall on the drained plots and the peaky hydrographs were typical of a mole system in a clay soil. In the undrained plots only a small proportion of the winter rainfall was accounted for in flow from the top 30cm and up to 75 per cent of the water was able to percolate downwards possibly to below the barriers that separated the plots.

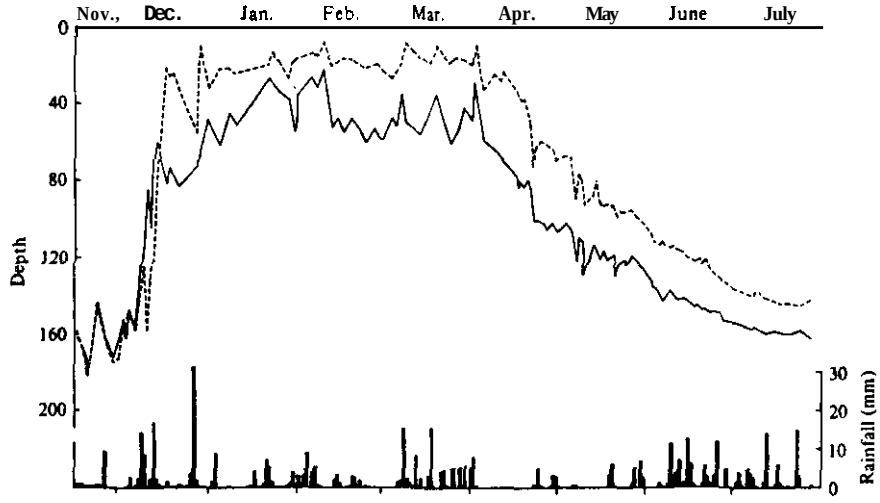

Fig.1. Variation in deprh to rhe water table, derived fmm hydraulic potential profiles, in undrained (---) and drained (—) land during 1979-80.

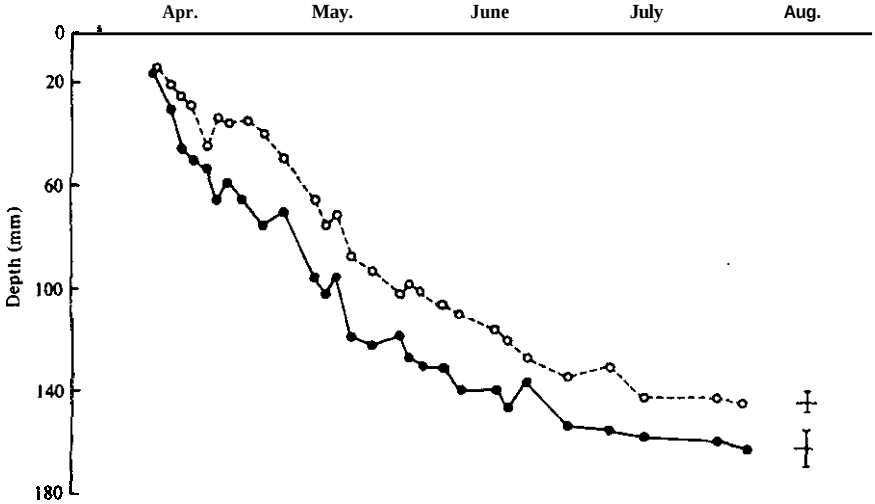

Fig.2. Maximum depth of water extraction by winter wheat in undrained (o---o) and drained (●—●) land in 1980. Vertical bar represents standard error for each treatment for rhe last measurement.

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Farm – the first two years recent work on mole draina

Losses of Nitrogen

Water samples from each run off component were analysed for nutrients and nitrous oxide gas content. Concentrations of nitrate – N from all drained plots were largest in autumn (50-95 mg N/l) but decreased thereafter (1-5 mg N/l at the end of March). Losses of nitrate – N were mainly through the mole drains and the quantities lost in surface run off or in flow in the cultivated layer were small on both treatments. Gaseous nitrous oxide, ammonium and phosphorus contents were very small though potassium concentrations were somewhat larger (<3.5 mg/l). Concentrations of herbicides were negligible.

The depths oi water extraction and water use by the crop were monitored and in 1980, on the drained plots where water-tables were deeper, maximum depth of water extraction differed similarly (Fig.2). Further, in April and May 1980 when rainfall was low, the percentage of water extracted from the top metre in the undrained plots decreased- exponentially with depth and 88 per cent was extracted from the top 30cm. In contrast, on the drained plots extraction declined more steadily with depth; relatively more water was extracted from the deeper horizons than on the undrained plots, especially between 40 and 80cm depth and small amounts were extracted from below 1m.

Tillers yields and quality

The agronomy and growth of the winter wheat crops are treated in the third paper. Root densities in December 1979 were similar on drained and undrained land but by April 1980 they differed greatly (Fig.3). Fewer tillers were produced by the surviving plants on undrained plots, so, when the number of shoots reached a maximum in March 1980, there were 25 per cent more shoots on drained than on undrained plots (Fig.4). The differences in shoot density decreased progressively during the year and by harvest, drained plots had only 5 per cent more fertile shoots per unit area. The yield of grain was 0.74 t/ha. greater on the drained than on the undrained plots mainly because individual grains were larger. The grain quality from the undrained areas was inferior to that from the drained land. There were also more weeds and more weed seeds in the harvested grain on the undrained plots.

The full titles and authorship of the papers are:

A study of mole drainage with simplified cultivation for autumn-sown crops on a clay soil.

1 Background, experiment and site details, drainage systems, measurement of drainflow and summary of results, 1978-80.
R Q Cannell, M J Goss, G L Harris, M G Jarvis, J T Douglas, K R Howse and S LeGrice, J agric. Sci, Camb. (1984), *102*, 539-559.

2 Soil water regimes, water balances and nutrient loss in drain water, 1978-80
G L Harris, M J Goss, R J Dowdell, K R Howse and P Morgan, J agric. Sci, Camb. (1984). 102, 561-581.

3 Agronomy, root and shoot growth of winter wheat, 1978-80
F B Ellis, D G Christian, P L Bragg, F K G Henderson, R D Prew and R Q Cannell, J agric. Sci, Camb. (1984), 102, 583-594

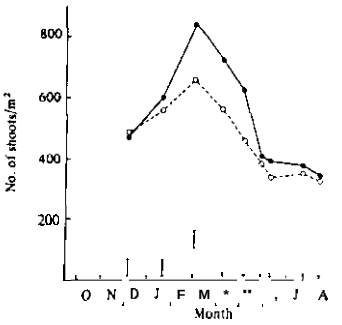

Fig.4. Effect of drainage on number of shoots of winter wheat 1979-80. Solid line – drained; broken line – undrained. Vertical bars indicate standard errors.

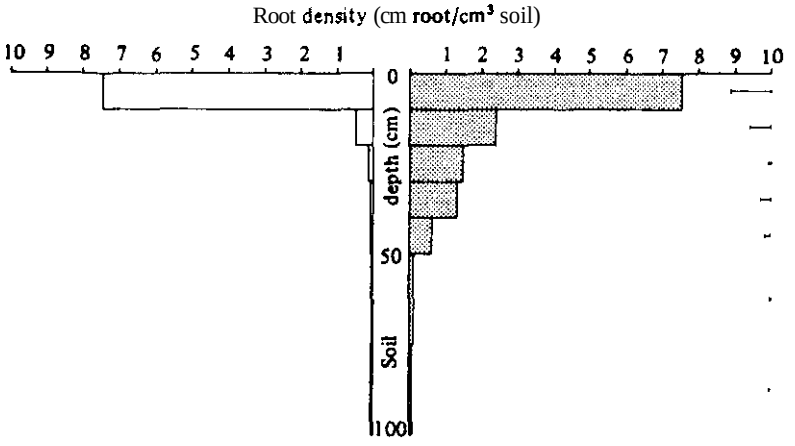

Fig.3. Root distribution, April 1980 – rhe beneficial effect of drainage has become quite pronounced. Shaded area – drained: open – undmined. Horizontal bars indicate standard errors.

We ore indebted to rhe Cambridge University Press for permission to reproduce the figurer accompanying this article.

Water Meadow Flooding – the Border Dyke Method

An experiment to determine whether a modified technique of water meadow drowning gives beneficial results in terms of grass production

by A Parker and A Lester-Card (ADAS)

WATER meadows are found extensively throughout Southern England in valleys whose rivers rise in chalkland. A feature of their management was the traditional drowning system to which they were subjetted in January and February to promote an early growth of grass using the warmer chalk led water as a warming medium. To ensure proper working of the system continuous attention was required in routing and re-routing the water so that the areas were covered. This required a high labour input and as the older practitioners died out, so did this technique, until now very few farmers use it (I).

During a visit to New Zealand one of the authors (Mr A Laster-Card) studied a method of surface flooding for irrigation purposes known as Border Dyke. On his return to the UK, working in an area where water meadows are common he thought that features of the method could be used to semi-autornate the surface flooding in winter (2, 3, 4, 5, *6)*. A site was found and an experiment was set up by the Agriculture and Land & Water Services of ADAS. It extended to 1.34 ha. at Odstock. near Salisbury, Wiltshire, bordering a major watercourse, The soil was Wylye series (7).

The Site (see Fig 1)

The ridge and furrow typical of water meadows was levelled and graded. The area was divided into 5 strips separated by bunds 30cm high with 60cm bases. Each strip was 15m x 150m with a longitudinal gradient of 1.2 per cent and zero cross-fall. A control area was established. The experimental site was re-seeded with a Timothy/Ryegrass/ White Clover mixture. The hydraulic design was based on the method set out in the USDA Soil Conservation Service National Engineering Handbook (R).

The Method

The flow in the river was controlled by a sluice at point A. At this point there was also provision for excess river flows via a secondary sluice. Primary flow from the river was diverted into the feeder stream. The main feeder stream lies in section A-B and has been imnroved to orovide a flow of 0.035m^3/sec (1.24 cu secs).

From the above stream, which has a depth controlling sluice at B, there was a controlled flow on to the first four strips via 100mm diameter drains at ground level *(6* drains to each plot). The drain inlets had manually operated flaps for 'flow' and 'no flow' conditions.

After the necessary time had elapsed the above drain inlets were closed and the excess water allowed to run off the area via an open ditch C-D at the further end of the plots.

Results

Temperatures were recorded weekly on Wednesdays at 0900 hours. They were measured as follows:

- 10cm below ground level
- 30cm below ground level
- Air

I n the mainstream of the river

It was found that the 30cm temperature in the flooded area dropped below growth temperature – usually taken as 5°C – for only just over one week in the winter of 1979/80. The control plot was below this temperature for over five weeks in Dec/Jan and for a further week in March.

A similar picture was observed for the 10cm temperature. In this case the flooded area was below 5°C for about one week in January, the control was below for at least four weeks in the samemonth and for a further week in March

A plot of the water temperature shows its consistency during the winter months and that up to the end of April its fluctuations were confined to a range of 4.6°C with a modai vaiue of 7°C.

The source water was sampled for nitrate and ammonium nitrogen. The latter was not detected but small amounts of nitrate were. The results of the sampling were:

Date		
12.2.80	5.6	1.1
28.2.80	7.0	1.4
2.4.80	5.6	1.1

The units/acre are calculated for each inch of water applied. In metric terms these

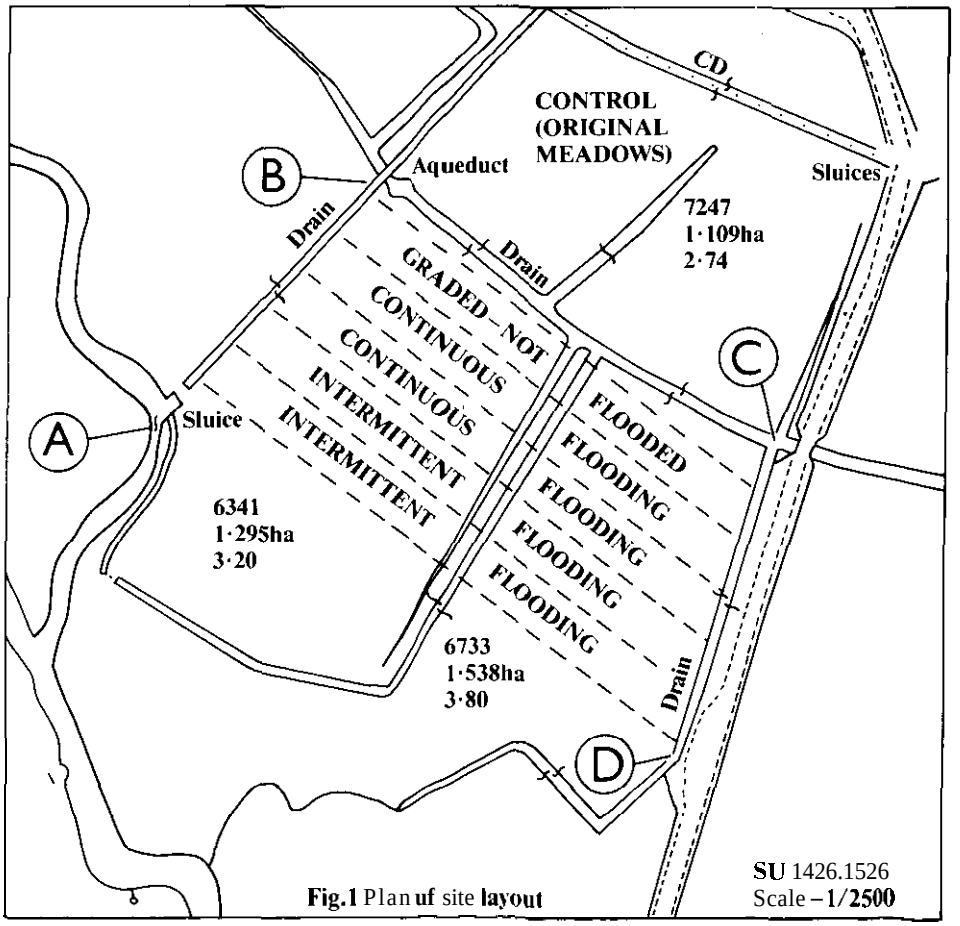

Fig.1 Plan uf site layout

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figures convert to 5.6 and 7.0 kg/ha. of nitrate N for every 200mm of water

Discussion

Continuous watering produced good growth but tended to damage the pasture where the depth of flow exceeded 5cm.

Phoro *1—Headrace* and inlets of feeder *pipes*—looking *from* point A *to* point *B.*

Intermittent watering involved the anticipation of frosty spells. To apply this technique correctly requires someone to live very near the site. If there is no constraint on the quantity of water available, then continuous watering controlled below a sheet depth of 5cm produces the better result.

Difficulties were experienced with the flooding, largely because vandals altered the hatches and sluices controlling the water to individual strips, generally making things awkward. When there were large flows in the river, even with the hatches fully open and the entrance to the head race shut off water found its way onto the site.

Conclusions

In its original concept, water meadow flood control was considered more of an art than a science. In so far as it is used to combar freezing conditions in the winter this could still be true. The amount of labour required continuously on site for the constant adjustment of flows, has been replaced by the experimental system to a large degree, whilst still requiring close management if the "on-off' system is being used. With continuous flooding the labour inputs are negligible. The eye is a better judge of when to turn off the water than any empirical means. Only for a summer irrigation is a fully automatic system likely to be successful.

Photo *2—Flooded c.f.* non-flooded, April 1981

There is little doubt that large quantities of grass can be produced very early by winter flooding, although it has not been possible to measure this. Problems of flood control have so far prevented the early use of this grass.

There are few problems with the layout, and water is distributed very evenly from the head race by means of the flapped delivery pipes. In winter two pipes are adequate to give sufficient flow over the 15m wide plot. When the water flow is much less in summer it is necessary to open more pipes, but it is doubtful if six are necessary,

The Ryegrass/Timothy/White clover sward seems to stand up to the treatment, though it may be necessary to control creeping buttercup by spray chemical.

I. DR J H BETTEY
The development or Water Meadows in Dorset during the Seventeenth century

2. ALAN WARREN
Border Dyke Irrigation MAT Timaru – New Zealand

3. W A ALLISON 1975
Extract from Warai Plains Irrigation Scheme
NEW ZEALAND DEPT OF AGRICULTURE
WINCHMORE IRRIGATION RESEARCH STATION
Design and Land Preparation for Border Strip Irrigation

4. M CHRISTELLER MAF OMARU NZ
The Determination of Border Dyke Installation Scheme Design Criteria

5. DEPT OF AGRICULTURE ALEXANDRA NEW ZEALAND 1969
Border Dyking and Automatic Irrigation

6. W R LOBB AND A D HALL
DEPT OF AGRICULTURE 1963
Automatic Irrigation Reprint from New Zealand Journal of Agriculture

7. SOIL SURVEY OF ENGLAND AND WALES
Soils in Wiltshire (Sheet SU03, Wilton) D W Cope

8. SOIL CONSERVATION SERVICE
US DEPT OF AGRICULTURE
Irrigation—National Engineering Handbook Section 15

Research and Experimental Work on Drainage

SaWMA's Annual General Meeting was hosted this year by the Field Drainage Experimental Unit at Anstey Hall, Trumpington, Cambridge. Members attending the AGM were given opportunity to study a series of presentations of the Unit's work and to speak with research workers about their individual projects. Mr D A Castle, Head of the Unit gave an introductory talk outlining the field studies and laboratory work currently in progress. Projects include hydrological studies of mole drainage, the effect of submergence on mole channels, improving pipe sire design with respect to different cultivation regimes and quantifying the utilisation of grass production.

Other work is also being done on the drainage practices on restored Open Cast Coal Sites, reduction in the poaching of grassland, the drainage of saline soils, and the further development of instrumentation.

We will be reporting more fully on a number of these topics in forthcoming issues of Soil and Water.

Geoff *Baldwin*

Our new editor

Geoff took early retirement from the position of Director and General Manager of an engineering company, part of a major international group, and became a consultant in Marketing and Promotions.

His qualifications for the SaWMA post derive not only from his recent work, but also from many years in the agricultural machinery industry.

Prior to entering industry Geoff lectured and demonstrated at the Cambridge University School of Agriculture, during which time he also wrote widely for the technical and general farming press.

With a family background of journalism and farming, (his father was a journalist and his grandfather farmed near Morpeth, Notrhumberland), he is now able to offer a unique combination of talents and experience to SaWMA and will play a key role in our Association and its activities

Harry Allen, SaWMA Council

Soil Science in the Soviet Union

by R J A Jones, Soil Survey of England and Wales

MY TWO week stay in the Soviet Union was arranged under the terms of the **Anglo-**Soviet Cultural and Scientific Agreement. I had requested the opportunity to visit five' centres but, in the event, only two of these were on the agreed itinerary.

The first visit was to the Dokuchaev Soil Science Institute in Moscow, founded in 1926 with the main aim of mapping of soils for their economic potential.

The Institute has three divisions:

I Soil Science—dealing with soil genesis, geography and classification of soils.

II Soil characteristics—concerned with fertility.

III Irrigation of unfavourable soils-mainly studying the problem of salinity.

Additionally, the Dokuchaev Institute is responsible for co-ordinating the research work at the 18 Soil Science Institutes in the different republics and also at the Land Resources Institutes and the Institutes of Irrigation Studies.

Soil Mapping

Whilst at the Dokuchaev I learnt that the soils of the USSR are mapped at scales ranging from 1:20M to 1:500. It is claimed that all agricultural land has been mapped at scales of 1:200,000 or larger but there is need to update many of these. It is proposed to re-survey the general area under agriculture at a scale of 1:100,000 but no time-table exists for this project.

On a brief visit to the Soil Physics Department we discussed the use of the neutron probe for measuring soil moisture content. The general attitude seems to be that the probe gives unreliable results. It is also considered expensive, a problem to transport and even harmful.

Penetrometers, mainly the hand held cone type, are regarded as modern. They are used to provide field data for assessing rootability and also to gauge the power required for cultivation.

Compaction problems

My next visit was to the Agrophysical Institute in Leningrad. There I visited the Laboratories of Hydromechanics and Soil Hydrophysics, where soil water retention properties was the main topic of mutual interest. Moving on to the Laboratory of Physics and Biophysics of soils I found the research interest to be the study of soil compaction by the huge machines increasingly in use on the Collective farms (tractors weighing over 12 tonnes). Compaction is becoming a serious problem in the traditional areas of the USSR with theresearch emphasis on avoidance since mechanical methods (eg. subsoiling) are rarely used to alleviate its effects, presumably because of the vast areas under cultivation.

Lack of Communication

From my visits and discussions in the USSR I am now acutelv aware of the lack of communication there between specialists. Such contacts as there are seem to be limited to publication of experimental results in Soviet journals and co-operation between former students and colleagues now working elsewhere. In the immediate future it does not seem likely that new technology will overcome these problems.

Soviet research in soil science is based on sound theoretical principles but is very conservative in approach. Original development was in response to economic demands and to solve the problems of regionalisation of agricultural activity, for example, the concentration of wheat in the Ukraine and cotton in Central Asia.

With the great increase in cotton products in recent years many scientists are now working on a new problem—salinity. The main remedy is to wash the sodium salts out of the soil into rivers, but this is creating saline river systems which are now a serious ecological problem. Other agricultural changes have been achieved more successfully.

Soil Erosion

South East England **Soil Discussion Group (SEESOIL) 12th** December **1984**

Andrew Moffat (Soil Survey) reports

THE MEETING was organised to review evidence for soil erosion on agricultural land and discuss approaches to its control. It was attended by over 100 delegates and ten papers were presented.

Introducing the meeting, John Boardman (Brighton Polytechnic) pointed out that off-farm costs of erosion, such as insurance claims against domestic flooding, or road clearance, are probably larger than on-farm costs. In the context of UK public policy, the implication of, and financial responsibility for, erosion has been largely ignored.

A Soil/Survey/MAFF project has shown that water erosion is widespread in the UK. Land under cereals is most affected, and erosion can be related to slope, soil type, organic carbon and clay contents, drill direction and wheeling intensity.

On the South Downs, John Boardrnan reported that in 1982-83 about 27 per cent of arable land was subject to erosion, with rates of loss up to 100 tons per hectare. The risks of erosion have increased markedly since the introduction of winter cereals. Alan Harrison-Reed, (Wolverhampton Polytechnic), considered comoaction and wheelings are major factors causing erosion in the West Midlands. The degree of compaction is related to soil texture and organic matter contents, and by the length of exposure to heavy rainfall.

Discussing approaches to erosion control, Roy Morgan, Silsoe College, ruled out mechanical protection works such as terracing as inappropriate for the UK, but grass strips on slope convexities and valley floors could help. Recent experimental work has shown that some plants, eg. Brussels sprouts, may actually increase erosion risk. Minimum tillage and early establishment of the crop may also help to reduce erosion.

The full proceedings of the conference are to be published by SEESOIL later this year.

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Soil Compaction measured by the NVRS penetrometer

THE CONCEPT of a simple penetrometer must be almost as old as the concept of tillage itself. Once the idea of soil loosening had been accepted it would not have been long before somehody pushed a stick into the soil to judge the effectiveness of their efforts. The major advance in penetrometers in recent years is the use of modern electronic sensors and methods of data recording. David Goodman and Hugh R Rowse report on the seedbed penetrometer developed by the National Vegetable Research Station.

Seed germination and crop establishment are much influenced by soil conditions within a few mm of the seed. This is particularly true of small vegetable seeds and is well illustrated by the profound effect on crop establishment of factors such as the design of the soil-engaging components of the seed drill or the effect of a surface crust on the soil. Any method used to investieate conditions around theseedshouldtherefore be capable of a spatial resolution of a few mm and preferably should also enable many replicate readings to be made to take account of the inherent variability of the soil.

The modern penetrometer differs little in principle from the primitive stick. Its essential components are a probe which is pushed into the soil, and a means of measuring the depth and the force experienced by the probe tip. One improvement is the use of a tip (usually conical), which has a diameter larger than the shaft on which it is mounted. This ensures that the force recorded is essentially that experienced by the tip itself, and not that due to the friction on the shaft.

Electronic sensors

The major recent advance in penetrometers is the use of modern electronic sensors and methods of data recording. This means that sufficient data can now be collected to enable relatively small differences to be distinguished.

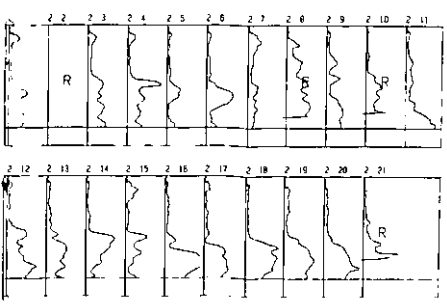


Fig.1: Computer drawn traces shoring individual penetrations. Note rejected data marked "R"

In operation, the 'foot' of the penetrometer is placed over the point where the test is to be made, the recording system is switched on and the probe lowered into the soil. As the probe enters the soil the optical sensor sends electrical pulses to the recording equipment at 3mm depth intervals. If the probe encounters a stone the penetration is abandoned. On return to the laboratory the logger is coupled to a microcomputer and the data off-loaded for storage and processing. Fig.1 shows a typical set of results. Each graph is an individual penetration. Those marked 'R' are incomplete and are automatically rejected by the computer. The very great variation between individual penetrations is obvious and it is only by taking a large number that a consistent pattern can be detected.

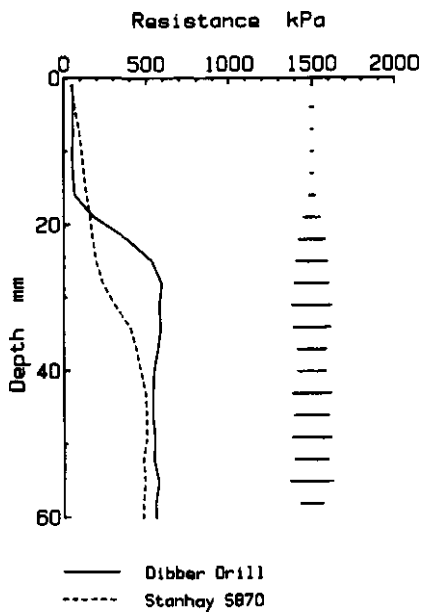
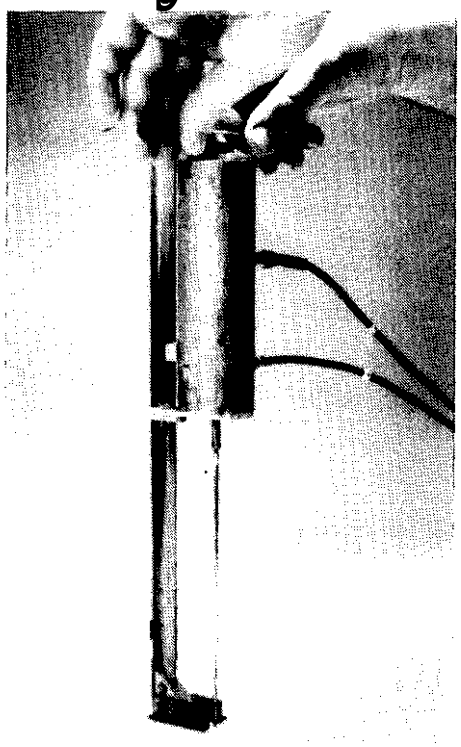


Fig.2: Variations of penetrometer resistance with deprh produced by on experimental dibber drill and a Stanhay S870 precision seed drill. Drilling depth approximately 200mm.



The NVRS Seedbed penetrometer.

Soil compaction demonstrated

An experimental Dibber drill developed at the National Institute of Agricultural Engineering has a wheel which runs on the seedbed on which are mounted a number of dibbers which push individual seeds into the soil. The drill has produced some very good results which are attributed in part to the extra consolidation of the soil beneath the seed which re-establishes the flow of water to the seed zone, and also to the reduced soil strength above the seed. The measurements shown in Fig.2 clearly demonstrate these features in comparison with a Stanhay S870 precision drill.

Autumn versus Spring seedbed cultivation

The penetrometer may be used to make measurements at different distances from the centre of the drill line, to build up a picture of soil strength in the horizontal and vertical directions. The penetrometer was used in this way to measure the differences between an autumn and a spring-cultivated seedbed as shown in Fie.3. The extent of soil loosening caused by the Spring cultivation and by the passage of the drill coulter in the Autumn-cultivated soil can be clearly seen.

Conclusion

The results achieved show that with sufficient replication the penetrometer is capable of detecting small differences bet-

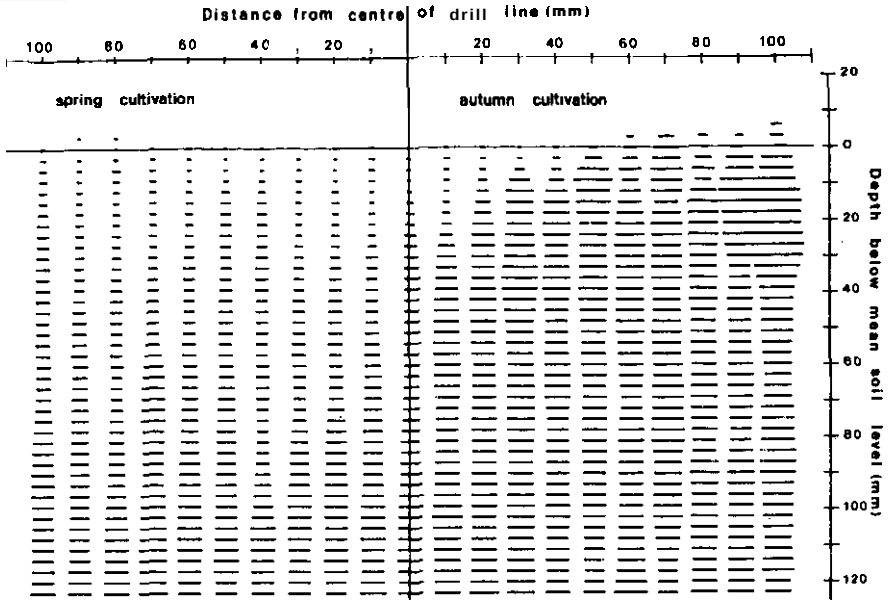


Fig.3: Diagram showing differences in the Spring between (a) Spring Cultivation, and (b) Autumn cultivation. The amount of penetration resistance is represented proportionately by the horizontal bars.

ween different seedbeds. What is usually of most interest is the relative differences between treatments and the depth in the seed bed at which these differences occur. For this type of measurement the seedbed penetrometer is excellent and we know of no other technique which can so easily handle the large number of replicate readings required, or which has such good spatial resolution.

Acknowledgement: We aregrateful to Mr L P Bufton, of the NIAE for permission to publish thedatashown in Fig.2.

Full report: Coodman, D & Rowse H R, 1984 A combined penetrometer and surface relief meter for studying drill coulter performance.
Journal of Soil Science, 35, 497-503.

The FAO Panel of Experts on Agricultural Mechanisation

At a time when it is in fashion to decry some of the United Nations' Agencies, it is good to report that one small International panel seems to be serving a useful purpose.

The FAO Panel of Experts on Agricultural Mechanisation, which meets approximately once a year, is somewhat unique. Currently, it consists of **44** members drawn from 30 countries. Each member is individually appointed and gives his services voluntarily. 21 members are from developing countries (mostly senior Government Officials responsible for mechanisation strategy and practice), 16 are from developed countries or International Research Institutes representing Government Aid and Technical Agencies, and seven are from the Farm Machinery Industry. Consequently, it is a panel where the "user", the "financier" and the "supplier" can all meet and discuss ways of improving the effectiveness of mechanisation and learn at first-hand the views of people often faced with many of the problems. In addition, various speakers known to be experts on the matter under discussion are invited to the meetings, and a limited number of "observers" (generally from the host country) may attend.

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Imp moling – a user's experience

Geoff Baldwin talks to Ian Laurenson, Assistant Engineer with the North West Water Authority at Preston

"No mess. It only took a day—they did a good job. That's why we've had them back since on another contract". Mr Laurenson's words echoed the sentiments of speakers at the Drainage Workshop on how to promote and attract business.

In this case, as Mr Laurenson went on to explain, the water authority had been faced with the task of re-grading about 2,500 metres of drains in order to present drainage water to a newer pumping unit. The site, at Kew, Southport, was a triangular plot of about 15ha bounded on two sides by open drains and on the third side by a disused railway embankment.

Mr Laurenson's proposal was that they should provide a new drainage pipe through the embankment near to the pumping station. This would have the dual advantage of greatly shortening the length of water course to the pump and also thereby offering the farmer a much lower level into which to feed his planned new field drainage system.

The adjacent land is Grade 1 agricultural —peat, overlying Down Holland silt (known locally as Blue Billy)—and the subsoil under the embankment was not expected to present any variations other than an occasional peat intrusion. However, at the drainage level, the embankment is 28 metres wide and there would clearly be a time-consuming and expensive job cutting an open trench through. Alternatives were considered, but a 400mm pipe was to be needed and thrust boring too was eliminated on the grounds of expense. The choice was for impact moling.

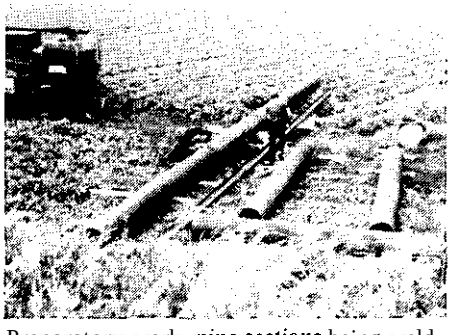
The contract went to Wright Plant Hire of Hull and, as Mr Laurenson had said, the actual driving through of the pipe took less than a day.

Overall, the contractors, with a gang of three, were on site just less than a week. Preliminary work involved the digging of a short approach ditch in line with the planned route through the embankment and into this was set the support and guiding frame to take the lengths of pipe. This support frame had to be accurately aligned and levelled as there is no other way of controlling the direction of drive other than setting it off straight in the first place.

With the *first* lengths of pipe welded *and* laid on the support frame, the impact moler was located in the end of the pipe *thrusting* against a conical *insert* and held tight in position by *two* turnbuckles on the fastening chains. Photo: I *Laurenson*

As the pipe is driven through there is some slight compaction in the surrounding soil due to the thickness of the pipe wall but the core of soil remains in the pipe until at the end of the drivc it can be blown out by compressed air. To do this, a temporary blanking plate is welded on one end of the pipe and compressed air introduced behind the plug of soil in the pipe. During the actual pipe driving Mr Laurenson had measured progress at about 1 metre every 12 minutes (5 metres an hour). The accuracy of the drivc was impressive—the exit point was within 200mm of prediction (an error of only three quarters of a per cent on the 28 metre run).

Following this successful operation, the most recent occasion on which North West Water have again used impact moling has been on another re-grading job where it was necessary to arrange a lower-level conduit underneath a roadway. This time an even larger pipe, of 18" diameter, was driven through, although the distance, at 9 metres, was shorter than on the earlier occasion. According to Mr Roy Roberts, General Manager at the contractors, P Wright Plant Hire Ltd, the maximum size they can consider for this technique is up to 32 inches outside diameter.



Preparatory work, *pipe sections* being welded alongside *the* support frame.
Photo: *I Laurenson*

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Since its formation, these meetings have taken place in Kenya, England, Germany, France, Italy and Turkey—sites chosen because the host country has borne some of the administrative costs. Discussions have covered such subjects as: Mechanisation of small farms; Tillage systems for the humid sub-tropics, Tillage systems for arid land; Methods of land clearance, Parts and service for farm machinery; Multi-farm use of machinery.

A report, with recommendations, is prepared after each meeting and 30 copies sent to the relevant Ministries of each of the developed countries' Governments.

At the 1984 meeting in Turkey, Bob Bell, Head of the Overseas Division at NIAE Silsoe, and one of the Panel's original members, asked for specific evidence of the effectiveness of the Panel. Replies from a number of members were very encouraging. The World Bank spare parts policy has, as a result of the paper on "Parts and Service", changed to ensure finance for spare parts for subsequent years after purchase of machines supplied under World Bank schemes, and Governments have been given clear guidelines on how to cater for after-sales service and parts supply. Following the findings on "*Multi-farm* use of machinery" (which conclusively showed that the private contractor made much better use of equipment than either Government machinery stations or co-operative ownership schemes), several countries changed their policy. A Far East country representative reported great improvements in land clearance, including fewer erosion problems, as a result of adopting methods suggested by the Panel.

All credit must go to the originator of the idea for the Panel, Dr Hartmut von Hulst, Chief of the Agricultural Engineering Service of the FAO, and the support he has received from his Director, as well as from his own staff—notably two British members Tom Griffith-Jones and Thurston Weaving.

DIARY

APRIL 1985
23-24 Measurement of soil water properties – Short Course, Silsoe College

MAY 1985
1 Saline Soil on the North Kent marshes – SEESOIL Spring Field Meeting
8 **Management of Wetlands** – British Hydrological Society, Wild Fowl Trust, Slimbridge
9* **Farmers Weekly International Drainage Event** – Veals Farm, Laughton, East Sussex

JUNE 1985
5-6 Cereals '85 – RASE – NAC Stoneleigh, Warwicks
with ADAS, Soil Science – effects of compaction from trafficking on crop growth
14 Farm Walk 11.30 to 4.30 – Burnley Hall Farms, East Somerton, Norfolk. Farm visit with conservation, wild life, dunes and broads, marshes, drainage, water resources interests. Contact Dr Ede, 36 Thornton Way, Cambridge (0223) 276532 or turn up in the farmyard.

JULY 1985
1-4 Royal Show – NAC Stoneleigh, Warwicks – Arable Marquee includes – soil acidity demonstration
straw incorporation machinery
land drainage feature
9-11 Great Yorkshire Show – Showground, Hookstone Oval, Harrogate
10-11* Association of **Drainage** Authorities Open Days – Cross Guns Meadows, Thorney, Nr Peterborough

SEPTEMBER 1985
4* Tractors at Work – Proctor Bros (Wingland) Ltd, Sutton Bridge, Lincs
11-12* Cultivations, Straw Disposal '85 – on heavy land farm belonging to H Raby & Sons, Great Stukeley, Nr Huntingdon, Cambs
Demonstrations include: ploughing & alternative systems on burnt & unburnt stubble; straw incorporation and disposal systems

* denotes events at which SaWMA is participating

SaWMA CONFERENCE – POLLUTION ON THE FARM

Tuesday 12 November 1985 full details to be announced in our next issue

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ADVERTISERS INDEX

Land drainage: Who to believe?

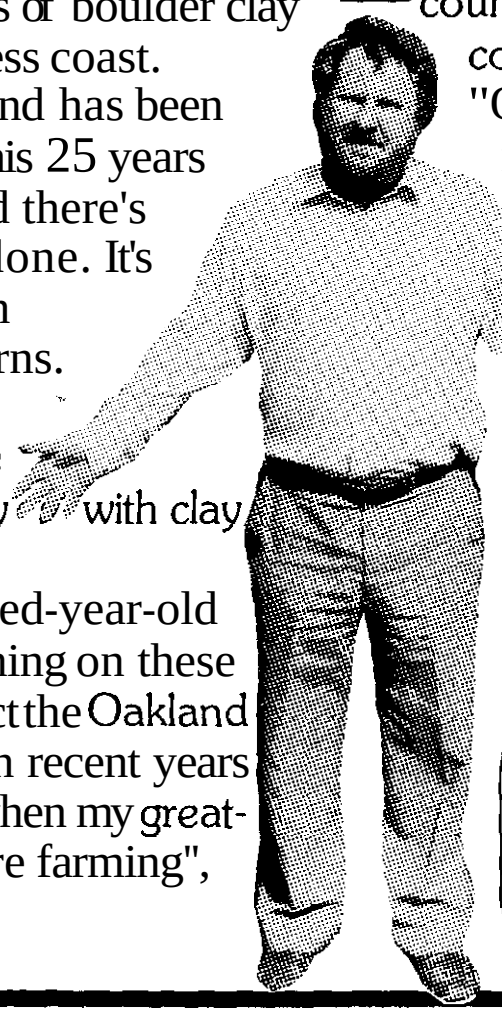
THE FARMER...?...OR THE CONTRACTOR

Tony Leake farms 800 acres of Humber silt on Sunk Island, and a further *800* acres of boulder clay on the Holderness coast.

80% of the land has been drained during his 25 years on the farms and there's still more to be done. It's a vital first step in maximising returns.

He knows drainage, and he drains exclusively with clay tiles.

"Some hundred-year-old tiles are still running on these farmsand I expectthe Oakland pots we've laid in recent years will be running when my great-grandchildren are farming", he says.



As a director of Caley and Martinson Tony Leake is also one of the country's leading drainage contractors.

"Our watchword is quality, at a reasonable price", he says.

"A Caley and Martinson scheme is an investment for a lifetime."

"If clay pipes are good enough for my farm I would certainly recommend them to our customers."

OAKLAND

CLAY PIPES FOR AGRICULTURE

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TELEPHONE **(0904)**87666 TELEX 57645