soil and water

JOURNAL OF THE SOIL AND WATER MANAGEMENT ASSOCIATION LIMITED

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Soil and Wafer is the half-yearly Journal of the Soil and Water Management Association. The views expressed in this publication are those of the contributors. The publishers disclaim anv responsibility whatsoever arising from the use of the information contributed. The Association is a charity whose main objective is to promote good soil husbandry.

More details of membership are reprinted inside the back cover.

The editor welcomes offers of editorial material and advertising requests; details on application.

Copy date for the Autumn edition July 12th 1982.

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Further **copies** ***available*** **upon** *request.*

COVER PHOTOS:
Interest in Subsoiling at the RASE Autumn Cultivations demonstration, Shrewsbury. See p. 19. Inset — The soil, that the subsoilers were set to tackle.

soil and water

Here in the UK we have the most dynamic reserve of expertise and ability within the whole spectrum of land drainage, yet it remains a mysterious 'subsurface' exile to the average agriculturist. Talk may be fertilisers, crop varieties, infestation controls, etc, but rarely does one hear about land drainage.

Is it because once completed it happens to be an 'unseen' product, or s(it is carried out by some characters who for some unexplained reason are)t accepted as _ :urist or e clas ! as onstructi :ontractors. It is a very specialised personal industry about which only those directly involved really understand the problems with which it is faced. Perhaps this individuality and reticence precludes attempts to organise a co-ordinated voice?

The apparent fear of speaking out on major issues, to exploit our potential, or to risk reputations by public discussion of our business problems only further reduces and dilutes the strength of our demands for improvement to policy issues. Our colleagues overseas have recognised the dangers in this and now command very powerful lobbies with their respective Government departments.

What can we do? — The contractors themselves have to determine how best to apply the organisations available if they can be used to serve their needs. Could a National organisation be developed to serve the land drainage industrv from the existing organisations providing changes are made? — or is something else required?

There is the established 'vehicle' in the NAAC and the less specific but allied organisation of complimentary interests in SAWMA.

The two have different motives but should be of benefit to the other. Essentially, the NAAC is geared to act in an administrative role on policy matters and the correlation of information as necessary for guidance to members businesses. SAWMA acts in a technical and communications role — the vital link between the contractor and the farmer utilizing the expertise of Research Workers and Ministry Advisers. With your support this role is made much easier.

SAWMA can act as a catalyst and do much to practically promote the need for ore land drainage through technical demons i :o farmers and land owners with the attendant factors of subsequent soil management for improved performance after drainage. But it does require direction from the land drainage industry to achieve the mutual benefits possible.

We have to work together to exploit the enormous potential expertise that we have in UK, — we have excellent 'laterals' in the form of contractors but the 'connectors' to the 'Mains' (our aims) are sadly below standard.

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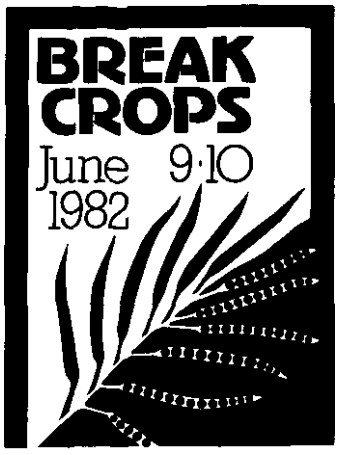
EVENT DIARY

12th May 1982	Straw — Burn or Bury? Conference, St. Ivo Centre, St. Ives, Cambs., organised by SAWMA.
9th June 1982	Veg-Bed 82. Spread Eagle Farm, Biggleswade, Beds. More details from P. Rickard ADAS Cambs.
9th–10th June 1982	Breakcrops '82 — Organised by the R.A.S.E. — Bishop Burton, Beverley, Nr. Humberside.
10th June 1982	Cultivations for Winter Cereals — Open day — SIAE, more details Sandy Hamilton, SIAE, Bush Estate, Penicuik.
10th – 11th June 1982	French Drainage Event. Toulouse.
14th – 18th June 1982	Course in Land Restoration — Wolfson College, Cambs. More details SAWMA, or Land Capability Consultants (0954) 60888.
29th–30th June 1982	'Sprays and Sprayers', Whittlesford, Cambridge.
5th–8th July 1982	Royal Show — National Agricultural Centre, Stoneleigh.
7th – 8th July 1982	A.D.A. National Demonstration Aquatic Weed Control Bristol.
22nd – 28th August 1982	9th International Colloquium of Plan Nutrition — Warwick University, Warwickshire.
22nd – 28th August 1982	Weathering, Soils and the Sedimentary Cycle — Symposium sponsored by the Canadian Society of Soil Science — McMaster University, Ontario, Canada.
7th–9th September 1982	Crop Establishment Meeting — NCAE, Beds. organised by Assoc. Appl. Biologists and N.C.A.E.
13th–16th September 1982	Autumn Meeting and A.G.M. — B.S.S.S. — Aberystwyth 'The Changing Landscape'.
4th – 10th October 1982	Polders of the World — Symposium and Exhibition — The Netherlands. More information from SAWMA.
10th–19th October 1982	Meloracia '83 — USSR International exhibition — Irrigation equipment, pumps, land clearing, laser equipment. More information I. Trinchenko, USSR Embassy, London.
13th–14th December 1982	4th National Drainage Symposium — Chicago, Illinois.
14th–16th December 1982	Irrigation Short Course, NCAE. More details SAWMA or Pam Cook (0525) 60428.
14th–17th December 1982	Drainage Short Course, NCAE. More details SAWMA or Pam Cook (0525) 60428.
April 1983	Soil Water — B.S.S.S.
4th – 8th July 1983	Biological Processes and Soil Fertility — Meeting of the B.S.S.S. with Commissions III and IV of the International Society of Soil Science, at Reading University.

N.B. INFORMATION INCLUDED IS SUBJECT TO CONFIRMATION. FOR MORE DETAILS PLEASE CONTACT THE ORGANISERS OR THE TECHNICAL SECRETARY ON 0203 555100.

Advertisers Index



at Bishop Burton College
North Humberside

BREAK CROPS — A NEW EVENT FROM THE RASE

A national demonstration covering the prospects for and husbandry of cereal break crops is being organised by the RASE. Held at Bishop Burton College of Agriculture, the event includes commercial and advisory demonstration plots covering establishment methods, drilling dates, weed control and soil management.

SAWMA has established 4 plots looking at the effects of compaction on Spring Oil seed rape, and combinable peas. Work at the PGRO and Sutton Bonnington has shown that wheelings can reduce plant populations of peas by 50%; this demonstration sets out to illustrate this and help farmers recognise and solve compaction and associated soil problems.

For more information on the event contact the SAWMA Office.

CULTIVATIONS . . .
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SOIL CARE . . .

BSRAE Association
Members Day

NIAE, Silsoe, Beds.

Wednesday 26th May

More details:
Visits officer,
NIAE
Wrest Park
Silsoe, Beds.
Tel: 0525 60000

ROYAL SHOW-STOPPER

Visitors to this year's Royal Show will find a new centre specifically looking at the farmers basic resource, his soil. The Royal has gradually built up a strong reputation for mixing trade interests with practical demonstrations. This July near to the Arable Centre, and Veg Area (between Ave. A and 4th Street) the RASE and SAWMA with the help of ADAS and the Soil Survey of England and Wales are mounting a Soils Centre.

The basic aim is to pass on latest research interests through exhibits and illustrate soil problems and their possible solutions in the form of field plots.

Field demonstrations will show the effect of soil acidity on crop development, and also seed bed conditions and surface compaction on the growth of Spring Barley and Sugar Beet. Figures 1 and 2 indicate the two extremes of soil conditions created in the plots in early March, before sowing. Figure 2 shows the devastating effects of wheelings on the soil which is a fine sandy loam.

ADAS officers and other experts will be on hand in an associated technical marquee to discuss farmer problems. Exhibits confirmed at the time of writing are to cover Drainage, Soil Assessment, Soil Compaction and growth of peas and oil seed rape, Traction and Soil map interpretation. See you there? ? ! !

Fig. 1. Well structured control plot.

'The Soils Centre' — Mid March.

Fig. 2. The Compacted plot.

SOIL ASSESSMENT BOOKLET

At long last, in conjunction with ADAS Soil Science, the Association has produced its first specialist publication. Aimed largely at the Young Farmer, "Soil Assessment" will be the basic text for the BP sponsored NFYFC Soil Assessment Competition. It is a simple text split into two sections, the first covering Assessment of Soil Properties, the second, their Management.

In a foreword written by the Association's President Sir Nigel Strutt, he stresses that the booklet "should have a wider potential use beyond the specific purpose of the NNFC Competition;" and that "Young Farmers could do worse than give their fathers a copy for Christmas."

The simple to follow text supplied by ADAS Soil Scientist John Archer is interspersed with colour photographs illustrating texture, structure and other soil characteristics; it will prove to be an excellent pocket guide for use in the field.

Copies of the booklet are available from the Technical Secretary, SAWMA Ltd., National Agricultural Centre, Stoneleigh, Warwickshire, CV8 2LZ. Price £1.00 each (including post and packaging).

Orders of 10 or more will receive an additional copy at no extra charge.

DRAINAGE COURSE

The December drainage short course continues to pack them in. Fully booked once again, Doug Castle of ADAS and his colleagues at the NCAE produced their sixth short course in association with SAWMA. Jim Lusted, a contractor from Perryhill Went, had the following to say in connection with last year's four-day offering.

"We were quickly made welcome by the College staff and presented on arrival with a professional folder of the notes of the course which saved us from unaccustomed writing and enabled us to listen more carefully.

The lecturers, despite on occasions a total loss of voice through a throat infection, made us feel at home and they talked with a great deal of practical experience. They obviously knew the problems that contractors come up against when doing their drainage work, and they showed us the damage done by compaction in different types of soils, and the trouble caused by lack of good husbandry which has made drainage so necessary. We were given a good theoretical understanding of the problems of subsoiling and moleploughing and how they help to speed water, down to the drains.

Jim Lusted

Various contractors exchanged ideas on different makes and types of drainage machinery, levelling devices, and the local methods they employed in their craft.

The food and accommodation at the College were superb and the days went very quickly, either in the lecture room or in easy socialising in the dining room or bar. All in all I enjoyed the course immensely and thought that it was very good value due mainly to the hard work and enthusiasm shown by the staff of the College on our behalf."

One sad note from the point of view of the College and course is the recent promotion of Doug Castle. Undoubtedly he was the leading light behind the success of the course: he will be missed but we wish him luck in his new role as Regional Surveyor based at Head Office. Good news for next year is that under John Gregory the course will continue and dates have already been fixed:

Irrigation Short Course — 14 – 16th December 1982.

Drainage Short Course — 14 – 17th December 1982.

Contact: Pam Cook, Short Course Secretary on 0525 60428 or Mike Saull at SAWMA on 0203 555100 for more details.

Crumbs & Clods

DIRECT DRILLING AND REDUCED CULTIVATIONS

At last there is an authoritative and well produced book, covering all the recent research and views on Direct Drilling and reduced cultivations.

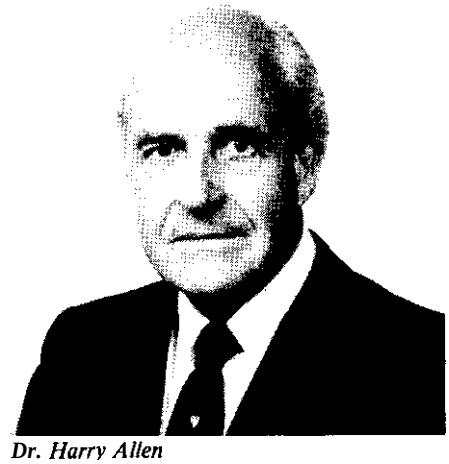
The possibility of direct drilling crop seeds was first given serious consideration twenty years ago. A lot has happened in such a short time, most of which has been well documented by author Harry Allen in this 220 page text.

Dr. Allen, former UK Technical Manager of ICI Plant Protection Ltd has been to the forefront of those developing direct drilling and reduced cultivation techniques; he is also one of the science's best known communicants, having been Chairman of the Association's Technical Committee for three years.

In this book he reviews and discusses the progress of direct drilling since 1961, paying particular attention to the problems that occurred and their practical solutions. He goes on to examine the economics of the technique and describes the development of specialised machinery.

A great deal of excellent practical advice is given to those new to direct drilling or wishing to extend their activities. There are chapters, supported by farm stories, giving guidelines for direct drilling cereals, oilseed rape, grass, forage, brassica crops, silage maize and sugar beet. The more important developments overseas are also considered.

Direct Drilling and Reduced Cultivations is hardback, 216 × 138mm and includes 37 black and white photos and 7 colour plates. It is priced at £8.25 from all good booksellers or £8.95 by post from the publishers — Farming Press Ltd., Wharfedale Road, Ipswich, IP1 4LG.



Dr. Harry Allen

NEW BULK HANDLING SYSTEM FOR DRAINAGE TILES

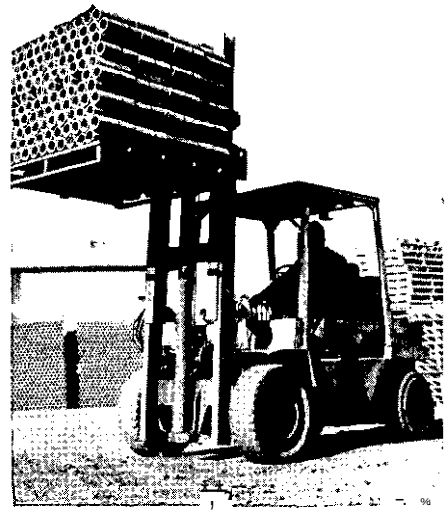
A palletised system of speedy bulk handling of clay land drains has been introduced by Oakland, the UK's biggest tile manufacturer.

The system, called "Pallapak", allows tiles to be handled by any lift truck, or by tractors with fork lift attachments.

Pallapak is a development of the well established system of strapping which permits tiles to be handled in bulk by trenching machines and lorries equipped with special cranes.

Oakland has adapted the strapping technique and can now load up to five hundred 3 inch tiles on a single pallet. The company claims that one forklift can now unload a lorry in less than a fifth of the time required by two men handling loose tiles.

For further information contact Richard Sturdy on 0904 87666.



THE GRASSLAND RESEARCH INSTITUTE 'PUT OUT TO PERMANENT PASTURE'.

Land has been acquired at North Wyke and Rowden Manor near Okehampton in South Devon for the Grassland Research Institute to establish a Permanent Grassland Division.

Permanent grassland is the most important category of grassland in England and Wales — over half the farmland is permanent grassland, yet up until now relatively little research (other than surveys) has been carried out on it. Professor Alec Lazenby, Director of the GRI, says:— "The establishment of the GRI Permanent Grassland Division in South Devon will enable the Institute to explore the problems associated with the improvement of permanent grassland and to demonstrate the potential of such land in achieving high levels of productivity of milk, beef and sheepmeat."

The land at North Wyke comprises 158 ha (390 acres) mostly in grassland, but with some woodland. It was previously one of the research stations of Fisons Fertilizers. The adjacent land at Rowden Manor consists of 91 ha (225 acres) of old permanent grassland, much of it in need of improvement and with both herbage and soil problems. Thus the new Permanent Grassland Division will have some 249 ha (615 acres) of land at its disposal. Altitude varies from 400' –600' above sea level, average rainfall is over 40" per annum.

The staff of the new Division (including farm staff) will total about 40 people the majority of whom will be moving from Hurley. The Head of the Permanent Grassland Division is Dr. Roger Wilkins, formerly Head of the Agronomy Division at Hurley. Dr. Wilkins is known internationally for his work on forage conservation, especially *ensiling*, but for many years has had wider agronomic interests.

'LAND DRAINAGE IN ENGLAND'

All credit to Henry Oakland and Sons Ltd., for organising a series of meetings in England and Scotland over the past year. As a delegate at the Shropshire conference it was most pleasing to see speakers helping to sell land drainage to the farmer.

At Shrewsbury Mike Cowell, a senior surveyor with MAFF's Land and Water Service, predicted that fully automated trenchers as sophisticated as the "driverless" trains on some underground railway systems might be operating hy 1990. He went on to say that land drainage may even be a one-man operation within the next ien years.

"The operator will have little more to do than move the machine from site to site", said Mr. Cowell.

The machines of the future would also feature computer monitoring of trench grades, with a print-out to verify the precise statistics of every scheme.

One consequence of automation would be an end to the traditional herringbone pattern of drainage, which according to Mr. Cowell has no particular virtues and would be unnecessarily complex for the new machines.

At the Banff Conference farmers were told that drainage costs less in the north-east than anywhere else in Scotland.

This was claimed by the soil science chief at the North of Scotland College of Agriculture, Mr. Ray Morris. According to Mr. Morris, the average cost before grant of a drainage scheme in the area is £190 per acre (£460 per ha).

This compares with £260 per acre (£620 per ha) in Caithness and Sutherland, and £290 per acre (£700 per ha) in Tayside. Lanark is the most expensive area for drainage in the country, at £375 per acre (£800 per ha).

Varying soil conditions, rainfall, and drainage techniques account for the differences.

In the north-east, most drainage is designed for spring line interception in relatively free-draining soils, so larger diameter pipes and small scale schemes predominate.

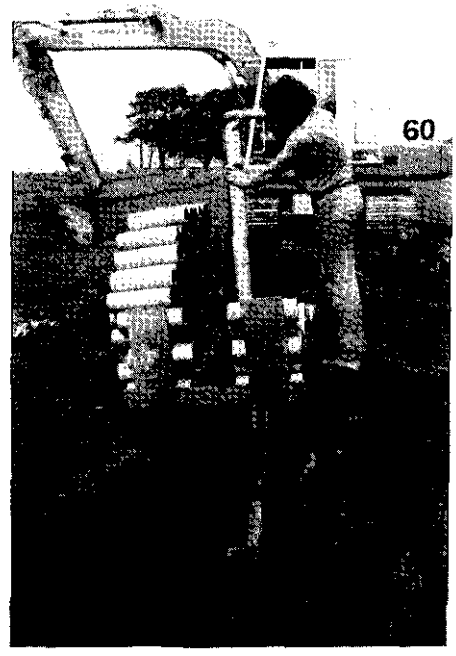
Mr. Morris emphasised that, in suite of regional differences, drainage was still a good investment throughout land. In the decade f 1970 the national price index for farm buildings had increased by 370%. for tractors by 480%, and for fertilisers by 510%. Drainage costs had, however, risen by only 250% in the same period.

TILE LAYER FOR THE BACK-ACTERCONTRACTOR

A simple, low-cost tile layer for use in conjunction with back-acters is to be manufactured by a northern drainage contractor. It consists of an all-welded vee-shaped steel plough and tile chute, and has been developed over the past five years to increase his work output at the same time as reducing labour cost.

Working on the stony fell land which predominates in the area, with one man in support, contractor Bob Hutchinson of Littledale, Lancs., has laid up to 40 chains in a day.

Mr. Hutchinson says that "the biggest practical advantage to me as a contractor is that our tenders are now competitive in a much wider area than was previously the case." "The farmer, on the other hand, gets the benefit of a perfectly formed trench



The Hutchinson Tile Layer

bottom, which it is simply not possible to achieve with a back-acter alone."

The tile layer will probably sell for around £1.000.

NEW COURSE IN LAND RESTORATION
Wolfson College, Cambridge, 14–18th June 1982

The course is concerned with the fundamental principles and technical practices required in successfully restoring land back to agriculture, to amenity or water use, following mineral working.

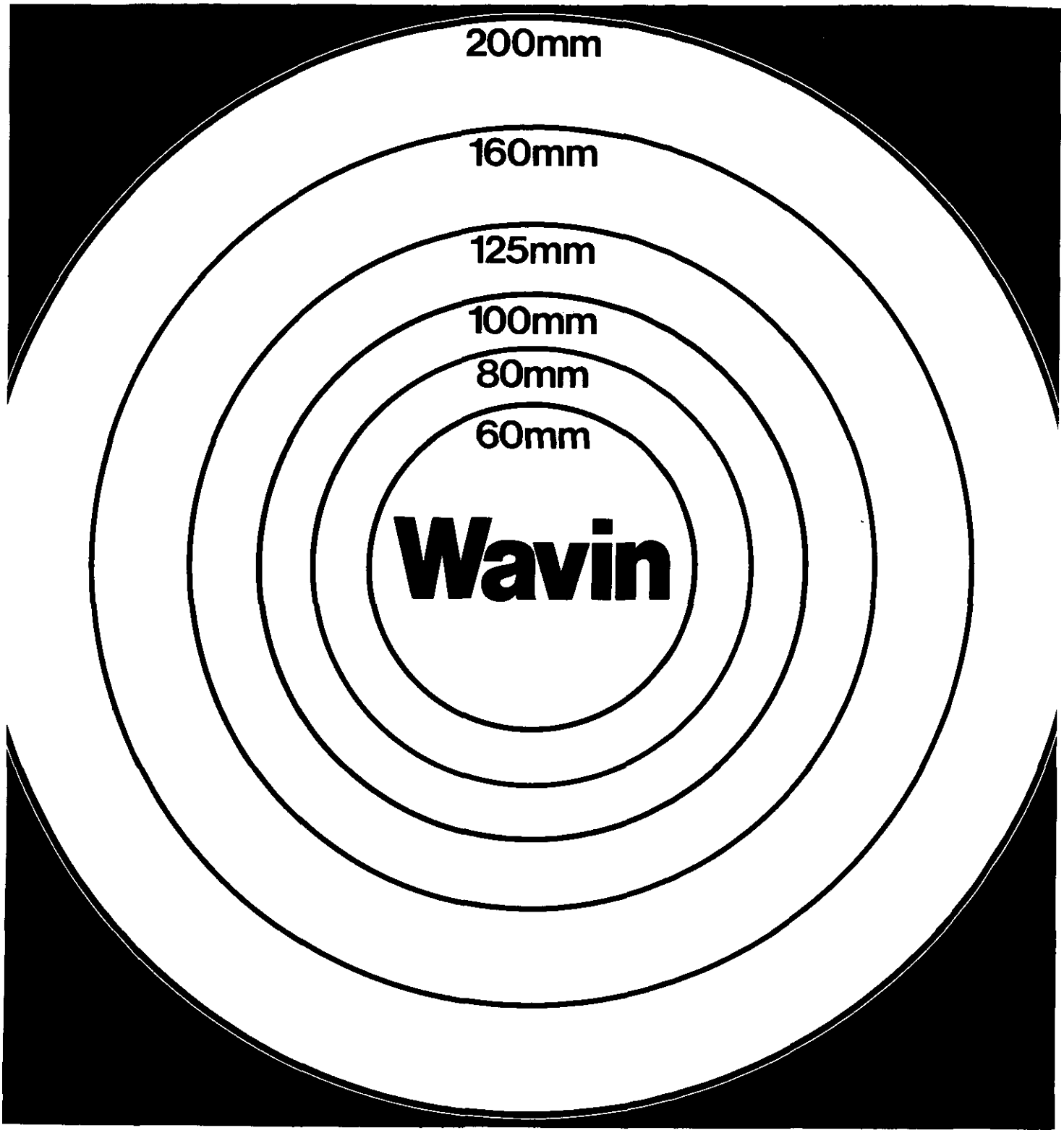
It examines the needs of crops and other vegetation in disturbed land and how these can be satisfied by proper treatment of soils and drainage. Prominence is given to the new requirements of the Town and Country (Minerals) Act – 1981.

This course is designed to assist Planners, Restoration Supervisors, Site Managers, Earthmoving Contractors, Estate and Farm Managers and others in the better understanding of soil and crop requirements in order to achieve higher standards in land restoration and subsequent use.

The lectures and demonstrations quantify the basic requirements and these are followed up by field visits to see soils and drainage, research projects and progressive restoration of sites.

Further details are available from:—

Dr. *B.* F. *Bland*
Land Capability Consultants Ltd.,
Times House,
Willingham,
CAMBRIDGE, CB4 5LH.
Tel: (0954) 60888.



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SOIL AND CROP LOSS — A PROBLEM WE CAN LIVE WITH?

In December the Association were joint soonsors with the RASE and **ADAS** of a conference entirely devoted to **the** subject of Soil and Crop loss. The aim was to review current thought and research and to establish whether an S.O.S. — Save our Soils — **message** should he broadcast to farmers in Great Britain.

Six speakers compared the extent and nature of **global** and national soil erosion and outlined practical methods **by** which a soils guardian and defender can prevent wind or water loss of soil **and/or** crop.

Opening the Conference, Dr. Roy Morgan Senior Lecturer at the National College of Agricultural Engineering stressed that although erosion is not as emotive a subject in GB as elsewhere in the world, recent studies suggest that the problem requires re-examination. Global erosion rates (see table 1) indicate that the United Kingdom is at the lower end of the spectrum, however, is this rate acceptable? Guide lines set down by the USA Soil Conservation Service in 1960, indicate that a figure of 11t/ha/yr should be the tolerance level for soil loss; table 1 indicates that under bare soil conditions rates in the UK can be above this.

Dr. Morgan concluded that erosion is not a national problem at the moment, but there is a real need for soil conservation at field level to stop local erosion events.

Modified Cultivations on **Sandland**

Mike Selman from Gleadthorpe EHF confirmed the view that erosion is only of localised importance; he recommended the use of modified cultivations on light **Bunter** Sandstone soils to control windblow.

Perhaps the most well known technique outlined by Mr. Selman was that developed by the Chairman of the Conference, Phillip Glassford who farms near **Worksop.** Mr. Glassford goes against standard procedure by rolling land when its surface is wet.

When it dries he uses a spring tine cultivator to produce a cloddy surface. The clods by increasing surface roughness help stop wind erosion; precision drills cope quite adequately with such a seedbed as front rollers crush the clods before the seed is planted.

Severe gully erosion on the Isle of Wight, Spring 1978. Cambridge University Collection: copyright reserved.

	Natural	Cultivated	Bare Soil
China	2	150 – 200	280 – 360
USA	0.03 – 3	5 – 170	4 – 90
Ivory Coast	0.03 – 0.2	0.1 – 90	10 – 750
Nigeria	0.5 – 1	0.1 – 35	3 – 150
Belgium	0.1 – 0.5	3 – 30	7 – 82
UK	0.1 – 0.5	0.1 – 3	10 – 45

Rates in t/ha/yr

Table 1. Rates of erosion in selected countries

Another method is by ploughing and pressing to produce alternate hill: and valleys. Any subsequent rain helps "cement" these undulations producing an alternative rough surface which can last for several weeks and cover the main blowing period of the year. Mr. Selman considered that the problems with using live or dead guard crops are due to the difficulty of spraying and the relative expense compared with modified cultivations, which made them less appealing.

A further development was explained by Mike Nuttall from Norfolk Agricultural Station. Direct drilling and strip tillage work at Norfolk Agricultural Station using an ICI Plant Protection rig was beginning to show comparable yields of sugar beet when compared with a traditional ploughed preparation, and work is proceeding to achieve higher responses.

Wind Erosion, near Misson, Notts, Spring 1978. Cambridge University Collection: copyright reserved.

Erosion Control on Peaty Soils

Current research work and farmer experience on peaty soils was outlined by Bob Wickens, Director of Arthur Rickwood EHF. He considered that the main sensitive crops on peat soils are sugar beet, onions and carrots and these have **10.5, 1.7** and **3.8** thousand hectares each in this country. **The expected losses due to the effects of wind would be about £210,000 annually, which on average implies that control measures should not exceed £13/hectare;** cheap and effective methods are thus very important. Mr. **Wickens** gave the following examples:—

(1) Artificial wind breaks — Can be moved from field to field but require a tremendously high labour input. ***Cost £300 a hectare a year.***

(2) Direct drilling into crop residues — gives early protection but can cause drilling problems. ***Cost £60 a hectare a year.***

(3) Planted straw — Said to attract birds and makes inter-row hoeing impossible. It has been very labour intensive though a new machine is now on the market and Arthur Rickwood hope to buy one in the near future. ***Cost £40 a hectare a year.***

(4) Short term living shelter — Live catch crops are effective but cause difficulty due to incomplete kills by herbicide. ***Cost £25 a hectare a year.***

(5) Subsoil raising and mixing — One of the more permanent techniques it stabilizes the surface soil and can cut down oxidisation and peat wastage. Although very expensive it is a once-and-for-all operation which could last for 25 years. ***Cost £200 a hectare a year.***

(6) Willow hedges Extensively used at Arthur Rickwood EHF. They now protect **50%** of the farm land occupying only 3% of the total. They do however require intensive management yet are a very good way of protection from erosion. ***Estimated cost £15 per hectare a year.***

Soil Stability Aids

Chris Asthill covered the use, application and cost of soil stability aids.

As well as dealing with the more common products such as poultry litter and pig and cattle slurry. Mr. Asthill said that sewage sludge would be effective in halting wind blow; as an added bonus it would also give significant quantities of trace elements and lime to the soil, where the latter has been used during processing. Sludge however has problems; environmentally its smell will linger for **3** – 5 days after application and it can cause toxicity. Factory waste lime applied in the form of clods of the size of golf balls is most effective on light soils. Additional benefits are the correction of surface acidity and the addition of valuable trace elements. However, it is not always possible to obtain lime in the correct state. Costs would be about **£80** hectare assuming an average 16 mile distance from factory to farm.

Vinamyl **3270** and Vi-Grow synthetic resins if applied correctly give the best results. However, they are both expensive costing around £100 a hectare.

On reflection Chris Asthill thought that we were still a long way short of producing a cost effective soil stabilisation agent for protection of sugar beet.

Small rills in wheelings on sandy soils can lead to extensive gully erosion. Copyright R. Evans.

Potential losses

In conclusion Dr. Evans of the Soil Survey of England and Wales said that "Soil and crop loss caused by surface water run off is higher than farmers realise and in the long term this could prove to be more serious than windblow." Dr. Evans is involved in compiling data on soil and crop loss using air photos backed up with field visits and although evidence is far from conclusive he considered that there would be a lowering of agricultural productivity if land at risk in lowland England is kept in a continuous arable cropping system.

Arable areas most at risk are:

1. The gently sloping land in East Anglia and the West Midlands where water erosion could potentially strip land.
2. Light land in the Vale of York, Lincolnshire, Nottinghamshire and East Anglian breckland.
3. Peaty soils in East Anglia and South Humberside.

Dr. Evans has collected evidence of approximately 1300 cases of eroded fields since 1977 though many have been located by chance. He is anxious to get a more complete picture and would appreciate the help of any SAWMA member towards this aim. His work suggests that although erosion and deposition usually affects less than 4% of the area of most fields it can be as high as 34.5% in some instances. Usual amounts of soil removed by erosion are equivalent to 0.5mm of topsoil per year, this Dr. Evans considers to be offset by formation of soil at a rate of 0.1mm – 1mm each year; clearly in some cases there is a shortfall.

Gully erosion in a sandy loam soil over gravel. Copyright R. Evans.

Conclusion

Water and wind erosion of land under continuous arable cropping is greater than many think; it is often only the peak event that is noticed.

By modifying cultivations, cropping patterns, using contours, windbreaks or stabilising agents, we can control erosion on farmland, but often these are time consuming, impracticable or not cost effective. Short term effects are obvious and costly, but the question must be posed, can we ignore the long term consequences of continuous arable cropping?

Copies of the papers from this conference are available from the Technical Secretary, SAWMA, National Agricultural Centre, Stoneleigh, Warwickshire, CV8 2LZ. Cost £3.50 members, £5.00 non-members.

(Above) Chairmen Roger Joice and Doug Campbell with Chief Inspector Keith Wigmore of the Derbyshire Constabulary.

(Left) Bob Craik, Tony Pope and Bill Tail gel on update on Interdrain Machines from their Rep Mr. Martin.

WORKSHOP WINNER

Superkart at the Novotel.

Mick Docking (Barth GB Ltd) answers a question from the floor.

Jan Van-der-Stelt of Interdrain on the Machinery Manufacturers panel.

Alan Twyning 'Loser control'.

V10-1

MASTENBROEK

Drainage Machinery

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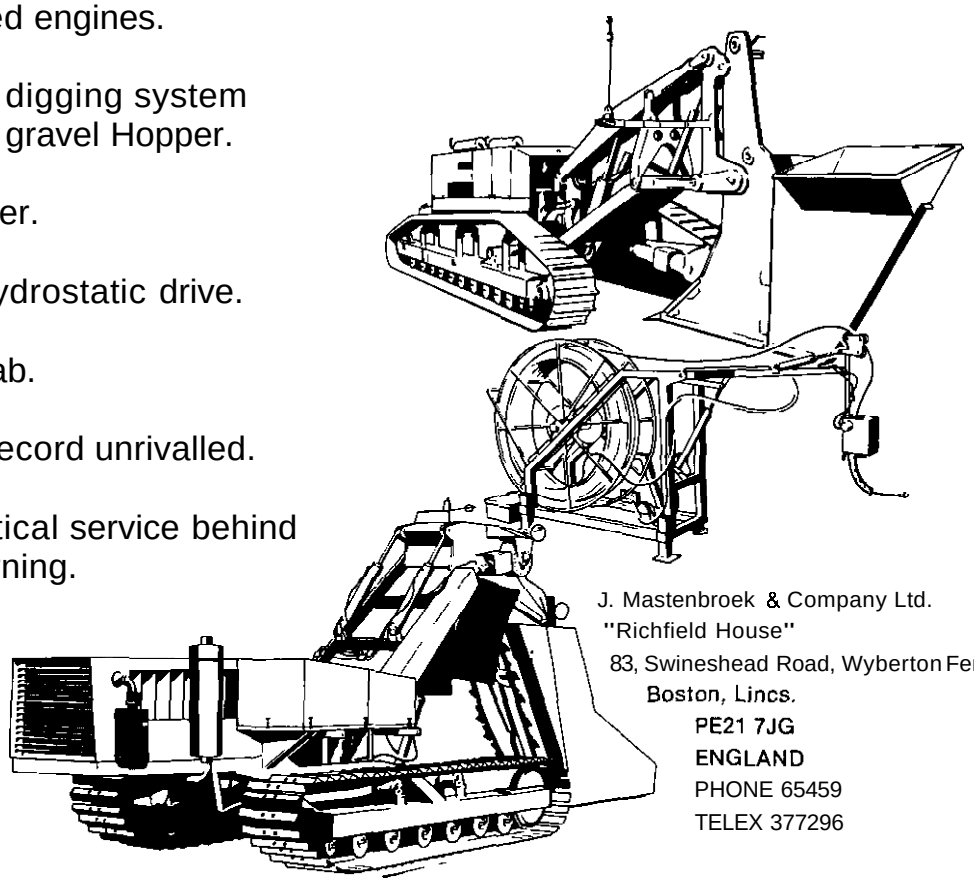

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WORKSHOP WINNER

After the coldest and most severe winter weather experienced this century in the U.K. the first National Drainage Contractors Workshop came as a welcome break and heralded a new phase in the history of the British Land Drainage Industry.

Contractors, consultants, dealers, manufacturers and their friends took over the Novotel at Long Eaton for 2 days in January for the first National Drainage Workshop.

"Practical Image"

In opening the proceedings, SAWMA Technical Committee Chairman, Mike Darbishire, hoped that the Workshop would convey a practical image, something which would permit informal discussion and the exchange of experiences and views. He felt that contractors and manufacturers alike should be in a position to exert more influence on policy and that this would come through frank and honest discussion.

Mr. Darbishire who was convenor for the event, felt that "collectively those present had a responsibility to create a public image of a proud and powerful industry". "This", he said, "must come through selling our expertise and services in a more efficient way".

The response to his call was most promising and the very wide range of subject matter covered formally by the speakers raised many questions and stimulated discussion between colleagues over a drink or during the frequent breaks in the proceedings.

Code of Conduct

Concern was expressed about sub-standard work in some areas due to inexperienced contracting companies, and it was evident that a 'code of conduct' is urgently required. Constructive recommendations arose out of discussion, stressing the need for improvement in communication, more co-ordination, and a demand for a strong representative platform from which to influence policy.

Whilst the Workshop was staged for Drainage Contractors it was well supported by the manufacturers of machines, clay tiles and plastic pipes and other ancillary equipment manufacturers such as Laserplane and gravel trailers. Other sectors of representation included the Association of Drainage Authorities, Consultants, Research establisl t:, the National College of Agricultural Engineering, The National Association of Agricultural Contractors, and the Land and Water Service of MAFF. The delegates from Europe represented drainage interests from France, Germany, Holland and Eire.

Noted was the need for better marketing programmes, training and possible licencing of drainage machine operators, a recommended listing of experienced contractors, and better information and co-operation in the fields of research.

The latter was pre-empted by the circulation of a questionnaire prepared by the N.C.A.E. staff who were in attendance under the leadership of Gordon Spoor. This was particularly relevant as research is being undertaken on the requirements for Trenchless ploughs over the next decade.

Plastic vs. Clay

The British Clayware and the Plastic Land Drainage Manufacturers' Association were referred to as the 'contestants' and respectively gave some persuasive presentations on how to judge the economics and performance capabilities of one material against the other.

Roy Butterworth, representing the Plastic Land Drainage Manufacturers Association, introduced a new film promoting the use of plastic pipes, their argument rested on the fact that:

1) Plastic pipes are lightweight and can be deposited at one point in the field.
2) They are easy to handle, especially when unloading.
3) Lightweight pipes mean that one lorry can carry 15,000 metres compared with five lorries to carry this length of clay tiles; the latter weighing nearly 90 tons with a subsequent risk of soil compaction.
4) The continuous length prevents breakdown of the drain due to soil movement.
5) Flexibility means plastic pipes do not lose any efficiency.
6) Plastic pipe is chemically inert, non toxic and immune to all degrees of soil acidity, it is also unaffected by agro-chemicals.
7) The plastic pipe allows water to ingress through many uniform perforations around the circumference and along the whole continuous length.
8) Because plastic pipe is continuous it is possible to JET the system at a later date if necessary.

Richard Sturdy, Chairman of the British Clayware Land Drainage Industry took for granted the fact that delegates knew the advantages of clayware and instead quoted figures produced by a leading contractor of a drainage scheme involving the installation of lateral drains at 15 yard spacings and incorporating the use of permeable fill.

Cost per acre of drainage

	Clay	60mm Tubing	80mm Tubing
	£	£	£
Pipes	95	60	90
Installation	120	105	105
Permeable Fill	180	180	180
	395	345	375

Total cost to the farmer less 50% FHD Grant.

197.50	172.50	187.50

Thus, although there is a higher cost for clay installation, according to these figures, total installation costs are only £25 more per acre compared with 80mm tubing which l a lc flow . . Mr. Sturdy sid this a small price to pay, especially when comparing the 50% grant aided figures, and bearing in mind the long term proven reliability of clay.

Financing a contractor's business

Tony Molyneux, Agricultural Superintendent with the Midland Bank Ltd., produced more figures, this time for those looking for finance. He considered that as high rates, of inflation have increased working capital requirements, the amount of capital being set aside for depreciation and machinery replacement has become totally inadequate.

He concluded that little has been left for expansion and many have sought additional credit. He advised that whether one considers an overdraft on a current account, short term loan accounts, hire purchase, leasing or medium and long term loans, the true cost of each method of finance will depend on the rate of interest and also on the business's ability to utilize the capital allowance.

Manufacturers panel

At the end of the first day the Manufacturers panel produced some stimulating thought on the shape of things to come in drainage machines, indicating a healthy and progressive future. The six manufacturers forming the panel were from Bruff, Barth(GB), Hoes, Steenbergen, Interdrain and Mastenbroek to whom credit must be given for their very constructive contribution.

Avoidance of Compaction

Undoubtedly one of the highlights of the workshop was Gordon Spoor's paper. He reviewed the current research work going on in the National College related to pipe installation and the affect of soil conditions around the pipe on drainage effectiveness. Soil compaction and smear in the vicinity of the pipe tend to increase the height of the water table between the drains and restrict water out flow. This compaction could occur beneath the pipe, at the side of the pipe or within the backfill material itself. Of the three possible types of compaction in the backfill and at the side of the pipe are the most serious. Therefore during installation the aim must be to return the backfill in a stable loose condition and to minimise if not avoid completely any compaction along the sides of the pipe.

To minimise damage risks during trenching installations Mr. Spoor suggested the following:

1. Work wherever possible under drier soil conditions draining through a standing crop where appropriate.
2. Minimise cutter speeds, because high speeds tend to increase smear and break down the backfill thus increasing the chances of instability in the backfill material.
3. Always ensure the tile box is narrower than the cutters to avoid compaction at the side of the trench.
4. Avoid backfilling when the spoil is in an exceptionally wet or dirty condition.

"Machine colour doesn't matter"

Work by Bob Fry at NCAE during the past 2 years on trenchless operations indicated that all the current machines behave and move the soil in a very similar manner. There is a risk with these machines that some smear can occur at the side of the pipe when draining under moist conditions. This smear, however, is only of a very shallow depth and experiments have shown that the fitting of cutters on the back of the tile box can satisfactorily overcome this problem.

Mr. Spoor concluded that there are very few soils in Britain which are unsuitable for trenchless installation although a few further tests have to be completed before this can be confirmed. Care should be taken when mole drains are to be installed soon after trenchless pipe installation that the heave be rolled down first otherwise the moles will collapse as they pass into the disturbed soil area near the pipe.

Compaction and smear are not a particular problem with any installation method when gravel backfill is being used for mole drainage in top water problem areas. Greatest care needs to be taken to avoid compaction when draining to control groundwater problems.

Conservation Conflicts

The paper on Health and Safety in land drainage stressed some important aspects to be considered in this specialised field. David Mattey from the HSE in Nottingham clearly provided a few timely reminders. John Andrews from the RSPB also pricked a few consciences: When asked what his view was on compensation to farmers wishing to exploit some of the 3500 sites of Special Scientific Interest in GB, Mr. Andrews thought that it was often a breakdown in communication or even complete unawareness that caused the loss of area of important conservation value. Unfortunately, if the NCC cannot afford to pay compensation as a body, they could not lay the blame on a farmer or contractor — fundamentally it is the Government's responsibility.

The Role of **ADAS** and MAFF

John Waddington outlined where the Ministry and in particular ADAS was going in the '80s. This talk stimulated much interest and some direct contractors questions. He considered that by altering the grant application process his staff had more time for on-farm advisory work. When asked whether recent changes could lead to substandard work automatically receiving grant and cowboy contractors getting away with poor installation work, he considered that this could happen but in general it was the responsibility of the NAAC or perhaps another contractor based body to monitor standards and weed out the few bad teams.

The 'Workshop' was a **success,** and fully justified the initial aims. For the first time the core of those responsible for Land Drainage in UK assembled for a two day **'Workshop', a the need for co-o dina d discussi on many aspects of the industry** was certainly expressed by the enthusiasm of those attending. It is hoped that lbis will be the fore-runner of many more to come.

The Association acknowledges the support of
Interdrain, PLDMA, BCLDI, MAFF, NAAC, John Mastenbroek & Co. Ltd., Barth Drainage Machines (GB) Ltd., Bruff Manufacturing Co. Ltd., Eric Smith & Son (Stretton) Ltd., Henry Oakland & Sons Ltd., NCAE, Aqua Pipes, and all those who so readily gave their advice and guidance.

Tony Molyneux "Little left for expansion".

Bill Tait from Northumberland

WORKSHOP '83
FOR MORE DETAILS —
PHONE MIKE SAULL
0203 555100

Soil and Water, Volume 10, No. 1. Spring 82

TINES FOR FERTILIZING AND CULTIVATING THE SUBSOIL

Dick Godwin — Senior Lecturer in Soil Dynamics, outlines the work carried out at the NCAE on tine design for deep fertilizer placement.

Recent small plot experiments at Wye College, Rothamsted Experimental Station (RES) and the National Vegetable Research Station (NVRS) have highlighted the potential that exists for increases in the yields of many crops if phosphates and potassium fertilizers are applied to the subsoil. These yield increases appear to result from the improved uptake of nutrients associated with the higher moisture content of the subsoil.

Where deep loosening of the soil is required, the idea of incorporating the granular fertilizer at the same time as the cultivation is carried out is attractive. The Agricultural Development and Advisory Service, RES and NVRS are investigating the mechanization of this combined operation. Prototype equipment for use in the field-scale agronomic experiments is being developed at the NCAE. Currently the emphasis is on ensuring that the equipment will uniformly incorporate the fertilizer within the subsoil. Should this prove successful, further tests will be conducted to examine crop response to different fertilizer distributions in order to determine the level of uniformity required for farm practice.

Design specification

The equipment needed to meet the following design requirements:

i) complete soil disturbance to a depth of 0.4m;
ii) uniform incorporation of granular fertilizer in the subsoil between depths of 0.25 and 0.40m, at application rates up to 2,500 kg/ha;
iii) minimal draught requirement and suitability of the equipment for use with 100 kW four-wheel drive tractors;
iv) provision of a loose level uncompacted soil surface after cultivation.

The first three specifications were set so that a significant body of subsoil could be loosened and fertilized without the need for excessively high draught forces. This would allow the operation to be carried out with the range of large tractors commonly available on UK farms. The fourth specification was set to ensure the minimum of additional tillage work necessary to produce a satisfactory seedbed without causing recompaction of a previously loosened soil.

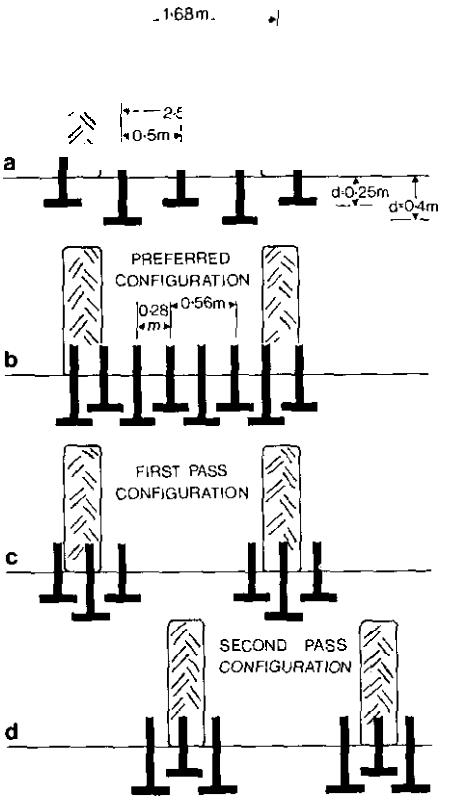

Fig. 1. Comparison of normal tine configuration (a) with preferred scheme (b) and two-pass system adopted to reduce draught requirements (c and d).

Tine configuration

The basic concept of the design is to deposit the fertilizer at depth in horizontal layers using winged tines operating at two depths. The deeper tines redistribute vertically the fertilizer placed by the shallower tines. The shallow tines ease the passage of the deep tines by loosening the surface layers and thereby increase their effectiveness. Although earlier work at NCAE shows that the normal subsoiler configuration Fig. 1 (a) with shallower working tines ahead of the deep tines would adequately and effectively loosen the complete soil profile, this tine arrangement would not produce the horizontal uniformity of fertilizer distribution required. Subsequent movement of the fertilizer placed by the shallow tines would therefore be minimal and result in very limited mixing with depth.

A closer tine spacing (b) is preferred for, although not giving a completely uniform horizonal fertilizer spread at both depths, it represents a practical minimum spacing which will still allow for adequate trash clearance, and leave a completely loosened unwheeled soil condition. The major disadvantage is a high draught requirement which would be beyond the limits of a 100 kW tractor under many soil conditions.

Reducing draught requirements

A solution to the draught problem can be obtained by conducting the operation in two passes using the tine configurations shown in (c) and (d). The soil disturbance and fertilizer distribution is the same as in the one pass operation but the draught is significantly lower. Good traction can be achieved during both passes because the tractor wheels always operate on undisturbed soil. A slight disadvantage is that the tine configuration on the machine must be changed from (c) to (d) at the beginning of the second pass. Care is needed to ensure accurate matching of suc-

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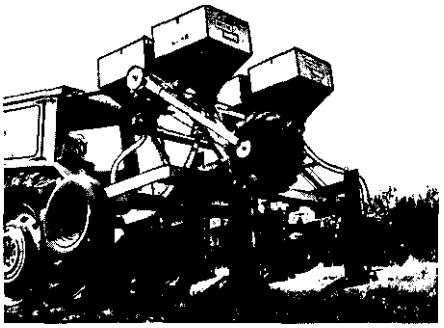
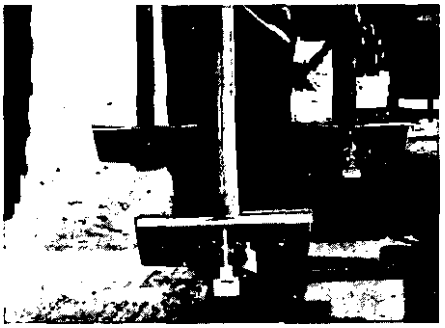
	Mean draught force (kN)	Area of soil disturbance (m^2)	Specific Resistance (kN/m^2)
1. 1st pass tine configuration (4 shallow winged tines + 2 deep winged tines).	32	1.325	49.1
2. 2nd pass tine configuration (2 shallow winged tines + 4 deep winged tines)	33		
3. Normal subsoiler configuration (3 shallow winged tines + 2 deep winged tines).	34	0.906	37.5
4. 2 deep winged tines	20	—	—

Working depth of shallow winged tines = 0.25m Forward speed 1m/sec
Working depth of deep winged tine = 0.40m

Draught Force and Soil Disturbance Data





Fertilizers can be applied to rhe soil during deep tillage with special arrangements of tines. Deflector plates below the tine wings aid the uniform spread offertilizer.

cessive passes, this being assisted by positioning the centre line of the tine groupings coincident with the centre line of the tractor wheels.

To minimise the size of the tractor required, it is necesary to equalise the draught of each pass. This is achieved by selecting appropriate numbers of tines and appropriate working depths for the shallow tines. In this case it has been possible to use the same number of tines in each pass but with the shallow tines operating at two-thirds of the depth of the deep tines which for practical purposes agrees with the second specification.

A uniform spread of fertilizer in a horizontal plane is achieved by allowing the fertilizer to fall at a controlled rate on to a deflector plate below the 0.30 m wide wings of the tines. By applying a greater amount of fertilizer through the leading shallow tines than through the following deep tines, a ratio of 1.3:1, an acceptable uniformity of distribution with depth can also be obtained.

Field tests

Field tests have shown that the machine will loosen the soil uniformly to the depth of the deepest tine, leave a relatively smooth soil surface and produce an acceptable uniformity of fertilizer distribution in the disturbed zone between 0.25 and 0.40m in depth.

The draught. forces for the first and second passes are not significantly different indicating that the design criteria have been met. Although there are six tines in use at any one time, their position is such that the total draught is only a little more than that required to operate three deep tines, with the added advantages of better fertilizer distribution and effective subsoil loosening under wetter conditions.

Although the draught of the normal subsoiler configuration is marginally greater than that used in the deep fertilizer application, the specific resistance (draught per area disturbed) is significantly lower. Thus, if future trials by agronomists confirm that deep fertilizer placement is desirable but that a uniform distribution of fertilizer is unnecessary, the normal tine configuration will be more efficient. If this is so, many conventional subsoiling units will be easily adaptable for deep fertilizer work.

Reproduced from the NCAE, Research and Development Booklet, 1981–82 Edition, pages

Copies of this booklet are available from:
Dr. R. P. C. Morgan,
Director, Research and Development
NCAE,
Silsoe. Bedford MK45 4DT.

SUCCESSFUL SUBSOILING — "LOOK BEFORE YOU LEAP"

Predictably, with the dry period in early Autumn last year, farmers could not wait to jump on a tractor, mount up their subsoiler and send smoke pouring into the sky. It was a good Autumn for a tool which often lies neglected in the farmyard nettles, but one wonders whether the frenzy of activity was as efficient as it could have been.

SAWMA organised two demonstrations in September 1981 looking at deep soil loosening equipment and its effective use. This is a summary of our results.

Spade work

'Look before you leap' is the message but I wonder how many farmers took up the spade and examined the soil at depth as a precursor to soil loosening. It is unfortunate if one wants to minimise power requirement and maximise shatter, that careful soil examination is necessary, because let's face it pit digging is back breaking work.

It must be said that. the identification of pans, poorly structured layers or general compaction, is not easy, however by letting the spade do the work, one can soon pick out resistant areas of soil. Each Soil Scientist has a different method of examining soil, some require more imagination than others! As a simple guide though one should pose the following questions which will help identify the need for deep soil loosening and the possible depth of cultivation operation.

Choose representative areas within a field to dig profile pits and include sites where you have noted poor crop growth, or waterlogging. Your problem may be localised so it is important to look in more than one place and interpret the results accordingly. It has been suggested that about 15 holes should be made in a 50 acre field.

When digging ask yourself:

1. Are there any resistant layers in the soil? If so. make a mental note and refer back to them once the pit has been completed.

After digging look for:

2. Characteristics of poor drainage in the subsoil i.e. mottling/gleying. If evident subsoiling may be wasted and drainage necessary.

Fig. 1. Soil loosened by a single leg subsoiler no wings, 20" depth. (dotted line indicates disturbed zone)

3. Zones where rooting is poor.
4. Large, strong aggregates which hinder penetration, zones of compaction, platey layers or horizontal fissuring. These layers will probably coincide with areas of resistance identified when digging the pit.
5. Moisture differences down the profile; in wet soils, compaction restricts drainage, thus above a pan the soil may be wet, while in dry soils the pan may be hard and dry, but the underlying soil wet.
6. Blue-grey areas (especially where crop residues have been ploughed in). These indicate poor aeration and often smell sulphurous.

Once one is sure that there is a poorly structured zone within the soil, measure how deep the layer is and set the subsoiler to operate an inch or two underneath.

Effect of depth of operation

At the RASE Autumn Cultivations Demonstration, the Association with the help of ADAS, mounted a working demonstration looking at the effects of different settings and depths ( )el tion Once the problem had been identified a traditional subsoiler was used to illustrate depth and spacing requirements. We were most grateful for the assistance and loan of a single leg subsoiler, by Watkins Naylor, especially when one considers the poor use we put it through.

Single leg no wings 20" depth

The compaction extended to about 14" depth, therefore this operation was about 6" below critical depth. Fig. 1 shows that a . narrow zone of shatter has be en c eated d the subsoiler foot has created what can be described as a square mole. A lot of power has been used to create a deep zone of disturbance.

Fig. 2. Soil loosened by a single leg subsoiler no wings 15" depth.

Single leg no wings, IS" depth

This depth is about right for the soil conditions. A wider zone of shat-

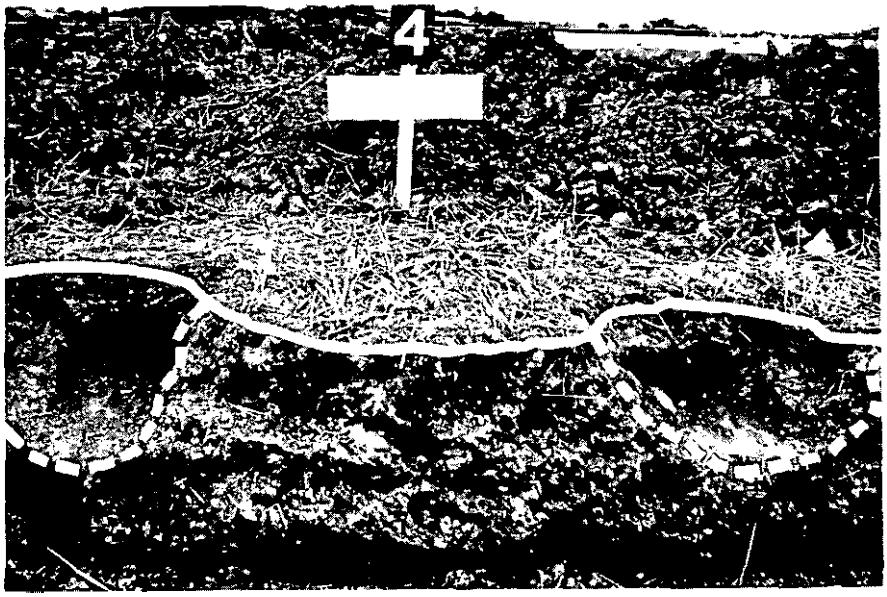


Fig. 3. Soil loosened by a Twin Leg subsoiler wilh wings, 60" centres.

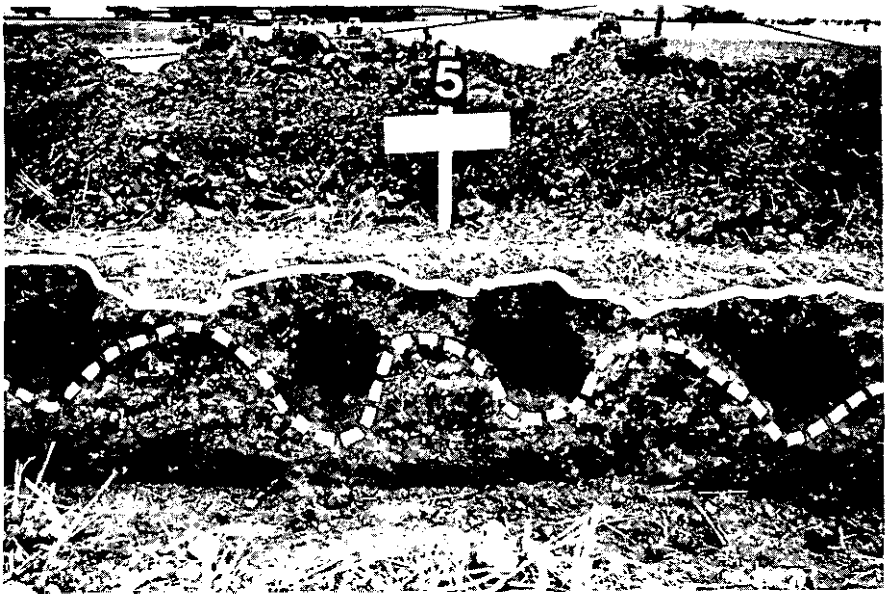


Fig. 4. Soil loosened by a Twin Leg subsoiler with wings, 30" centres.

(Dotted line indicates disturbed zone.)

ter has been created giving better heave and causing little disturbance in what is a well structured subsoil, Fig. 2.

Spacing

Spacing is particularly important in ensuring an extensive zone of shattering. Just as important is the use of wings. Wings will essentially widen the zone of shatter and hence increase the efficiency of loosening.

Using principles outlined in Vol. 9, No. 1 *Soil* and Water by Spoor and Goodwin, the Shropshire demonstration looked at different centres based on two subsoiler tines mounted on a standard tool bar frame, directly behind tractor tyres at 60" centres (Fig. 3).

The first difference to note from comparing Fig. 2 is the width of shatter; this has increased considerably due to the inclusion of wings. However between the tines there is still a large area of soil left untouched and compact. Figure 4 on the other hand indicates a second operation coming back in between the slots which gives a much better loosening pattern at depth. This is the sort of pattern farmers with traditional one or two tine subsoilers should be aiming for, by adjusting implement geometry and the number of passes.

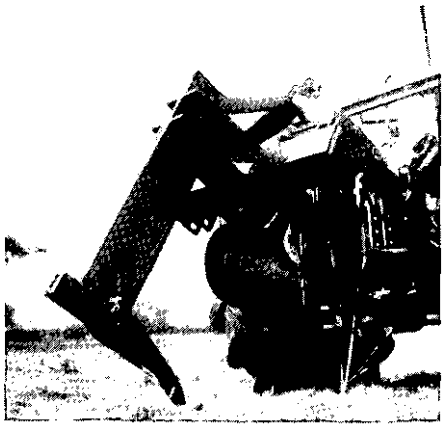
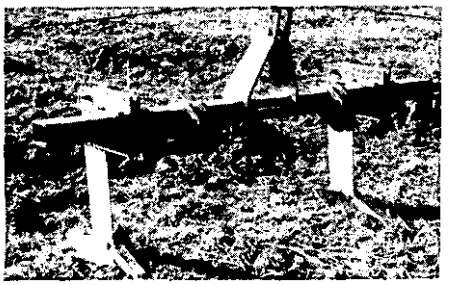


Fig. 5. The Watkins-Nayler wingedsubsoiler.

It is thus important to design subsoiling operations giving wide zones of shatter and adjust tine spacing on a toolbar with this and power capacity in mind. It is possible using a simple single leg subsoiler with a wing as shown in Fig. 5 to perform such a loosening operation.



Ransome's Twin Leg subsoiler

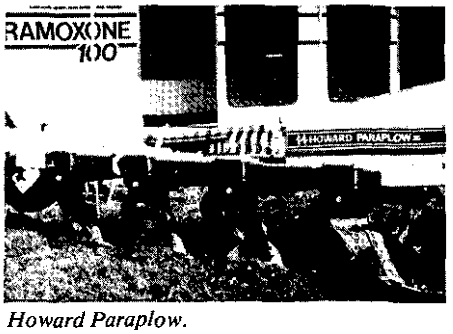
Modern soil looseners

There is now a whole range of different designs of machines ,on the market which disturb the soil using different shapes and combinations of wings set out across the width of a tool bar. Obviously, these will require more power but at demonstrations they have caused a lot of interest.

SAWMA looked at 5 such machines which gave different results in different situations. It is always difficult to quantify the effects of implements on the soil, and our experiences show that all those used are capable of producing excellent shatter in the right conditions.

McConnel Shakaeraror.

1. The Paraplow
(Howard Rotavator *Ltd.)*
Has angled blades passing through the ground at 45" to the surface. The legs ensure minimum surface disturbance to suit direct drilling, reduced cultivation and grassland situations. The soil being broken as it passes over the legs with cracking following the natural fissuring of the soil. The Paraplow works extremely well as a fissure reopener and gave good results in conditions where the soil was relatively moist at depth. Leaves a very smooth stepped surface.



Howard Paraplow.

2. The *Flatlift* *(Taylor* Gent)
   The Flatlift tine uses a point and shin that is tapered to a cutting edge, thus giving no lifting effect in from of the shank. The lifting comes from the wings at the back ensuring that the loosened soil is not brought to the surface. At demonstrations this produced an extensive zone of shatter across the width of operation with a very level surface.

3. The Shakaerator
   (F.W. *Connel* Ltd)
   The Shakaerator is vibrated through the ground by the tractor's p.t.o. The whole implement is moved up and down and from side to side at the rate of 9 or 10 vibrations a second using a vibrator unit. It can work without bringing large lumps to the surface or by mixing topsoil and subsoil. This machine worked well in dry situations, but proved temperamental in moist soil.

Taylor Gent Flatlift.

4. Triple Task + Progressive
   (Haylock Ltd) (Flatford Ltd)
   The progressive type cultivators use the principle of loosening from the top with different banks of tines. These range from sweep tines moving deeper to a final bank of subsoiler blades.
   Both machines gave variable results dependent upon soil conditions. Setting is critical but when correct, complete deep loosening is possible.

Summary
1. Get critical depth right.
2. Use wings to widen the shatter zone.
3. Set spacing to give an acceptable surface finish and a wide enough shatter zone at depth.
4. Loosen from the top down.
5. Above all make sure that the operation is necessary because loosened soil is very weak and subsequent trafficking can cause resettlement and severe compaction.
6. 'Look before you leap'.

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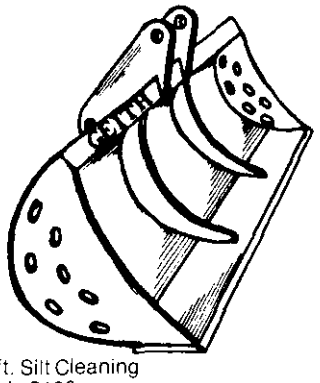

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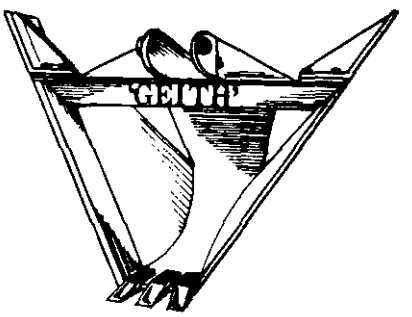

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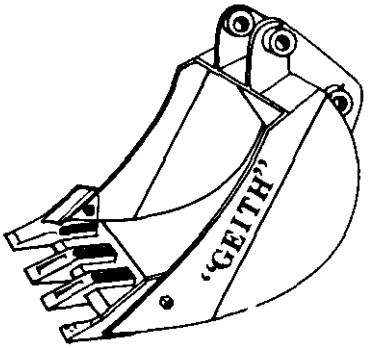

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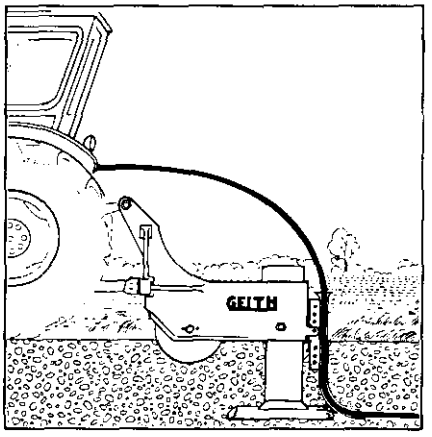
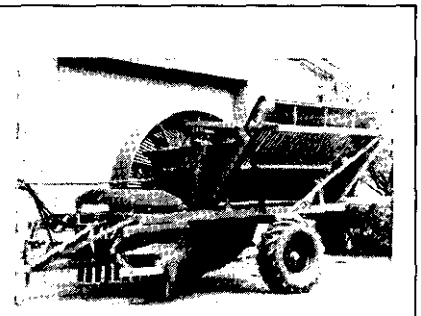


"Geith" Mole/Subsoiler
Plough with tube laying
attachment



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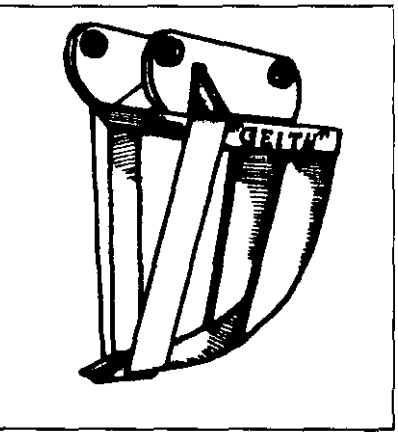

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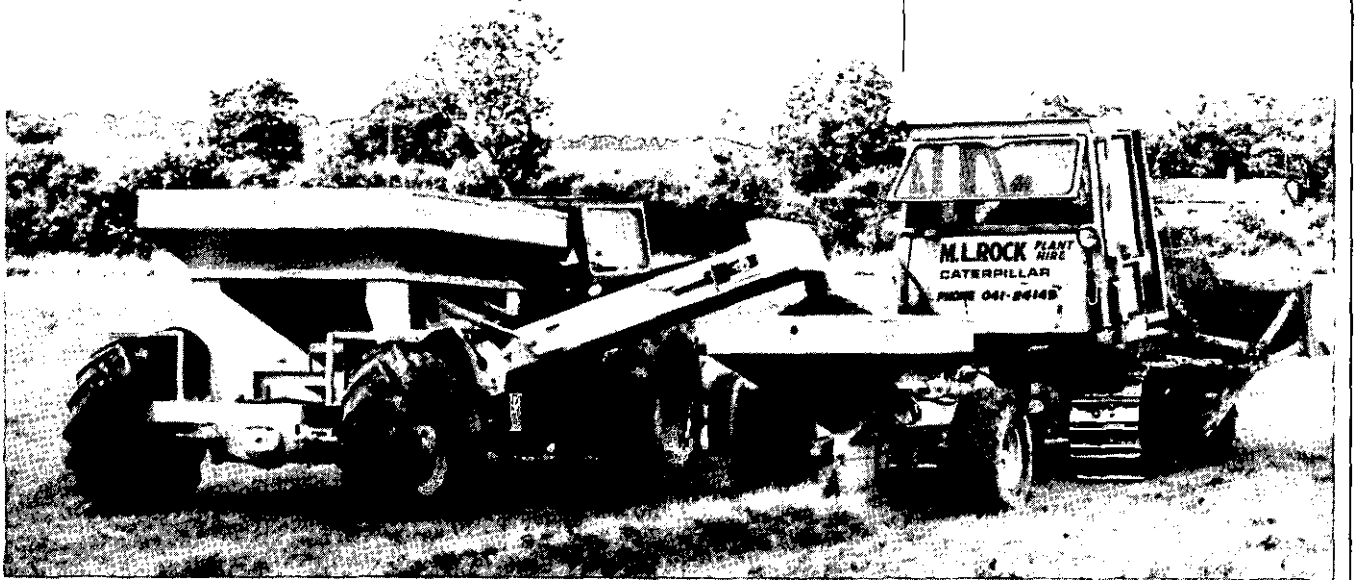
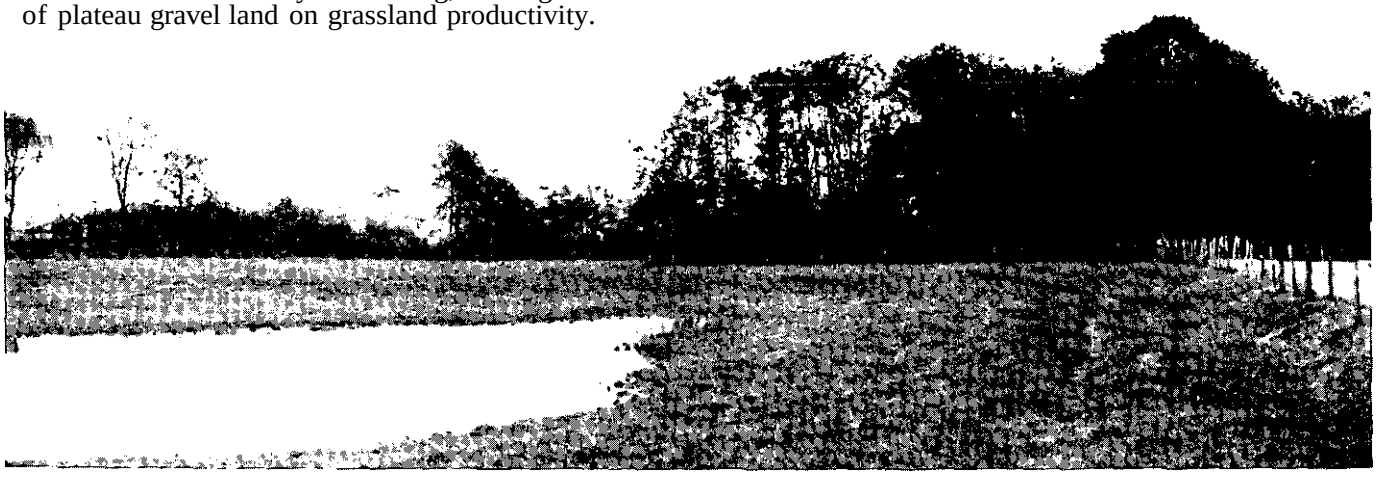


Crop Growth *Soil and Water, Volume 10, No. 1. Spring 82*

GRASSLAND PROBLEMS ON RESTORED LAND

Peter Gagen presents a summary of his work as a postgraduate student in Soil Science at the University of Reading, looking at the effects of the restoration of plateau gravel land on grassland productivity.



Summary

The restored soil of the study area was particularly weak, and poorly drained. This has caused poor quality grass growth and led to 40% of the 90 hectare site being affected by soil structural damage, standing water, puddling smearing, compaction, and hard capped ground. This paper looks at the causes of these problems and suggests possible solutions.

Causes, Origins and Effects

1. Presence of standing surface water
This is due to:

i. Poor penetration of rainwater.
ii. Neglect of open channel drains.
iii. Lack of sufficient open channel drains, ditches and subsurface tile drains.
iv. Incorrect siting of open channel drains with respect to the newly restored soil and relief conditions.
v. The presence of a perched water-table resulting from:
   a. Impervious clay at or near the ground surface.
   b. Collapse of soil structure following severe *puddling/smearing* by stock *and/or* farm machinery.
   c. Cultivation pans created when re-seeding.
vi. Formation *of* water receiving sites and the collection of surface water *run-off* due to:—
   a. Insufficient contouring of the underlying clay and/or unexcavated gravel.
   b. Lack of a sufficient gradient over the site.
   c. Oversteepness of former pit sides which are now field edges.
   d. Lack of sufficient time for settling to occur before re-seeding, ploughing and grazing of restored land is commenced. (See also iii and iv.)
   e. The formation of platy structure in the top soil enhancing the lateral displacement of surface water to depressions.

2. Smearing and surface puddling
This is caused by:—

i. Overgrazing and incorrectly timed grazing on permanent pasture.
ii. Incorrect timing of operations such as ploughing, re-seeding, fertilizing and mowing.
iii. Incorrect location of field entrances and feeding troughs in relation to the altered soil conditions.

3. Too high fertilizer usage

It is a mistake to think that high applications of fertilizer will effectively promote the re-establishment of grass. It is more likely to—

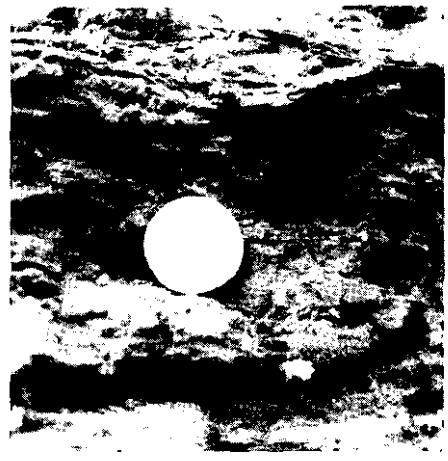
i. Encourage surface puddling by increasing the flocculation (bringing together) of clay particles in the soil so reducing pore space.
ii. Encourage a rapid decay of any surface mat which could increase the soil load bearing capacity.
iii. Lead to a more upright growth of grass, thus exposing larger areas of soil to the elements.
iv. Give shallower rooting especially where the fluctuations of the perched water table lead to a surface deposition of fertilizer, inducing seedling burn.
v. Cause a collapse of soil structure, something which was formerly stabilised by plant roots.
vi. Increase acidification and the promotion of an extremely loose and friable tilth susceptible to wind erosion.

Requirements and solutions

For good grass growth one should manage the topsoil in order that:—

1. Free exchange of gases and percolation of rainwater into the soil can occur.
2. Root growth is *unimpeded.*
3. The soil has strength to withstand the impact of heavy rain even without surface cover.
4. It can provide bearing capacity for all traffic.

In a period of only twenty years after gravel extraction and restoration, the newly arranged soil **WILL DEVELOP LARGELY IN RESPONSE TO THE NATURE AND QUALITY OF ITS REPLACEMENT AND THE FARM MANAGEMENT IT RECEIVES,** whereas soil formation under natural conditions has taken a period of 10,000 years.



Weak Platey Structures.

Drainage

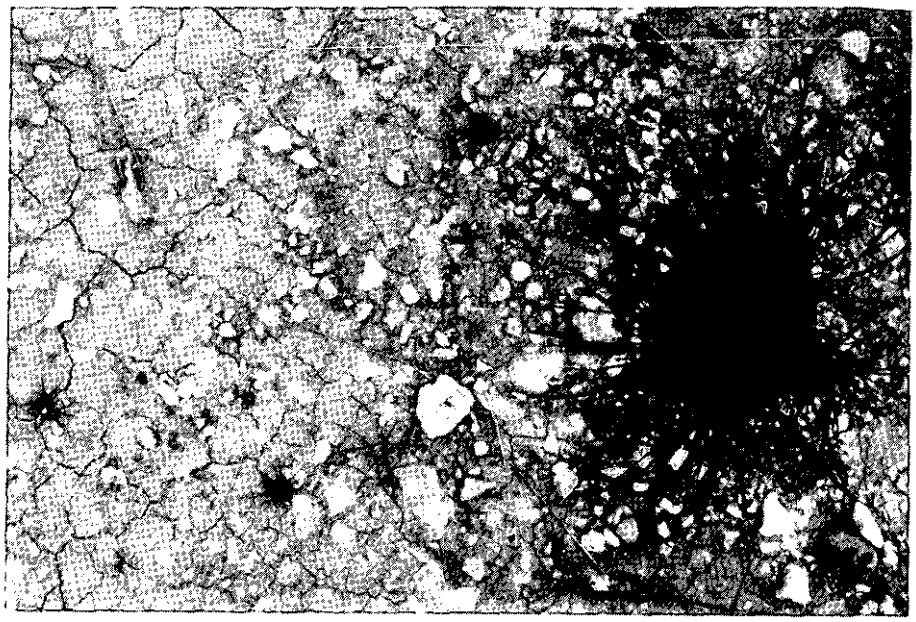
Effective drainage of restored sites is most necessary and of prime importance. This should be with tiled mains

with adequate fall and in the worst hollows submains. Mole drains should provide adequate connectors to the tiles. The installation of such a system should be the responsibility of the mineral contractor and be a part requirement of the granting of extraction permission from the Local Authority and the landowner. This would ensure that land would return to a productive state.

Landscaping

A complete revision of the existing practice of dry working gravel extraction would help improve land quality after restoration. The present system of extraction means that the restored ground surface is usually lower than that which previously existed. It is essentially a basin, whose floor is graded to an outfall.

Why not use a series of domes, giving an accentuated topography in conjunction with properly installed tile drains?



Capping of the weakly structured reinstated soil.

Subsoiling

Subsoiling could then be carried out periodically to improve soil condition and enhance soil water movement.

A cutting disc is recommended in order to reduce sward tear. Double wheels or caterpillar tracks are essential to prevent tear by slip and further puddling/smearing.

Subsoiling should be to a depth of **30** to 35 centimetres, connecting into permeable fill. This should not be undertaken during May to July unless adequate grass for the herd is available. The reason for this is that the soil may become desiccated if a drought follows subsoiling. Late spring or early summer is recommended. Late autumn is also possible after crop removal as the soil will receive the benefit of the winter's frost. The soil should be dry to the depth to which subsoiling is to be attempted.

The sloping land of the dome sides should be subsoiled at an angle to reduce the risk of both soil erosion and formation of wet areas at the base of slopes.

Maintenance of the ditches surrounding the fields is very important. This will ensure that the drainage system is effective.

Puddling and smearing are severest near gateways. It is recommended that mineral operators consult farmers as to the siting of gateways particularly if new fenced boundaries are installed. Drains can then be laid either side of gateways.

Good grazing management

Grazing should be suspended at the start and end of the season in order to prolong the use of grass and so avoid the need for conservation. Stock must be kept off the land throughout the first two years following reinstatement in order to allow the surface to settle and for soil structure to consolidate. Where stock is used to control grass growth they should be kept off not only between October and April but also during wet weather.

Conclusions

Good management requires the appreciation of changes which are constantly taking place in the soil. Increased vigilance and awareness are necessary when farming restored land which has had the bulk of its subsoil removed and the remainder thoroughly mixed before being replaced and reworked.

Mineral operators by careful and informed handling of the worked land during a programme of reinstatement (which it is suggested should be of a statutory period of five years following the installation of the drainage system), will ensure continued successful restoration.

Furthermore farmers should be made aware that the land, even after a S year reinstatement programme, will need careful management before it can achieve a well structured and fertile state.

UTILISATION OF SEWAGE SLUDGE ON AGRICULTURAL LAND

Every year Britain produces more than 30 million tonnes of wet sewage sludge. The cost of disposing of this material is about £180 million a year — some 40 per cent of the total cost of treating sewage. At present about 25 per cent of the sludge is dumped at sea hut this proportion may be reduced in the future. Another 30 per cent is dumped in landfill and the remaining 45 per cent is put to good use by farmers who have used sewage sludge as a fertiliser for many years. Here James Stark of the Water Research Centre looks at the use of sewage sludge in agriculture.

Sewage sludge contains nitrogen and phosphorus and both nutrients are present in higher concentrations than in farm yard manure but unlike FYM, sludge contains little potash. If all the sludge produced were used on land it could meet probably only 5 per cent of the national requirement for N fertiliser but perhaps 15 per cent of phosphate needs. Sludge saves money for the farmers who use it. The nitrogen and phosphorus in sludge put on land in 1981 was worth about £15 million.

Agricultural use is the only current means of sludge utilisation which offers benefits; in soil the plant nutrients and organic matter in sludge improve conditions for plant growth. In addition to the value of N and P already mentioned, recent evidence has shown that crops benefit particularly from organic matter. Organic manures can cause increases in yields greater than those expected solely on the basis of their content of inorganic nutrients. The explanation for this "extra" benefit is related to soil structure. New high-yielding crop varieties demand readily available supplies of nutrients throughout their growth, and the improved physical structure which organic matter confers on a soil can be crucial in ensuring these supplies. Organic manures make heavy soils more friable and give light soils a better crumb structure and moisture holding capacity.

Various types of sludge may be applied to land. This is because sludge can be treated in different ways at sewage treatment works, depending on the proposed disposal route, which may in turn be influenced by the availability of agricultural land in the proximity of the sewage works.

James Stark (right) and Assistant apply air-dry *digested* sludge *to plots.*

Liquid sludges

Liquid raw sludge receives minimal treatment but liquid digested sludge is held in tanks at 30°C for a month during which up to 40 per cent of the organic matter is broken down to methane and carbon dioxide. The methane is often used to provide power for the sewage works or occasionally even to provide fuel for specially converted lorries taking sludge to land. Digestion ieduces odours and the numbers of some pathogens and releases nitrogen in ammoniacal form which is readily available to plants. Sludge may also be treated by lime stabilisation which involves adding calcium oxide until the pH is raised to 11; this reduces odour and destroys most bacteria but loss of ammonia can occur. Additional treatment involves dewatering of raw, digested or lime-treated sludge. Dewatering is achieved mechanically or by allowing the sludge to flow onto drying beds. Dewatering usually increases the dry solids content of the sludge to at least 20 per cent and this is equivalent to a reduction of volume of perhaps ten-fold with a concomitant reduction in disposal costs.

Liquid sludges are useful to farmers as they are easily applied to grassland directly from tankers or ,with irrigation equipment, several times during the growing season. Of all the sludge types, liquid digested sludge contains the highest proportion of readily available nitrogen.

Solid sludges

Dewatered sludges produced by air or mechanical drying must be ploughed in, and so can be applied only once a ye u usually in the autumn before a winter-sown crop. Solid sludges also contain less plant nutrients per unit of dry weight than liquid sludges. However a normal dressing of solid sludge contains more organic material than does a dressing of liquid sludge, and so builds up soil organic matter levels more effectively.

Manurial value

The Soil Science Section of the Water Research Centre (WRC) was formed at Stevenage in 1977. Work has been carried out on the manurial value of sewage sludge used as a fertiliser. Three field trials were set up to study the nitrogen value of lagoon-matured digested sludge and liquid raw sludge; applied annually to established grassland in both the autumn and spring. Sludge is produc-

ed by sewage works every day of the year and spreading takes place over as many months as possible. It is important to establish how much nitrogen is lost from autumn and winter applied sludge, hearing in mind potential pollution of groundwater and the needs of the crop for nitrogen in the spring.

In another experiment, dewatered sludge cake was incorporated into the soil at various rates and cropped with ryegrass for three years to measure the gradual release of organically bound nutrients. The three field trials of identical design were established on three different soils, a sandy loam, a clay loam and a silty loam. The results have shown that in general terms, all the ammoniacal-nitrogen in sludge is immediately available for crop uptake and 10–30 per cent of the organically bound nitrogen is made available in the first year after application of the sludge.

Land reclamation

Another use for dewatered sludge is in the reclamation of land, of which there are some 20,000 hectares justifying restoration. A field trial was therefore started on an old gravel quarry which had been filled with urban refuse and capped with boulder clay'. It was felt that restoration of refuse tips was a useful method of using sludge and helped return waste land to agricultural production. Furthermore many tips occur near towns and are therefore close to sources of sludge. The field trial compared the effects of two types of dewatered sludge: dried digested sludge and lime-treated cake. A single, heavy application of about 100 tonne dry solids of either type of sludge restored the site to productive grassland the following year and sustained grass growth over four years of cropping without the need for extra inorganic fertiliser. Consolidated sewage sludge is particularly useful for restoring fertility to impoverished soil. It provides a source of slow-release nitrogen and phosphorus together with organic matter to improve soil physical conditions for crop root growth.

Application guidelines

The practice of applying sludge to land is likely to increase in the future and the recent report of the Department of the Environment's Sub Committee on the Disposal of Sewage Sludge to Land[2] contains guidelines aimed at ensuring that sludge is used on land safely with regard to contamination problems, and efficiently in terms of its plant nutrient content.

It is essential that sewage sludge is applied carefully to avoid surface run-off; which could pollute rivers and ditches. Spreading of sludge is not carried out close to ditches because this could result in direct contamination of watercourses. ige is also applied i accorda ic with crop

Young Lettuce — high rote of sludge application (left hand plot) control (right hand plot)

requirements for nutrients to avoid groundwater pollution following leaching of surplus nitrogen.

Potential problems from pathogens are avoided by taking extra precautions where risks are greatest. Thus, for instance, appropriate 'safe periods' are recommended between applications of different types of sludge to grassland and grazing by cattle.

Sewage sludge contains higher concentrations of many elements than occur in most soils, so additions of sludge are carefully controlled to avoid metal contamination problems. The guidelines propose limits for twelve elements. The limits are conservative because of the absence of definitive evidence from experimental field trials, and the belief that it is better to adopt a cautious attitude initially and to raise the lim if experimental idenc ions show higher concentrations of metals in soil to be acceptable. The limits are designed to protect not only crops but also humans and animals which eat them. Metals in sludge, when added to soil, are u by the mixing of sludge and soil to plough depth. The uptake of metals by plants grown on a sludged soil is influenced particularly by soil pH value and cation exchange capacity, as well as by the type of crop. The transfer of metals from soils to crop is greatest in acid soils of low cation exchange capacity.

Current work

The WRC is examining metal uptake by crops from sludge-treated soil by means of laboratory plant pot and field trials including soil concentrations of metals in excess of those currently thought to he acceptable. Choice of crop is very important in these trials. Wheat and potatoes contribute 74 per cent to the plant part of the human diet and so are very relevant to dietary intake studies involving cadmium and lead for Instance, which are principally toxic to animals rather than crops. Red beet and lettuce are known to take up large amounts of heavy metals and are good experimental indicators ,of the availability to crops of metals in soil. Although they have been widely used in studies involving phytotoxic elements such as copper, nickel and zinc, very little sludge now goes to horticultural land where these sensitive crops are grown.

Conclusions

Utilisation on land is often the most economic sludge disposal option for inland sewage treatment ' k It is also the only route which involves productive use of the plant nutrients and organic matter in sludge. Experiments are continuing at the WRC to define both the fertiliser value of sewage sludge and acceptable te of application for agricultural land.

References

1. *COKER, E. G., DAVIS, R. D., HALL, J. E. and CARLTON-SMITH, C. H. Field experiments on the use of consolidated sewage sludge for land reclamation, 1976–81. Water Research Centre Report ER 257-M, 1982.*
2. *DEPARTMENT OF THE ENVIRONMENT/ NATIONAL WATER COUNCIL. Report of the Sub-committee on the disposal of sewage sludge to land. DOE/NWC Standing Technical Committee Report 20, DOE 1981 (available from the National Water Council, 1 Queen Anne's Gate, London SW1H 9BT, price £4).*

V10-1

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Soil and Water, Volume 10, No. 1. Spring 82

"R & D — WHAT'S IN IT FOR ME?"

Warwickshire farmer Brian Douthwaite discusses research **id development** in **agriculture with emphasis o the importance** of **ii between** farmers and scientists.

As a practising farmer I have taken a hard look at research and development and its links with farmers. Farming 550 acres in a family partnership on lower lias clay, good timeliness of operation is most necessary for successful grass and winter corn cropping. Recent years have seen a continuing arable swing to virtually all autumn sown cereals and oilseed rape. We now have 300 acres arable; the rest is grass supporting an 115 strong dairy herd plus followers as herd replacements or for beef. This has brought a tremendous pressure on time and timeliness, particularly in the autumn months and hence a very large number of farmers have switched to reduced cultivations. However what is a reduced cultivation? There e b as many d types of d d or minimal cultivations as there are farmers!

Having been on the NFU's Council for five years, I have an insight into the political side of farming and through the NFU's Technical and Machinery Committee, into research and development. The communication of results through to farmers is critical. Unless the chain from researcher to farmer and vice-versa is completed then research, to my mind, is merely for the academics and is of no practical value. While the need for a strong political lobby will continue to be essential not only on prices, legislation etc., but also to put our sound case for the need to farm without undue constraint from the environmental and so called welfare lobbies, our success or otherwise as farmers will depend on the availability, and our use of, the benefits of research. Happily the NFU Technical and Machinery Committee is taking a keen interest in research and development, so I have some understanding of how research comes about and how the results progress (hopefully) through a chain of intermediaries to the ultimate user: you and me 'the farmer'.

Priority subjects for State financed research and development are decided through the Joint Consultative Organisation (JCO) after extensive discussion with farmers and others. At this point in time the JCO is trying to look 10 to 15 years into the future to assess what will be needed to enable farmers and growers to improve quality and efficiency. MAFF and the Department of Education and Science pay for this research and development which mainly is carried out at Agricultural Research Council establishments, Experimental Husbandry Farms and at agricultural departments of universities. It is not the Intention of this article to become deeply involved in the subjects being researched at the moment, or which have been, or ought to be researched, but rather to concentrate on the communication of the results of research to the farmer and grower.

Research stations

I have been fortunate to visit a number of ARC establishments either as a member of an official NFU delegation or to attend an Open Day. The Grassland Research Institute (GRI), Rothamsted. Experimental Station, the Weed Research Organisation (WRO), the Let L ato and the National Vegetable Research Station (NVRS) come immediately to mind. There are, of course, a number of others which I have not visited. Each publishes the results of its work in its Annual Report, available to those interested and also in papers given by members of staff to conferences etc. Some work is centred on one establishment, some is spread throughout a number making it difficult to get a complete picture. Is this a case for better collation? Research reports often cater for a very wide audience and part of each report — or each article — should be aimed at the farmer rather than the fellow scientist or adviser. Authors should imagine that they themselves are farmers and briefly and simply answer the question 'What's in it for me?' Perhaps such extracts could be collated as a farmers' guide to research and development.

Typically, results of the ARC research move down the chain through the Experimental Husbandry Farms (EHF) for development. ADAS advisers then sift the results and pass them on to farmers in a language which we understand. Commercial firms often take up the results of research. The outstanding results of work at the National Institute of Agricultural Engineering (NIAE) have been put into commercial practice in very recent years, e.g. improved grass conditioners on mowers and improved pick-up reels for forage harvesters. Outstanding results have also come through joint projects with agricultural machinery manufacturers, e.g. Taskers Tillage Train and Bomfords Dynadrive. Agrochemical manufacturers are another obvious example of commercial firms applying the results of basic research; though we may think that they have been slower than leading farmers in this respect when looking at research into reducing rates of application. There are several exciting developments in spray technology already on the farm and in the pipeline, for example, controlled droplet application and electrically charged spray particles.

Shows and societies

The Agricultural Show Societies, led by the 'Royal' (RASE), make a very important contribution to the communications of R and D particularly by the specialist working demonstrations which they stage and the conferences which form such an important part of the winter farming calendar. There are many societies and associations which bring together farmers and growers of similar interests in small groups, e.g. Grassland Societies which exist in most counties and agricultural discussion groups which seem to flourish. A very good example, I think, is the Soil and Water Management Association which not only organises demonstrations and exhibitions at agricultural events and shows but also communicates the results of research and development in a practical and effective way through this journal. Quite recently the Association has submitted a document to the JCO listing areas of prime importance for future research requirements in the soil science field.

Conclusions

A very great deal of basic research is in progress and this should go hand in hand with a continuing and effective communications policy. We as farmers must see that the results of research are passed QUICKLY through the chain to the farmer and grower. With this in mind I make a special plea to those ARC establishments which have not yet formed an Association to enable farmers to attend special open days etc., to do so without delay. Not only does this provide us with the earliest possible access to the results of research (a ic those who ta e u t the benefits of the research very early get the full commercial it enables us to meet the scientist face to face and talk to each other in a mutually comprehensible language. Every opportunity must be taken to improve the understanding between us and the scientist working on our behalf.

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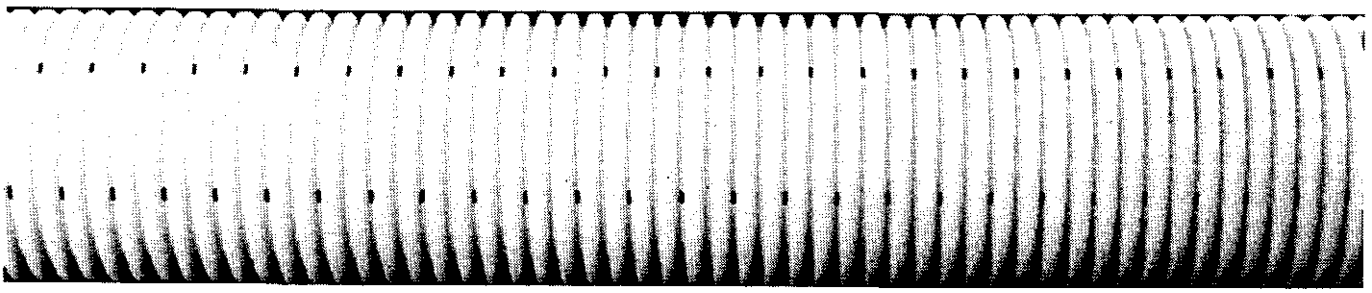
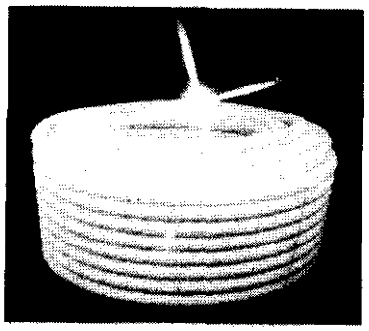
IN LAND DRAINAGE PIPE





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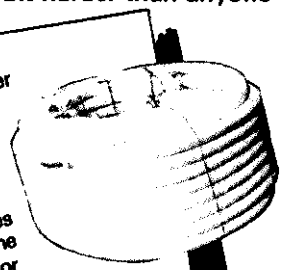

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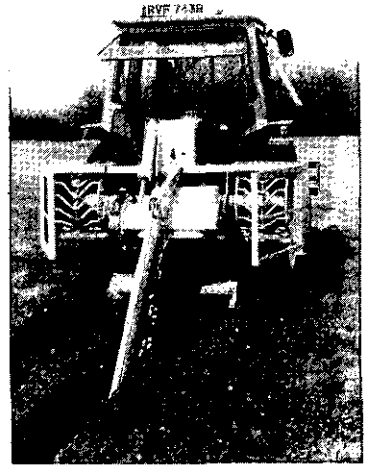

The advantages of a trencher with a well proven power unit, high cab comfort and good mobility both on the road and over rough ground are now available to tractor owners at only a quarter the cost of specially built trenchers to a similar specification.

The AFT 65 fits standard category 2 three point linkages and the need for tractor gear box modifications is eliminated by the trencher's hydraulic wheel drive system. This operates direct onto the tractor rear wheels and can be engaged or disengaged at will.

Speed selection is fully variable between 0 and 300 metres/hour to suit ground conditions and depth of dig (although the maximum speed depends upon the capacity of the tractor's hydraulic pump). The oil is circulated through the frame of the trencher for cooling and is filtered immediately before returning to the tractor rear axle/reservoir.

The digging boom is raised and lowered hydraulically and there are four different lengths of digging boom and chain to cater for different classes of work, maximum depth 33" to 51" (85 cm to 130 cm). Trench widths can be varied between 5" and 12" (12 cm and 30 cm) on a single digging boom by changing blades, and between 15" and 18" (37 cm and 45 cm) on double digging booms which are mounted side by side.

Soil disposal is by twin augers which leave the soil conveniently close to the trench for backfilling and the crumber end is autocompensating for alterations in trench depth whilst digging. A grading device for drainage and a backfill blade are available as optional extras.

The drive to the digging chain is taken from the tractor P.T.O. through a torque limiter which protects the trencher from shock digging loads.

When not mounted on the tractor the trencher stands on two front support legs with the tip of the digging boom ready to be reconnected at any time. Mounting or demounting takes approximately half an hour.

A. F. Trenchers claim that the AFT 65 thus fulfils the special needs of the farmer who wishes to undertake some of his own drainage work or the civil engineer or contractor installing, a great variety of pipes and cables in many conditions.

A simpler version of the AFT 65 is available without the hydraulic wheel drive unit for those tractors with creep speeds similar to that given by the drive unit. i.e. 0–300 metres/hour maximum speed at full power.

Further details can he obtained direct from the manufacturers:—

Mr. W. D. Baker, Soles Manager, A. F. Trenchers Ltd., Gosbecks Road, Colchester, C02 9JS.

AGRISPON — A SOIL'SUPPLEMENT WITH A DIFFERENCE?

After y yea f op t ıd research a soil supplement named AGRISPON has been introduced into the ·ld Agricultural ·ket

Early in 1980 the product was introduced to the UK for trial use on farm, vegetable and horticultural crops.

Agrispon has been welcomed by farmers in other countries in the world as a significant contribution to their enterprise, and trial work in this country is proceeding apace to present evidence for our use.

Agrispon is a clear solution of both organic and inorganic compounds Including some 26 trace elements, many of which are in chelated form. It also :oı ıi organic mpour ds, which ·ti ıl· activity of certain soil borne organisms and specific growth activity in plants producing responses similar to those experienced with cytokinins and gibberellins. The manufacturers claim that Agrispon works in two ways.

1 It enables plants to establish themselves more quickly and to utilise available fertilizer more effectively.
2 It works as a biological key to the Nitrogen cycle which can unlock nitrogen in the soil naturally, therefore stimulating plant growth.

Past experience gained from laboratory tests, greenhouse pot trials and large scale field experiments reveal that Agrispon enhances crop growth, resulting in greater yield, when used in addition to the normal recommended rate of nitrogenous fertilizer.

Field ıer ne

Fi· ·kp rin ·s demonstrate that under normal conditions of soil management ·e application of nitrogenous fertilizer may be reduced by amounts varying between 50–70% depending on soil type, if supplemented by Agrispon.

Farmer tests and replicated experiments on Wheat, Barley, Oil Seed Rape, Grass, Potatoes, Sugar Beet, Kale, Cabbage and other farm and horticultural crops have demonstrat-e· that yields can be maintained when tl use of _ ı from conventional sources is greatly reduced and in many cases increased yields have been recorded.

Agrispon may be used on all farm and vegetable crops, trees, house and greenhouse plants as well as pastures and meadows. It is applied simply with a standard farm sprayer usually at the rate of one litre per hectare.

Documented evidence from all over the world shows that the application of Agrispon advances the maturity of the crop. In the UK tests on Oil Seed Rape, Barley and Wheat have shown as much as 10 days earlier maturity against control plots, where recommended rates of nitrogen were used.

Agrispon has demonstrated its ability to stimulate root growth, increase the availability of Nitrogen and to increase the micro-organisms population of the soil.

Indirectly it helps in building up humus and organic matter and provides improved physical structure of the soil. Moreover Agrispon treated plants show less moisture stress under drought conditions or where moisture is not readily available.

Advisors' Diary

Soil and Water, Volume 10, No. 1. Spring82

THE WORK OF THE SOIL SCIENTIST

Richard Dight, an **ADAS** soil scientist stationed at Trawsgoed, The Regional Centre in Wales describes his work.

An important part of my work involves the pen — with communication the aim; I look after all **ADAS** soil science publications. Advising other colleagues on soils and plant nutrition is also a part of the soil scientists job often unseen by the farmer, but the bulk of the advisory work is done in conjunction with Agricultural and Horticultural Advisers, who bring farm problems to my notice. There are two particularly busy periods for the soil scientist, the first is late spring and early summer when farmers start to see evidence of poor growth or crop failure, the second is in autumn after harvest if crop yields are poorer than expected. At these times of the year soil and plant analyses are commonplace in an attempt to solve the problem and some may need a visit to the farm to examine the soil in detail and to discuss the remedy, in order to prevent a recurring problem.

Experiments and ***communications***

Some problems are not readily solved in one visit and may need to be followed up after consultations with colleagues in Agronomy, Entomology or Plant Pathology. When the same problem occurs on several farms in a particular area then more detailed investigation may be required in order to find a solution. This may take the form of soil and herbage sampling and analysis over a large area. Examples of such work are copper, cobalt and molybdenum surveys in some hill areas of Wales. **Alternatively** ;ie c experimentation may be needed to provide the answer. A current example is the level offertiliser especially potash that is needed to maintain reseeded swards on upland peat soils. The programme of experiments provides additional knowledge that is helpful to farmers. Communication of this new information is very important; in this instance I am presenting a paper at a local grassland society meeting under the heading ***Current Fertiliser Trends.*** In this instance it is a farmer's reluctance to use lime that is the focus of my talk; farmers know they need it but they put off the expense for as long as possible, quite often until crop failures press the point home hard. We find that lime quality is very important; farmers are getting lime on the cheap as limestone dust or screened limestone. Only 20% of this 'dust' passes the 150 micron sieve Instead of the recommended 40%.

Another example of how our experiments have helped farmers is our testing of phosphates when in this part of Wales basic slag ceased to be the major source. Soil analysis will save money, pinpoint deficiencies and indicate if too much or unbalanced fertiliser dressing have been given. The value of FYM and slurry, the importance of drainage and soil structure are also points to consider in preparing a talk.

Agricultural shows

Exhibits and demonstrations at agricultural shows and farm walks are effective means of getting information on particular subjects across to the farmer. Designing displays to do this is an important Dart of the promo-:ion effort. A Sheep Breeders A open day in Wales is usually a good opportunity which we utilize to demonstrate hill land improvement methods and management.

Inter-departmental liaison

The effect of land improvement on the trace element content of herbage has led to collaborative work with other **ADAS** specialists such as nutritionists, chemists and vets who seek information on soil fertility that could be affecting livestock health and animal nutrition. Similarly there is liaison between drainage officers and soil scientists on more difficult drainage problems where soil conditions need special consideration and farmers need guidance on soil management to get the best from an improved drainage system.

Although visits to farms and horticultural holdings are always full of interest there is much to be done on other aspects of the work; for me this includes writing and editing **ADAS** booklets and leaflets on soil science topics and making technical material easily digestible to busy farmers whose time is limited.

My work is varied, each telephone call brings a new unsolved problem and the detective work involved in finding a correct solution and persuading the farmer to adopt ones' recommendations is absorbing. The limite(res available to me for experi nent must be used to help to provide the industry with answers to the practical problems that arise for example from the intensification of agriculture. and the need to increase efficiency of production on the various soils of the a: lping as a soil scientist in these changes is the justification for my work.

Soil Scientist, Bryan Davis (right) and SAWMA Technical Secretary, Mike Saull examine rhe subsurface losening effect of rhe Flatlift or lost year's Wellingborough demonstration.

Photo: Courtesy of *Farmers Weekly.*

Soil and Water, Volume 10, No. 1. Spring 82

SOIL SURVEY — PROGRESS REPORT

Don Mackney, Head of the Soil Survey of England and Wales, outlines National Mapping priorities and looks to the future and the work to be undertaken by the Soil Survey.

1:250,000 National Soil Map

After several decades of detailed soil surveying, when maps were prepared for some 20 per cent of England and Wales, the Survey has just completed fieldwork for the production of a National Soil Map, at a scale of 1:250,000 (¼in. to 1 mile). This National Map prepared for the Ministry of Agriculture, Fisheries and Food will comprise six separate sheets each conforming to current ADAS regions and will be printed and available for purchase by April 1983, in flat and folded forms. Work is proceeding on the six accompanying Regional Bulletins describing the soils and their agricultural properties and these will he printed in July 1984.

The project has relied heavily on knowledge acquired in the successive periods of detailed surveying when the main soil types in the country were identified and their distribution patterns in relation to geology, landscape and climate established; without this scientific foundation rapid completion of the 1:250,000 map could not have been achieved.

Legends of the soil maps will be informative, appraising non-specialists of the essential properties of land, whilst retaining the scientific framework which has ensured a consistent approach to mapping and soil identification. Regional Bulletins will describe the soils, emphasising properties related to all aspects of their use and management. They will include data on climate, land drainage and agriculture, presented in practical ways to help promote an appreciation of the physical controls which influence farming and land use.

Maps and bulletins will comprise an inventory of our soils for use in national, regional and county planning over the next decade. They will be a basis for exchanging ideas between farmers, advisers, soil scientists, geologists, hydrologists, foresters and conservationists, and will have important roles in teaching at schools and universities to propagate both the language and geography of soils and to improve awareness of our national resources and their conservation needs.

A new survey programme 1982-1992

1:50,000 National Soil Map

Proposals have been agreed with MAFF to combine a national objective to complete a general purpose map at a scale of 1:50,000. Local areas will he surveyed in more detail; these will be areas of intensive agriculture and also those designated for specific purposes. ADAS officers have selected priority areas and projects for the period July 1982–December, 1985 (Table 1).

	1:50,000		1:25,000	
	Sheet No.	Name	Sheet No.	Name
South-east	185	Winchester	TQ63	Wadhurst
	179	Canterbury	TQ65/75	Maidstone
South-west	163	Cheltenham		
	194	Dorchester	ST41/51	South Petherton
	201	Plymouth	ST01	Culm Valley
Midlands	119	Buxton		
	150	Worcester		
	140	Leicester		
	127	Stafford		
East Anglia	131	Spalding	TF51/52	Terrington
	134	Norwich	TL14/15	Biggleswade
North	106	York		
	112	Scunthorpe		
	81	Alnwick		
	108	Liverpool		
	98	Wensleydale		
Wales	157	St. Davids	ST49	Caerwent
	136	Newtown		

Special Surveys:
1. National Peat Inventory.
2. Radnorshire, Eden District, Cumbria (EEC Sponsored).
3. Thames Valley mostly within Sheet 164 (Gravel Resource Areas)

Table. I. *Regional* Priorities *1982 – 95*

Special Surveys

Special surveys are exemplified by the National Peatlands Inventory, which will determine the depth, extent and character of peat soils and resources in England and Wales. Peatlands are a relatively scarce national resource under great pressure from many competing users and this study is intended to improve plans for rational multi-purpose utilization of lowland peat especially where agriculture, conservation, afforestation and extraction are considerations in the same area.

SAWMA and Priority Surveys

Decisions on future priorities both for 1:50,000 mapping and special surveys could be influenced by SAWMA; if sizeable areas (say greater than 10Km²) could be identified where a detailed map would benefit the farming community, it would then be possible to ask the Ministry to approve a priority survey. Table I indicates those areas where priority has been allocated. If there are other areas which the reader sees as *important, please contact the soil* survey or SAWMA.

RECENT PUBLICATIONS

Publications are available from the Soil Survey, Rothamsted Experimental Station, Harpenden, Herts; a free publication list with prices can be supplied.

Soil Survey Records with 1:25,000 map (2½in. to 1 mile):

	Price including postage & packaging
Soils in Yorkshire *VI: Northallerton*	£6.90
Soils in Cambridgeshire *II:* Barnack	£6.90
Soils in Cambridgeshire *I: Stilton*	£7.90
Soils in *Gloucestershire III: Cinderford*	£4.60
Soils in Devon V: *Chumleigh*	£6.90
Soils in Devon *VI: Brayford*	£6.90
Soils in Nottinghamshire *IV: Gringley-on-the-Hill*	£6.90
Soils in Essex *IV: Weeley*	£6.90
Soils in Dyfed VI: Llangadog	£4.60
Technical Monographs and Special Surveys	
Climatic Classification of England *& Wales* with *4 maps*	£7.15
Soils of the North York Moors	£8.90
Thickness of peat in *the Somerset* Moors (map *1:50,000)*	£3.60

SAWMA Events

Soil and Water, Volume 10, No. 1. Spring 82

SHORT COURSE FEVER

Once again this year the Association has been involved in the organisation and running of successful short courses at the National College of Agricultural Engineering. A recent introduction to the programme was the February Soil Management Course. **fully** booked and attended bs 25 farmers and farm **managers.**

The aim of the course was to help farmers understand the many aspects of soil management; helping growers to achieve a better return from their land. Delegates were shown how to examine soils and select implements to achieve a desired seedbed condition for the growing crop.

Course lecturers were largely staff at the College with Dick **Godwin,** Gordon Spoor and John Gregory performing the 'lions share' of the work. This helped maintain a consistent and often controversial approach to cultivation management much to the approval of delegates who persistently questioned but never received a straight answer. Such a policy also ensured that the message sunk home ai I am sure it will **influence** some c the future soil management decisions of the participants.

Dick Godwin demonstrates the use of a falling cone penetrometer.

Traction/Compaction and tyres

Dr. John Taylor concluded it was necessary to achieve a high level of traction, at the same time as minimising compaction. He concluded that to do this a farmer can:—

1. Increase tyre contact area (dual wheels, wide tyres, flexible tyres, half tracks)
2. Use special traction aids (strakes)
3. Improve weight distribution, or
4. Use four wheel drive.

A farmer should firstly arrange the axle loading of the tractor driven wheels so that the required pull can be **developed at** low slip (say 15%). Then secondly use the correct tyre size for the required axle load, to reduce ground pressure so that the soil' loading is below the level that will cause compaction. Unfortunately what this limit actually is, is not at all well defined at the present. These views were confirmed by Martin **McAlister** from the NIAE who thought lower inflation pressures and increased areas are most important and spent a fair amount of his time in private conversation giving advice on the effectiveness of special low pressure tyres, dual and caged wheels and low ground pressure vehicles.

Controlled Trafficking

Dick **Godwin** considered that one should aim to minimise the numbers of operations and passes required and use traffic lanes. When harvesting **farmers should operate earlier, a lj t equipment for compatible wheel c** tres and consider low ground pressure field transport equipment.

In gateways it will be **necessary** to concentrate the damage and then repair the damaged zone.

Soil disturbance and implement type

At this point the participants, having had defined the correct soil condition for optimum crop growth, settled down to the 'bread and butter' topics of soil disturbance and **implement** selection in an effort to achieve their aims. Gordon Spoor and Dick **Godwin** covered these aspects with their usual flair. Mr. Syoor thought **ha the mouldboard plough had con liti ned t peoples ts of soi** tillage and **that** a complete and uniform loosening was now not necessary. Indeed, he went on to say that they could be thought of as wasteful and that the way ahead was through precision tillage, where the soil is only disturbed where there is need for a change in its condition.

Lectures covering implement geometry, and the selection and **principles** of soil loosening equipment, left delegates in no doubt that cultivation approaches had to be planned more carefully and much further ahead. The final session of open forum, was prompted by the collective views of Silsoe experts including **ADAS** Chief Mechanisation officer, Brian Finney; when delegates discussed on farm operations and confirmed that they would experiment to achieve correct soil conditions.

''A Valuable Course''

Above all else the College provided excellent facilities for practical work. Participants spent about 30% of their time in the laboratory or the field, where a lot was learnt.

What was particularly pleasing was the way in which an extremely varied group of people became engrossed in the course material. Malcolm **Pear**son, Deputy Director of JSR Farms, summed up the thoughts of a group from his farming company which included Farm Managers to Foremen, when he said ''We all agreed that it was a very well constructed and presented course; many of the chaps thought it to be the best course that they had ever been involved in''. To qualify for this accolade obviously the course had to be very valuable to a practical person, and I think that this would he my summary of the event, that it did contain a good balance of theoretical principles and practical conclusions pointing to some of the difficult aspects of the correct use of soil. It made us all more aware of some of the inherent problems and determined to look more carefully on and below the surface to try to understand rather more of the basic problems in the best use of soil. Ed Piepereit, an Agricultural Engineer with Bomford & Evershed, thought that ''Although aimed at farmers and growers, the course was a valuable aid to agricultural engineers involved in cultivation equipment. It gave one an opportunity to listen and discuss many aspects of soil, plant and mechanisation relationships with those people expert in the research and education of such matters.

In conclusion, the major disappointment about the course was the fact that 15 were turned away, — still there is always next year!

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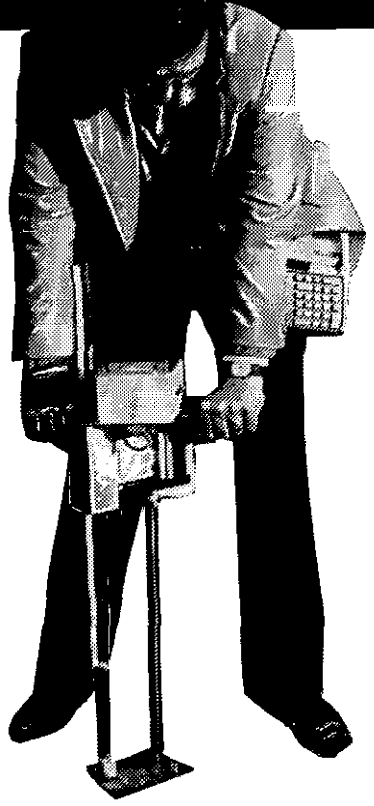

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The Association

SAWMA is well recognised as an organisation that provides a forum for debate and discussion on all aspects of Soil Management. Essentially, the role of the Association is to co-ordinate, direct and exchange information that promotes good soil and water husbandry.

Founded in 1973 by a group of progressive agriculturalists, the Association carries out this role by producing a journal and organising specialist events. Agriculturalists need to be aware of the continual changes within the industry – SAWMA is a means for many to exchange practical ideas with those of like minds.

The annual programme is designed to dovetail into the farmer's calendar and includes courses, specialist seminars, topical conferences. technical exhibits at agricultural shows and local field visits to Research Stations, leading farms and estates. In our experience, participants obtain a tremendous amount of information from personal contact with others from different sectors of the industry.

'Soil and Water', the Association's journal. provides a similar outlet for the exchange of views and realises the need for down-to-earth comprehensive coverage of soil and water topics.

If you want to improve profitability and agricultural management, and recognise the need for a constant reappraisal of information, then you will find an association with SAWMA invaluable.

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