

SOIL and water

Published by the Soil and Water Management Association Ltd.

January 1986

575



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SaWma
is to promote
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of care and management
of the soil**

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Volume 14 No 1, January 1986
Note: Volume 13 is complete in two issues.

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

Soil and Water is published quarterly and is SaWMA's principal means of promoting ever-improving standards of soil care and management, through the publication of research findings, scientific articles and practical information on the soil, its drainage, cultivation, irrigation and fertility. It is published for the benefit of the farmers and growers, researchers and advisers, consultants, manufacturers, contractors and others making up the membership of SaWMA.

The editor welcomes offers of editorial material and advertising requests; details an application. Except where used for promotional purposes, Soil and Water is available only to members of SaWMA. The annual UK membership subscription is £15.50 including VAT. (Overseas £18.00)

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Front Cover — Inter-Drain (England) weedcutting boat clearing sides and bottom of the river Wissey in Cambridgeshire. This type of maintenance is of vital importance for the functioning of a land drainage scheme, and is carried out by the Water Authorities and Internal Drainage Boards. A note about Inter-Drain is on page 5.

COMMENT

Provision of Information:

Professor Gordon Spoor speaking at the LDCA Conference has again stressed the need for farmers to be provided with information in a readily usable form — to enable them to evaluate alternatives and make decisions. And not only for farmers — as Gordon Spoor points out, all sides in the business will benefit whether they be contractors, manufacturers or farmers; or consultants, advisers and so on.

Fundamental research still needed

All this is particularly relevant in the case of drainage, and here Gordon Spoor has identified a number of lines where experiments and investigations are needed to provide information on which to base designs and decisions. Too much emphasis, he feels, has lately been put on the needs of the intensive end of farming — a change in research effort is now required to pay more attention to the needs of the less intensive areas and to maximise the use of fundamental available information.

At the same time, of course, we need to maintain our fund of fundamental information. Besides the direct experimental work aimed at providing answers to specific situations there is, and will continue to be, a need for more fundamental research. We must not forget that many of the most important and valuable of today's products and practices were inspired by the results of fundamental research.

Government responsibility

However, with no immediate identifiable application and profit motive, it is difficult for industry to justify the expense of fundamental research. The Government must realise this and ensure that funds are available if we in this country are not to lose out because the basic, long-term, fundamental research is abandoned.

Providing the information

Within all this there is, of course, a two-way traffic — the users have to let the researchers and experimenters know what they want and in due course they have to have a feed back of the results obtained and ideas derived.

It is SaWMA's aim to provide this two-way information route and for this reason we maintain especially close links with a large number of Britain's leading scientific, professional and commercial organisations. We aim to interpret and publish information from all sources which will be of practical value.

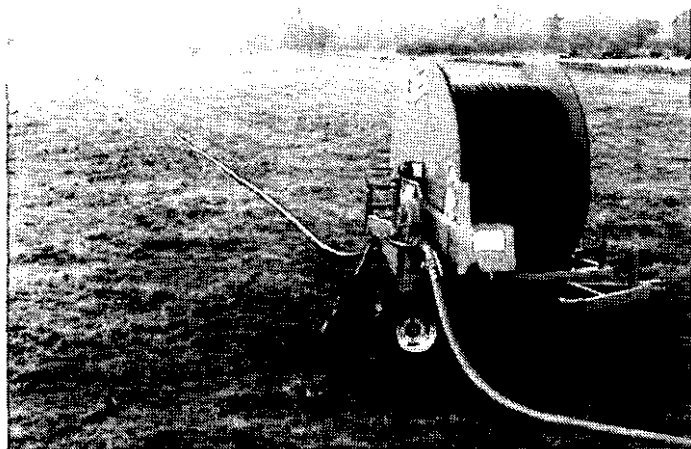
The Soil Survey of England and Wales

As a final word we would like to draw attention to the new image of the Soil Survey. The Soil Survey of England and Wales has for many years been a staunch supporter of SaWMA, much to the benefit of our members. We are pleased to see that, despite the severe cuts they have seen in their Government funding, they are coming back with a wide programme of helpful activities. We wish them well and we look forward to a continued close and beneficial relationship.

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Sykes Aquamat hose reel irrigator.

Sykes offers comprehensive new irrigation service

A new irrigation system offering farmers a complete range of equipment backed by a countrywide, seven day 24 hour service network has been launched under the name of Sykes Irrigation.

Sykes Irrigation - part of the Henry Sykes Plc group (Sykes House, 445 Woolwich Road, Charlton, London SE27 7AP) with 150 years of experience of water handling - provides hose reel and centre pivot systems designed for reliability and ease of operation.

The Sykes Aquamat range of robust hose reels, designed to irrigate from two to twenty-five acres per day, is available in four types -

ATB launches major marketing offensive

Earlier this year, the Agricultural Training Board was given approval by Parliament to market its products and services abroad, as well as at home

A marketing unit has been formed from within existing ATB staff and a Marketing Development Manager has been appointed to identify and develop new markets for the Board's products and services.

Already the work of the ATB is widely known and many enquiries are received from overseas. It will now be able to respond to these approaches more readily and to work more closely with other organisations operating overseas.

Commenting on this new move, ATB Chairman John Clayton said, "Since the Board's establishment, we have built up an unrivalled selection of training aids and expertise, covering well over 500 different activities from craft skills to financial and man management.

"We have attracted attention from all over the world. The marketing of this material has great potential, not only for the future well-being of the ATB, but as a source of finance to help the continuing development of training for the benefit of British farmers and growers."

with turntables or fixed chassis. Various drum sizes accommodate differing pipe diameters and lengths.

Sykes offer project appraisal, installation, system design, material specification, maintenance contracts and financial advice to meet individual needs. As well as sales, Sykes irrigation systems can be hired through any depot.

Field Drainage Design Service re-introduced by ADAS

Under the terms of their long standing Agricultural Services Scheme a new Field Drainage Service has been launched by the Ministry of Agriculture's Development and Advisory Service, (ADAS).

The service is primarily available to farmers, managers of agricultural land or to an agent (for example, a Consultant or a Contractor) acting on behalf of such interests.

* Four stages are involved. These are:-

Investigation of all available information, including site and soil investigations. Survey, plot levels and interpret as required. Design of system with necessary calculations to fix spacing, depth layout and pipe sizes. Preparation of design plan.

● Preparation of Bill of Quantities and specification. Advice on contract procedures, contractors and on tenders received.

Inspection of work in progress and advise on variations.

● Measurement and provision of final record plan. Check and advise on final accounts.

Charges for the full service of four stages will vary between £20 and £30 per hectare depending on the area to be drained. Alternatively, a client may choose a partial service comprising one or more individual stages.

Free feasibility advice

Besides the new more comprehensive design service, ADAS point out that they will continue to offer free feasibility advice, discussing whether drainage is required, outlining possible courses of action and advising on any statutory consents required.

Outside Consultancy service

The new Drainage Design Service is necessarily limited to farmers, but the Ministry is aware that the skills and experience available within ADAS can also be of help to other interests and organisations outside the scope of the Agricultural Services Scheme. A separate consultancy service is offered in such cases, with terms negotiable according to services required. Local authorities, mineral operators, pipeline agencies are amongst those to whom this Service should appeal - as also, of course, to Drainage Contractors when not acting directly as farmers' agents.

Anyone seeking to use the new service should first make application to the Field Engineering Advisor at his local MAFF office.

Soil Test Kits from Wilkinson & Simpson

The current research programme of Wilkinson & Simpson Ltd, Gateshead, is aimed at diversifying the product range and the Company's soil test kits will shortly be available for the UK market.

The Company also sees an expanding market for water testing kits and reagents, especially in the US and Europe and, according to the Managing Director, John Lever, this year could see a 30 per cent increase in turnover, with direct and indirect export sales accounting for at least three quarters of total turnover.

Wilkinson & Simpson Ltd. claim that the latest edition of their Palintest Water Tests catalogue is the most comprehensive listing available of kits and reagents devoted specifically to water analysis.

Details are given of 80 kits designed to measure the physical characteristics and dissolved naturally occurring compounds and pollutants in water.

For details contact: John Lever, Wilkinson & Simpson Ltd., Palintest House, Kingsway, Team Valley Estate, Gateshead, Tyne & Wear NE11 0NS Tel: 091 487 2164

PIPELINE...PIPELINE...PIPELINE...PIPELINE...

The Soil Survey of England and Wales

— services range from agriculture and land management to cartography and laboratory services

A new brochure from the Soil Survey of England and Wales outlines the many areas in which their services can be relevant and helpful. Besides the more obvious ones of agriculture and land management, forestry, conservation, resource planning, they list also remote sensing, cartography, laboratory services.

The brochure points out that Soil Survey is an independent organisation with 45 years of experience of soils and land use. Until recently it was funded entirely by the Ministry of Agriculture but now has the freedom to offer its skills more to individuals, groups or governments both nationally and internationally. The Survey has expertise in the distribution of soils, their properties and their suitabilities for specific purposes. It can also advise on land use, land degradation, land reclamation and land pollution.

The Soil Survey aims to provide a unique and comprehensive service which enables all users, whether individual farmers, planners, corporations or governments, to make the best and least damaging use of our single most important natural resource.

SAWMA is pleased to number the Soil Survey of England and Wales amongst its long standing Corporate Members.

The Soil Survey can be contacted at —
Rothamsted Experimental Station, Harpenden, Herts AL5 2JQ. Tel: (05827) 63133.

New concept cultivator in expanding Dowdeswell tillage range.

Further significant steps in their development from plough makers to manufacturers of a complete range of tillage equipment were exhibited at the recent Royal Smithfield Show by Dowdeswell Engineering Co. Ltd. A completely new type of cultivator was on show, and the first two rotary cultivators in a new range being developed from the recently acquired Howard Rotavator designs.

The outstanding new idea in the company's display — the completely new Tri-tine cultivator was shown as a design study identical to the initial prototype now being field tested. Advantages claimed for the Tri-tine are: a reduction in the draught necessary for multi-tine cultivation over any given width and depth, reduced risk of trash blockages and reduced wear on legs.

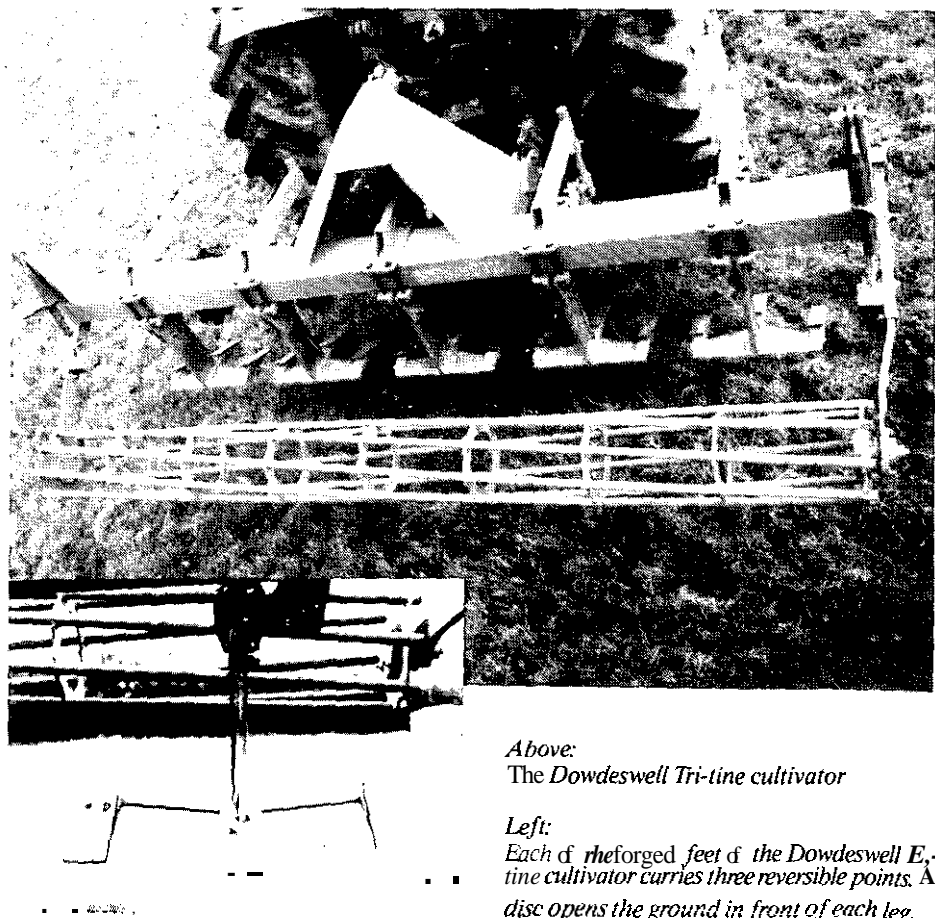
Fewer legs means less draught

Dowdeswell point out that the key feature which leads to all these advantages is the mounting of three cultivating points on each of the Tri-tine's extremely strong but slim, high grade steel legs. The number of legs needed for any given number of tines is therefore divided by three, by comparison with a normal cultivator, limiting draught and leg wear, and allowing all legs to be mounted on a single massive toolbar without increasing the likelihood of blockages in heavy trash.

A full width crumbler roller, for which a final design has yet to be decided will be standard equipment on the Tri-tine.

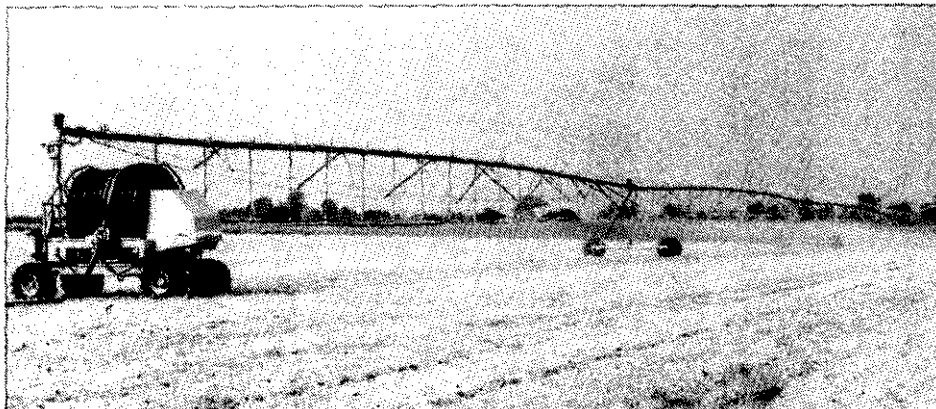
For further information contact Mr. Roger Dowdeswell, Managing Director or

Mr. Guy Seaman, General Manager, tel Southam (0926 81) 2335.



Above:
The Dowdeswell Tri-tine cultivator

Left:
Each of the forged feet of the Dowdeswell Tri-tine cultivator carries three reversible points. A disc opens the ground in front of each leg.



The REELINEAR self propelled irrigation system.

New British built Irrigation System

REELINEAR - a new British built irrigation system with the potential for worldwide sales has been launched by agricultural equipment company H. Cameron Gardner Ltd of Stroud, Gloucestershire.

The irrigator comprises a self-propelled, four wheel carriage supporting a powered hose drum and a pivot tower. The pivot tower acts as the central support and axis for standard centre pivot booms spanning the area under irrigation.

The irrigator combines some key characteristics of traditional hose reel, linear and a centre pivot irrigation system. In operation the mobile carriage and boom travel in a straight line up and down the field like a linear system and the boom spans are able to swing through 180 degrees, or even 360 degrees if required, in the same way as a centre pivot.

The booms are equipped with dual sprinkler systems to provide both linear and pivot patterns resulting in the same water distribution efficiency at similar low operating pressures as conventional linear/pivots.

Tailored to specific crop and soil conditions

Each system is tailored to meet the specific needs of the crop and soil conditions with complete control over the water application rates on fields of varying dimensions.

Regular and irregular field shapes can be irrigated by selecting the programme on the machine's electronic controls after which the chosen irrigation cycle will be performed automatically. The irrigation hose is powered off and on the drum as the wheeled carriage moves up and down the field, guided by a winch tensioned cable attached to anchors within the crop. Proximity switches on the unit provide fail safe operating and automatic shutdown when the required area of irrigation has been completed. The electronic controls change the system from linear to centre pivot mode or vice versa according to the pre-set instructions.

The price of the REELINEAR unit with 200m of 4.5 inch dia. layflat hose is around £34,000 less boom spans and towers which vary with each installation.

Travelling Irrigator Tests

In 1983 the Soil and Water Section of the New Zealand Agricultural Engineering Institute set up a project to study the performance of travelling irrigators. This was due to doubts about the efficiency of machines which apply water faster than the soil can absorb it.

The scope of the work has grown considerably since its inception and the report not only describes how irrigators apply water but also considers the effect that soil characteristics have on their efficiency.

A method is proposed for choosing the most suitable machines for a particular soil type.

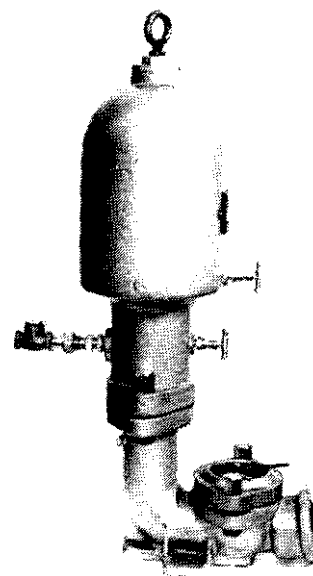
Other topics include the effects of different travel speeds and the results of attempts to level paddocks to minimise surface water ponding.

Price of the report is \$12.00. Enquiries may be directed to: Extension Secretary, NZAEI, Lincoln College, Canterbury, New Zealand.

A new Blake HYDRAM

John Blake Limited, Manufacturers for over 100 years of the HYDRAM range of self acting water pumps, announce completion of a special design exercise to develop their largest ever unit, a HYDRAM with 12 inch bore inlet drive pipe.

Regular production in the U.K. will continue to be of the standard range of ten sizes with drive pipe bores from 1 1/4 in. to 8 in. The manufacturers point out that with the HYDRAM relying for its operation on the natural energy in the fall of water there is no fuel requirement and therefore no running costs and no cause for pollution.



A typical Blake HYDRAM

Two days for Farmers Weekly International Drainage Event

Features this year will include conservation practices, lake clearance and in-crop drainage.

Farmers Weekly's International Drainage Event, now extending over two days, will be held on May 14 and 15, 1986, at Stratfords Farm, Marston Trussell, Northamptonshire.

The event, now in its 31st year, has long been recognised as Europe's most important drainage demonstration: a major opportunity for farmers, contractors, manufacturers and dealers from all over Britain and Europe to see the latest equipment and techniques in drainage, moling, subsoiling, ditching, hedgetrimming and (a new feature this year) lake clearing. Ground conditions permitting, in-crop drainage on 16 acres will also be demonstrated at the event.

Conservation will be featured on the site, with the retention of natural ponds and hedgelines, and a demonstration of hedgelaying and hedgeplanting.

Its central location means that the site is readily accessible - only a few miles east of Junction 20 of the M1. The Event is open from 10am - 5pm on both days. Admission prices are £3 for one day, or £5 for a two day pass. Full bar and refreshment facilities are available, and car parking is free.

For more information contact David Waugh or Andrew Wickenden, Room 1117, Surrey House, 1 Throwley Way, Sutton, Surrey, SM1 4QQ, or telephone 01-643-8040

Tracing Sources of saline water – Remote sensing in South Australia

July, 1985 saw the official opening of the South Australian Centre for Remote Sensing. Headed by John Douglas, the Centre operates the latest image processing and digital colouring mapping systems, leases state-of-the-art scanners and imaging radar system, and provides a complete package to clients in resource survey and interpretation. There is no similar centre in Australia.

Already some departments are making good use of the Centre's services. The Engineering and Water Supply Department, for instance, has maps produced by remote sensing showing water usage and the type of crops being grown by irrigators along the River Murray. In an important development, the Department is using this technology to help combat rising salinity in the River Murray. "We know that saline water is three degrees cooler than normal river water", John Douglas said. "By using an airborne scanner flown about 3,000 metres above water level, we can record fractional changes in water temperature and from this data may be able to plot exactly where the saline water is entering the Murray". This application of remote sensing is a world first, and could prove to be vital in the department's battle against river salinity.

According to John Douglas, continuing improvement in scope and resolution of remote sensing devices will bring faster, cheaper and more efficient ways of measuring almost anything. He believes that "remote sensing has been in the hands of a few scientist for too long, and knowledge about it must be delivered to the resource managers, who can benefit from it whether they be public servants, farmers, geologists, fishermen, etc."

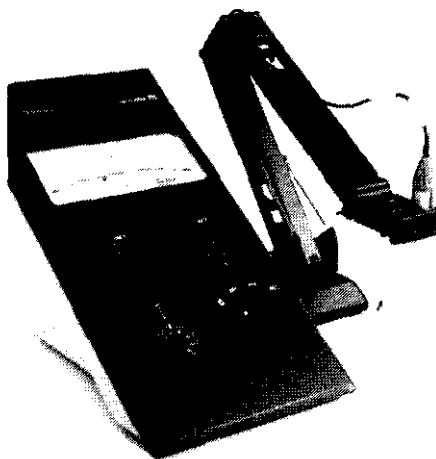
Development of Water Supplies Overseas

W. S. Atkins International has been commissioned by the Overseas Development Administration and the Government of Cameroun to carry out studies for the development of water supplies to the towns of Ebolowa and Sangmelima in Cameroun.

The existing water supply schemes are inadequate for long term requirements and water sources insufficient, especially through the dry season. The feasibility studies include the location and evaluation of new sources, by direct abstraction from rivers and by groundwater development. New works are likely to include abstraction mains systems and service reservoirs.

The scope of services to be undertaken by W. S. Atkins International are feasibility studies, including studies of water resources, and the preparation of design and tender documents for the schemes.

The project is funded under an aid agreement between the Overseas Development Administration and the Government of Cameroun.



The Corning Delta range of pH meters has been expanded through the addition of a new analogue model, Delta 115 which is robust and ideal for environmental applications.

Reducing pollution – the N.I.A.E's contribution to environmental improvement

A pamphlet from the NIAE draws attention to the many areas in which they are actively creating new machines and developing improved farming practices.

Of interest to the environmentalist, there is mention of NIAE work helping to solve the problems of pollution from straw burning:

- development of a more efficient tillage implement for soil incorporation of chopped straw and stubble
- a machine for making large high-density bales to reduce straw transport costs
- successful investigation of a low energy means of making straw wafers suitable for use as fuel

whilst spray chemicals should be reduced by NIAE work on:

- automatic sprayer boom attitude control which permits them to be mounted nearer to the crop and ground
- electrostatic spraying system development
- spray rate control systems to allow application rate to be more accurately determined

New Range of Concrete Slurry Tanks

Anglian Building Products of Norfolk, a subsidiary of the giant Norcross Group, has recently introduced to the UK a new range of pre-cast concrete slurry tanks for collection and storage of animal wastes on farms.

The fully sealed units are very economical to build, maintenance-free, seepage proof and are ideal for collecting and storing animal wastes which are used as fertiliser on farms. The company manufactures the segments for the system at its plant at Lenwade, near Norwich in Norfolk.

The system meets the stringent regulations now in force under Part II of the Control of Pollution Act 1974 which covers the entry of poisonous or noxious substances into underground waters, rivers and streams.

The Anglian Slurry Tanks are constructed from pre-cast concrete segments which are bonded together using a patented jointing system. Sizes range from 14-22 metres diameter and the two standard heights are 3 and 4 metres. The tanks take about six hours to assemble and build and they can be sunk into the ground where required. All the farmer has to provide is a base plinth of concrete on which they are to stand.

Unruly computers now more controllable

Demands in the agricultural market for an easy to fit, reliable, maintenance-free line conditioner are met by the new F.R.L.C. line conditioner and manufactured by Galatrek International Ltd, in North Wales.

Output is stabilised at $\pm 3\%$ and transients are suppressed without delay by the ferro resonant circuits and filters. The F.R.L.C. will also cope with very small breaks in the mains supply. With a range from 250VA to 6kVA the F.R.L.C. can also be ordered incorporating a step up or step down facility.

Further information: Galatrek International Ltd., Scotland Street, Llanrwst, Gwynedd, North Wales. Contact Ron Koffler on 0492-640311



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Pictures shows model TF700 digging 1.0 wide \times 48" deep through heavy ground at 60 linear yards per hour. The spoil comes out in a fine friable tilth making for easy backfill with the integral hydraulic angle dozer.

SOIL MANAGEMENT

"Look twice before you subsoil"

A report on this year's Soil Management Course at Silsoe College

Don't just think twice, but look twice as well! This was perhaps **this** year's main message at the popular Silsoe Soil Management Course.

Recognising the declining profitability in the industry, farmers are urged now to pay more attention to doing cultivations only where necessary. They should look at the condition of the soil, determine where the problems are and then only do the minimum of necessary cultivation/rectification work. Only subsoil where it needs it. Try to let nature do the job.

Plan in Spring but check in Autumn
The best time to study the soil and assess its needs is in the early part of the year up to end April/early May. Decide then what needs to be done, as there will probably be little change between then and harvest. But where you're in doubt certainly have another look at Autumn – sometimes an apparent compaction in the Spring will disappear when the soil dries out.

All of which may, of course, be easier said than done – one has to understand the nature of the soil and to know what to look for if one is going to make the right decisions.

Hence the course's continuing popularity and why once again there were over twenty people enrolling. The majority of them were farmers, but besides them three or four people from the service industries and from consultancy services added to the range of in-

terests and experience. And, whatever their prime occupation everyone on this course thinks, talks and feels soil for a concentrated four days of wide ranging lectures and practical field and laboratory work.



Examination in adjacent pits showed a **sudden** change from a clay to a sandy soil – the latter being quite compacted and without structure. Proper attention must be paid to soil type and condition to determine the appropriate cultivation programme.

More careful management with sandy soils

The field examinations brought home some interesting points. The College were able to demonstrate both good and bad aspects of soil management. Three holes dug close to one another demonstrated very clearly how abruptly can soil types change within a few yards. The old time field boundaries generally recognised this and this should still be borne in mind when contemplating field enlargements. On this site, one pit showed a consistently clay soil while within 10 yards, in the next field, we had sand down to one metre and beyond. And the sandy soil pit showed strong signs of extensive compaction and virtually no structure. The point was made that sandy soils generally need more careful management than do clay soils because of this high risk of compaction when water content is up.

drainage gives a greater spread of 'timeliness' for cultivations.

The course closed with a visit to the neighbouring Hexton Manor Farm, managed by Mr. Bill Pickup for Mr. Ashley Cooper. Mr. Pickup attended the first Soil Management Course in 1982 and at Hexton we were able to see for ourselves the principles of good soil management applied in successful practice.

It would be interesting to speak with some of this year's course members in another year or two's time and hear what changes they had introduced attributable to the wealth of ideas and knowledge presented in this course.

Anyone interested in attending next year's Soil Management course is invited to get in touch with Mrs Pam Cook, Professional Development Executive, Silsoe College, Beds MK45 4DT Tel: (0525) 60428.



Loamy sands are susceptible to compaction.

Benefits of drainage
The benefits of drainage, and ill effects of

RESEARCH

Effect of different tyre/soil contact pressures on soil and crop

Research at the National Institute of Agricultural Engineering.

The results of the second year of their long term investigation are announced* by the N.I.A.E.

Designed to monitor the effects on soil and crop responses, the experiment comprises three levels of tyre/soil contact pressure (normal traffic; low ground pressure and zero traffic), in conjunction with direct drilling and shallow cultivation.

The site at Silsoe, on an **Evesham** series clay soil, has wheeling treatments, varying in pressure from zero to 2.5 bar, which are built up progressively during a season and from one season to the next. Draught and/or fuel consumption, work rate and wheel slip are measured and cultivation energy requirements are calculated. Soil measurements, including bulk density, cone resistance and shear strength are taken at regular intervals during the year, and water use is monitored throughout the growing season.

Plan of the experiment

In the planning of this experiment it was envisaged that the characteristics relating to soil strength, (bulk density, shear strength and cone resistance) would show an increase in value with increased wheeling pressure and that this would occur particularly in the top 250mm of the soil profile. It was also anticipated that any significant increase in these characteristics would lead to a **corresponding** increase in the energy required for soil preparation prior to sowing. In addition it was assumed that there would be an interaction between soil strength characteristics and crop response, such that, above a certain level of compaction, crop performance would deteriorate.

Results the opposite of what expected

In the event, the results from this and the first year of the experiment indicated that, although bulk density and cone resistance increased following normal traffic compared with unwheeled soil, the LGP system resulted in generally greater values of these characteristics than either of the other treatments. This was **unexpected**, and a possible explanation is that during the autumn of 1982 soil moisture was so high that even pressures of about 0.5 bar on the LGP plots were sufficient to increase strength significantly, and, because of the extra tyres, this occurred over a greater area than on normal plots. In the very dry autumn of 1983, it is likely that exactly the opposite was true and little compaction occurred following either LGP or normal traffic.

As regards yield, measurements at the combine harvester showed, surprisingly, that the generally more compact soil, i.e. that under the LGP treatments, also returned the greatest yield of grain. This result may, however, also be attributed to there possibly having been compaction only in the first year coupled with the effect of taking mean values of plot readings.

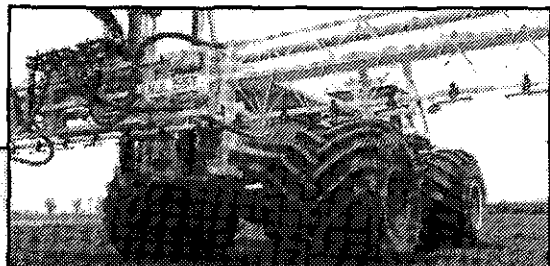
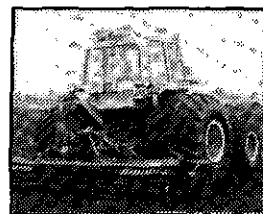
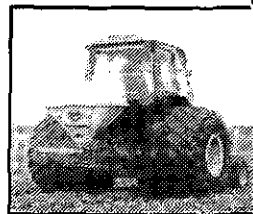
Experiment to continue

As the experiment continues, it will be interesting to note, firstly, whether the level of compaction on the normally wheeled soil will increase beyond that on the LGP plots and, secondly, whether yield response in this situation will fall off or increase further. One finding that appears to be conclusive at this stage, however, is that unwheeled soil of this nature reduces energy inputs for cultivation, but causes problems with manganese uptake in the crop.

Some further tentative conclusions are drawn by the authors and these will be followed up in reports of future years results.

* The effect of different tyre/soil contact pressures on soil and crop responses when growing winter wheat. Year 2 - 1983-84 DN1296 National Institute of Agric. Engng. Silsoe, September, 1985.

TERRA -TIRES GOOD YEAR

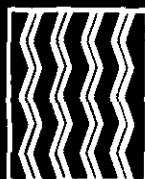


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Better Soil Management for Cereals and Oilseed Rape

Soil management was the theme of a Conference held at the National Agricultural Centre, Stoneleigh on 20 November. Here, Selwyn Richardson ADAS Soil Scientist and the technical coordinator of the Conference reports on the main points presented.

This Conference, chaired by John Rymer who farms 3160 ha in East Yorkshire attracted an audience drawn from farmers, commercial personnel, research workers and advisers. There was keen interest in the many aspects of this important topic covered by the six speakers.

Setting the scene

After pointing out that if we could leave our soils alone most of them could manage themselves better than we can Professor Gordon Spoor of Silsoe College set the scene by listing three main soil environment aspects requiring consideration;

- crop: seedbed, root area
- mechanisation: traction, support
- soil conservation: surface condition

The seed requires a fine tilth locally for rapid water uptake with a coarser surface condition to minimise capping risk and permit rapid emergence. An adequate number of continuous fine pores is needed in the root area for satisfactory root development. A course, open surface tilth is less prone to erosion but such tilth can be too coarse for uniform seedling emergence and moisture conservation. In addition traction and equipment support can be best achieved with compact soil conditions which are not particularly satisfactory for the crop or soil conservation.

Thus conflicts exist in terms of soil requirements and decisions are required on whether to go for a general compromise, ignore some requirements or aim to satisfy all. On balance the aim should be to satisfy all requirements.

With a given soil structure the quality of the final soil condition is always better if achieved with the help of natural forces, rather than forced by an implement. Management has therefore to be directed towards improving structure, and tillage used where necessary to assist the natural processes. The production of a good tilth usually requires some help from the weather.

Subsoil Management

Mike Marks, ADAS Soil Scientist stressed that besides maintaining an open solid structure to depth a prerequisite of good subsoil management is adequate drainage.

On heavy land the drainage of surface water during the winter months is commonly limited by the slow permeability of the subsoil. Soils in this category account for over 50% of the main cereal growing area of

England and Wales. The waterlogging associated with slow drainage has a major influence upon root growth and the ease of cultivating land for arable cropping. The generally accepted objective with under-drainage design is to keep the watertable below 50cm depth at all times of the year. This has been demonstrated to be the minimum requirement for avoiding yield loss in autumn sown cereals and for reducing the risk of wheel rutting and soil structural damage. The cost effective treatment of this objective on clay subsoils is heavily dependent on moling and subsoiling as secondary drainage treatments.

In an average summer, cereal and rape root systems must be capable of efficiently

extracting water from soil storage to at least 1m depth.

Early NAAS experiments in the East Midlands demonstrated the benefits obtained from subsoiling sandy soils affected by subsoil compaction. The yield response was larger in dry summers indicating that extra water was being extracted by the deeper rooting crop on the subsoiled area.

Year	Summer rainfall (mm)	percent yield increase	
		Site 1	Site 2
1965	24	12	12
1966	34	3	6

Table 1 Subsoiling response on sandy soils

In more recent experiments 11 harvests of autumn sown cereal and oilseed rape crops showed no yield benefit from subsoil loosening. Spring sown crops were more responsive. Lack of response is attributed partly to more efficient nitrogen use which masks potential responses to loosening and partly to rapid

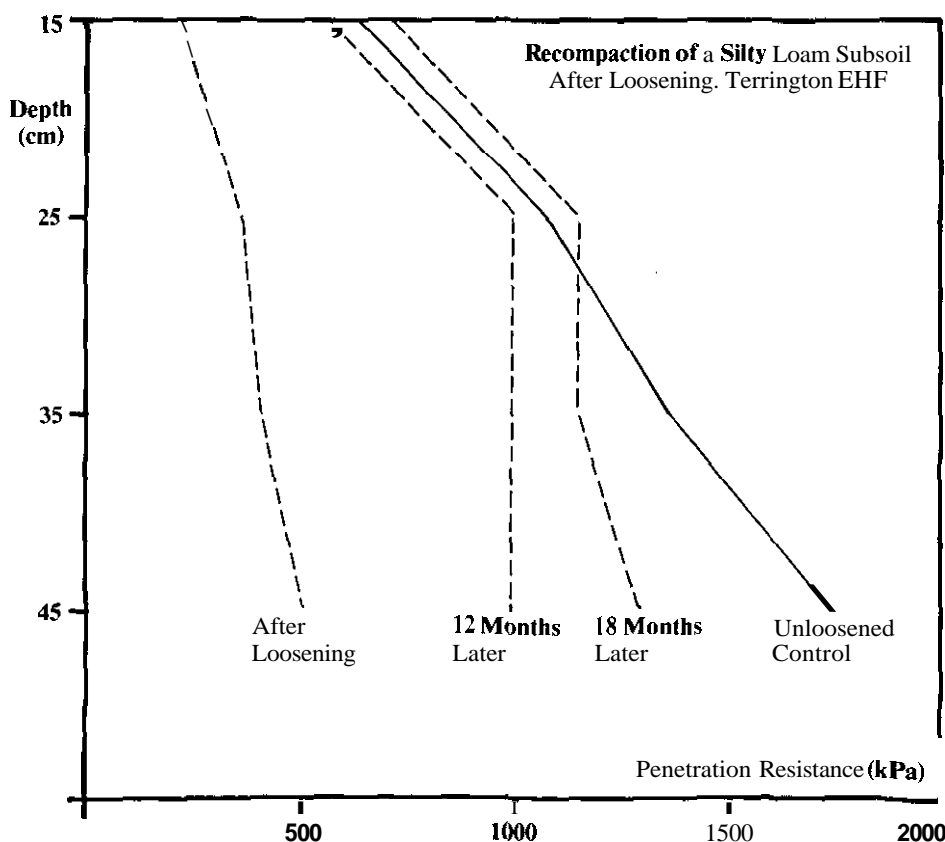


Figure 1 Ways of minimising recompaction after subsoiling need consideration

SOIL MANAGEMENT



Continuity of fissures from the surface into the subsoil is essential for good root development.

recompaction by subsequent field operations (figure 1). Thus subsoiling should only be carried out where a problem has been clearly identified and this requires the use of a spade for careful soil examination. There is increasing interest in loosening later in the seedbed preparation process to reduce risk of recompaction.

Straw Incorporation

The system chosen to incorporate straw must reliably deal with the straw to avoid interference with drilling or crop establishment; must create a suitable tilth and soil structure for crop growth; and must be as fast and cheap as possible. Eunice Lord, ADAS Soil Scientist described the approaches of either burying straw by ploughing or mixing it into the seedbed using discs, tines or rotary cultivators.

Where ploughing is already practiced successfully after burning or baling there should be few problems in ploughing down straw. Many trials confirm that changing from ploughing down ash to ploughing down straw has little or no effect on yield or crop husbandry.

A more difficult decision arises on farms where the present system is burning followed by reduced cultivations. Unless there is considerable spare capacity, changing to ploughing in straw will involve high capital costs.

Although changing from reduced cultivations to ploughing in straw on heavy soil has

not normally reduced yield in experiments it does carry the risk of poor establishment if seedbeds are dry and cloddy. In addition weather conditions combined with the slow workrate may lead to late drilling or even inadvertent sowing cropping. Yield penalties may then far exceed any yield losses attributable directly to straw incorporation.

Incorporate by plough:	
Very heavy	+1
Heavy	+1
Medium	+2
Incorporate by disc/tine	
Very heavy	+1
Heavy	-4
Medium/Light	-3

Table 2 Effect on yield of changing from burn + disc/tine to straw incorporation (1982-85)

The alternative on heavy soils is to incorporate straw by mixing, without inversion. The advantages are speed: ease of tilth formation and conservation of moisture; and relatively low capital and running costs. The main disadvantage is that yields have, on average, been lower with this system than after ploughing by about three percent.

Correct Choice of Machinery

David Pullen, ADAS Mechanisation Adviser attempted to clarify the enormous choice of cultivation equipment for topsoil and subsoil management and for straw incorporation.

The essential steps are;

- Decide on crop requirements eg rape or cereals.
- Analyse the existing soil condition eg straw residues, soil moisture etc.
- Choose basic operation needed eg loosening, mixing - this stage may be repeated several times before finishing the cultivation sequence.
- Select cheapest and most easily available implement suitable for basic soil action required.

The actions of the numerous cultivation implements available to farmers can be summarised as:-

- Loosening
- Consolidation
- Inversion
- Mixing
- Clod Breaking
- Levelling
- Cutting

These actions are not exclusive to each other, eg ploughing (inversion) may also loosen the soil depending on conditions.

To select the best machine to buy or use the main objective for a particular field condition and crop should be defined. Frequently tradition or fashion take over at this point and sometimes expensive machines are used for inappropriate jobs. Therefore it is helpful to consider the basic action that implements can perform and then choose the best one for the job.

Soil Erosion

Soil erosion by water in winter cereals is widespread but rare in oilseed rape. Wind erosion in both crops is infrequent. Bob Evans of the Soil Survey of England and Wales dwelt on the causes and effects of water erosion with particular reference to a recent survey.

There are two reasons why erosion occurs most often in winter cereals. The first is that

Mean effect (%)	(No. of sites)
+1	(9)
+1	(12)
+2	(10)
+1	(9)
-4	(12)
-3	(10)

winter cereals are the most widely sown crops, and the second that compared to other crops they are vulnerable to erosion for a long period, from October to April. Thus, in a survey of over 1500 eroded fields most erosion occurred in late winter and spring. Because oilseed rape is sown in August and September, it gets away quickly and covers the ground so that soils are at risk for only a very short period, and consequently few fields of rape are known to have eroded.

The number of fields affected by erosion varies from year to year, depending not only on the number, amount and intensity of the

SOIL MANAGEMENT

rainfalls but also when they occur. In the four years 1982-5 erosion was most widespread in 1983 and least in 1984. Sandy and light loams suffer erosion most frequently, with up to one-quarter of the area of the survey contributing to erosion in three years of the study 1982-4.

Erosion occurs when rainfall does not sink into the soil quickly enough so that it ponds on the surface and then flows downslope; when a critical depth and velocity is attained the water incises into the soil to form rills. The survey shows that rills mostly occur where downslope working concentrates water flow, especially along headlands where the slope steepens to more than 3°, and in valley floors.



Recent trial results show that loosening will only give a yield response where a structure problem can be clearly identified.

Thus, water flows down wheelings carrying little material but when it merges in the valley floor with water flowing from the slope opposite, or where the headland along the top of a field turns down the steeper valley side, sufficient depth and velocity of water are attained for it to incise into the soil. The direction of drilling on crests and slopes may be different and intersect, so that water stored on crests is routed down the steeper slope. Often wheelings are in deep ruts in which water collects, or there is ponding in hollows on headlands.

The two easy answers to combat water erosion are either to work land along the contours, or, especially if it persistently erodes, to put it down to grass. In many cases these are impracticable solutions and effort is needed to find inexpensive, small scale remedies which the farmer will use.

A Farmers View

At Manor Farm, near Hitchin, Bill Pickup grows cereals with oilseed rape and peas on 560 ha. He rounded off the conference by outlining his philosophy on soil management

and the system he uses.

One quarter of the farm is on chalk slopes of the Andover series where the soil is light textured and easy working. "Puffiness" is more of a problem than compaction and rolling is essential to consolidate the land following a good burn and use of a "C" tine cultivator.

More difficulty is experienced on the deep silty clay loam of the Burwell series which covers most of the farm. Its main defect is the very narrow moisture range between being too wet and too dry to work satisfactorily. To get autumn crops sown early large, modern machinery is employed but this is heavy and the silty soil readily compacts. To minimise compaction the soil is worked

on an 18m tramline system. The aim is to produce a seedbed which has been deep cultivated to 35 cm without producing clods with the following benefits being apparent.

- Rapid removal of water
- Plant roots have quick and easy access to the subsoil
- Any compaction is remedied
- Yields of cereals and oilseed rape have improved.

By subsoiling to 35 cm followed by a springtime cultivator to produce a seedbed the minimum of work is done. If restrictions on straw burning becomes still more severe a plough with subsoiler tines beneath would be used where possible.

Besides employing tramlines compaction from heavy machinery is further limited by using sufficiently wide and correctly inflated tyres.

By taking steps to avoid compaction coupled with deeo loosening to remove unavoidable compaction crops at Manor Farm are able to fully utilise the soil and produce vigorous growth.

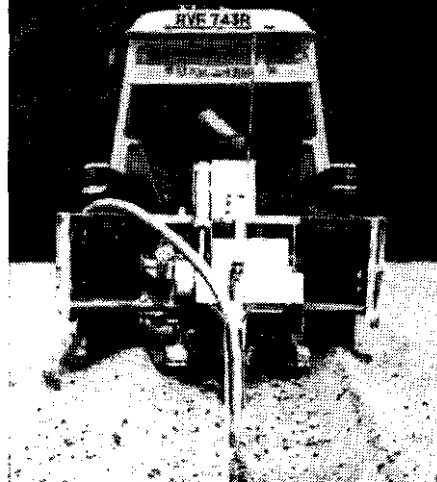
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Drainage Update

The Annual Conference of the Land Drainage Contractors Association – Geoff Baldwin reports

The **first** Annual Conference of the LDCA was held at the end of January at the Novotel, Nottingham. An **impressive** number of around 150 delegates attended the Conference and clearly found much of interest, not only in the formal presentations, but also in the opportunity provided by such a Conference to meet others in the same **line** of business and discuss **current** problems and solutions.

Theme – Opportunities for business

The foundation of the LDCA was announced twelve months ago at the **Drainage** Workshop jointly organised with **SaWMA**. From that initial membership of about **50 drainage contractors**, the total has now grown almost threefold.

The theme of the Conference this year was primarily aimed at the **commercial** interests of the members of the Association and speakers generally dealt with various opportunities open to Drainage Contractors to maintain and, hopefully, expand their businesses.

Opportunities with the Internal Drainage Boards

The opening **speaker**, Mr. **Peter Charnley**, North Level I.D.B., reviewed the opportunities for contractors in the Internal Drainage Boards and he stressed the local, involved nature of such authorities and their sensitivity to local demands and difficulties. He contrasted this with what he sees as the more impersonal nature of the large Water Authorities controlling the main rivers or of the County Councils responsible in some areas for servicing small upland streams. The Internal Drainage Boards are totally independent of the Water Authorities and they are responsible for providing to their ratepayers an economic, cost effective arterial drainage service in their specific areas.

The I.D.B.s deal with all flatlands and marginal areas in England. Effective arterial drainage is the life blood of flatland; without it field drainage is useless. Farmers in these areas recognise this and, accepting that up to 15 per cent of their fixed rental costs must be paid in rates, they naturally dictate the standards required. These standards have been constantly rising over the years and farmers require them to continue to be met in a cost effective manner.

Farmers' responsibilities

However, farmers themselves must still ensure proper maintenance of their own ditch systems and the underdrainage of farm fields – and with increasing financial pressures in the last few years we have seen a reduction in ditch weedcutting and annual maintenance. The old tractor with flail is no longer a viable proposition and, in any event, there is less time between harvest and drilling.

Many farm drainage systems installed in

the sixties only operate now at 30 per cent efficiency. Only about 65 per cent of the country's flatland has been underdrained and many areas require re-draining.

Scope exists here for Contractors to develop a proper maintenance package. Farmers will be more than ever concerned in future with the cost benefits of the improved workability of their land if drainage and ditches are properly maintained. Contractors here should address themselves particularly to today's "Farming Sons": They are the ones who will be taking over and looking for a proper return on capital in the future. "Teach-ins" organised by contractors pointing out the advantages of underdrainage and mowing where applicable, as well as maintenance packages would be cost effective.

Opportunities with the Drainage Boards
As regards opportunities within the I.D.B., Mr. Charnley emphasised here the need for regular and frequent maintenance. Submerged and emerging aquatic weeds in arterial water courses need to be cut and removed at least once and, generally, twice a year.

The early summer cut caters for summer floods, weed growth can obstruct flows to such an extent that water levels can rise as much as one metre per kilometre. The late summer operation clears the watercourses in readiness for the winter flows.

Some years ago these operations were carried out mostly by hand. Nowadays, this is not cost effective even if one could find sufficient scythe men. Labour has priced itself out of the market and a better job can now be done mechanically at a lower unit rate. Ten years ago the North Level Board employed 65

men, now there are 27 and natural wastage will reduce this to 15 in the next three years.

Internal Drainage Boards have no option but to mechanise these operations. This requires considerable capital investment but it is often no longer practicable within the Boards to operate such plant economically because of restrictive limitations on working hours. Contractors are in a better position – with their generally younger staff they can get the required annual hours out of the plant and at lower unit costs.



The future is with mechanical weedclearing with minimum damage to crops.

Specialised plant needed

But mechanisation of the work is not as easy as it would appear. Most I.D.B. arterial systems have been maintained by hand through farmers' land with little or no longitudinal access. So, cross ditches have to be piped and new culverts constructed to give access to both banks of the drain.

All this work can be done by contract. But that too would answer only part of the problem – with the type of plant commonly available today there is still risk of considerable damage to farm crops during

maintenance operations. So, there is a need to develop and operate specialist plant to work in the drain or on the bank along the brink in a width of 1.2m maximum. Contractors can do this in conjunction with agricultural engineers provided the market is available. So what is the potential market? There are some 14,448 kilometers of I.D.B. arterial drains in the flatlands of the country and at a cost of, say, 10p/metre there is a single cut potential of £1,444,800. And, as already pointed out, many drains are cut twice.

However, the real answer to mechanical weed clearing without affecting crops must be to work within the confines of the water-course. There are now machines successfully operating, cutting the bed and two metres up the batter and raking out all the material. It's a perfect contractor's tool, everything hydraulic and a capital sum of £40,000 operating for eight months of the year.

Types of work available

Summarising the types of work that he sees appropriate to drainage operations, Mr. Charnley listed:

for the Water Authorities:

- main river maintenance

for the Internal Drainage Boards:

- weed cutting
- flail cutting banks
- cleaning culverts
- installing side drains & culverts
- weed spraying & associated operations
- piling and revetment work
- mudding out operations
- channel improvement – excavation & spreading

for the farmers:

- weed cutting operations
- flail cutting banks
- cleaning culverts
- jetting underdrains
- renewing drain headwalls

There is surely a place here for the up-to-date, efficient, well organised drainage contractor.

Questions from the floor subsequently showed the keen interest with which listeners had followed Mr. Charnley's arguments. Mr. Charnley confirmed his view that chemical weed control must lose place to machine cutting, not simply as we follow Continental practice in restricting chemical input to water courses, but also as more species become resistant to acceptable chemicals. As regards support for purchase of capital plant it is likely that a lot of I.D.B.'s would look at some form of financing – for example, Hire Purchase assistance.

David Noble, Secretary, Association of Drainage Authorities, commented that there are around 260 I.D.B.'s in England. Of these, about half are in the Wash area, but significant numbers are also found in areas of South Yorkshire, Nottingham, Romney and the Somerset levels. Another speaker remarked how in the case of a smaller Drainage Board he had built up his contract service to cover the whole service right from preparing the programme.

Opportunities with the Water Authorities

After Peter Charnley's encouraging review of the potential with the Internal Drainage Boards, the next speaker, John Fitzsimons (Severn Trent Water Authority) was equally hopeful regarding prospects with the Water Authorities.

The Severn Trent Authority is the second largest of the ten Water Authorities in England and Wales. In 1984/85 the ten Authorities spent £787m. on capital projects and this included £55m. on Land Drainage and Flood Protection. Most recent figures for Revenue Expenditure (1983/84) are £1,950m.

Maintain close contact

Within Severn Trent the total expenditure was £352.4m. of which £12.1m related to Land Drainage Works. Of the total programme within Severn Trent more than 50 percent is currently undertaken by Contractors. In relation to Severn-Trent's Capital Programme, contractors are selected from standing lists on a rotational basis with three types-of civil engineering work in two value ranges of £80,000 to £250,000 and £250,000 to £800,000. These lists are updated with a major review every five years. The standing list is not used for Land Drainage Maintenance or other specialist work which is advertised in order to determine a select list usually of 6 contractors. Clearly, contractors need appropriate experience and must be able to demonstrate financial security to be placed on lists.

Tenderers for work up to £80,000 in value are selected at the discretion of the division concerned and the contract would not necessarily be advertised.

The other possible area where agricultural contractors may be considered would be for the laying of water distribution pipes. Annual expenditure including reconditioning with cement mortar linings under this heading is approximately £24m, with all the lining work let to contract. Approximately £18m is spent on new mains – 80 percent of which are up to and including 200mm diameter. Pipes, mains or either are ductile iron, PVC or MDPE. Almost half of

this work is undertaken by Contractors with the selection process relying on the standard lists.

Contractors must show financial benefits

With regard to river maintenance work, at the present time approximately 95% of the programme is undertaken by direct labour. If a larger percentage of this programme, which totals approximately £5m per annum is to be undertaken by hired and contracted services, it is important that contractors can demonstrate financial savings over the present system, in addition to fulfilling the sympathetic environmental needs and landowner requirements. Table A shows the breakdown of expenditure in 1984/85 under each objective head with the 8 Divisions in Severn-Trent.

Concern for the environment

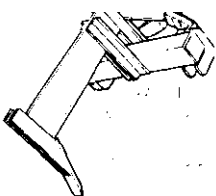
The growing concern for the environment, and the Authority's responsible attitude towards this, demands that contractors are chosen whose work is consistent with these requirements. It is incumbent upon the Authority as part of the Wildlife and Countryside Act to enhance conservation where this is consistent with the main function.

Answering questions, Mr. Fitzsimons explained that on the maintenance side, all contracts are less than £80,000 in individual value. A first approach by a contractor wishing to be considered for this work should be to the appropriate division of the Authority. Bob Fry, secretary of the Land Drainage Contractors Association, explained that the Association had already sent the Severn-Trent Authority a list of LDCA members and other Authorities would be similarly approached at an early date.

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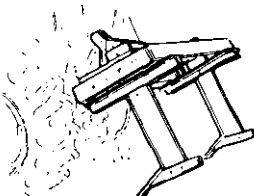
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Item	Severn	Division Trent	Total
Flood Bank Repair	234	235	469
Weed Control	132	193	325
Debris Clearance	97	280	377
Dredging	386	406	792
Trees/bushes	400	355	755
Revelments	19	103	122
Mowing	101	452	553
Structures	198	204	402
Other	34	348	382
Total	1601	2576	4177

Table 1. Land Drainage Operational Expenditure £'000's 1984/85 excluding salaries and financing expenditure.

Can Drainage live with conservation

In choosing the third subject for the afternoon session the LDCA organisers had recognised that maintaining a successful drainage business is not just a matter of getting contracts it is also important to retain a good image for the industry. Eric Carter, (National Farming and Wildlife Advisory Group) sought to answer the question 'Can Drainage live with Conservation:

Presenting a broad brush review of UK farming over the past 100 years, Eric Carter explained how post war measures encouraged farmers to adopt new technology and the country benefitted the increased production.

Changes in farming methods brought about major changes in the countryside, enlarged fields, loss of hedges, "improvement" of streams and water courses, drainage of wetlands, monoculture over wide areas, reduction in labour and rural employment. All these and other factors have led to an increasing concern among the public about modern farming methods and practices. Seen against the background of surplus production - the public cannot understand why land reclamation, new land drainage and other major farming activities are necessary.

The founding of FWAG

Some of these problems were foreseen as far back as 1969 when the Silsoe Conference was held which brought together, for the first time, farming and conservation interests to seek a better understanding and identify areas of compromise. Arising directly from the Conference, the National FWAG was formed with representatives from farming and conservation interests. The idea took root and local groups were set up with the same objectives. Their success led to the spread of the groups so that now there are 63 covering England, Wales and Scotland (there may be 64 if one is established in the Orkneys).

The groups aim to show that conservation of wildlife and landscape can fit with sound, profitable farming and they offer practical advice to farmers and landowners. The Farming and Wildlife Trust, set up in 1984, has enabled local groups (with aid from the Countryside Commission) to employ Farm Conservation Advisers - 26 are in post with others to be appointed. They are all very busy with waiting lists and aim to visit 100 new farms a year with follow-up visits as needed. They have no powers, go to farms only by invitation and, like the County FWAGs, rely on persuasion and co-operation and their ability to draw on a wide range of specialised advice.



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DRAINAGE



Opportunities in sportsfield work were explored by Mr. Peter Dury, Notts CC, whilst Prof. Gordon Spoor argued for more experimental work to establish the business economics – for example, of pipe spacing and gravel back fill.

Good drainage an essential pre-requisite

Good drainage is, of course, an essential prerequisite of farming whether for arable or grassland. Much drainage work deals with renewing existing schemes, often installed during the last century, or even more recently during and after the last war. Where drainage of wet areas, not previously drained, is contemplated then there may be concern over the loss of important wetland habitats. In many cases it may be possible to arrange for part of the area to remain undrained or to form a pond or small lake. This can be economic in that while draining the main area is fully justified, the cost of draining the last low-lying part may well be uneconomic and not always satisfactory. With rising costs and narrow margins it becomes even more essential to budget carefully and to be sure that capital works are carefully costed and show full benefit for the costs incurred. There is no longer any justification for drawing every last bit of land into cultivation.

The final decision is of course with the client, the farmer, but a contractor can help by showing how the greatest benefit will be achieved, for the money spent, on the areas with the greatest potential leaving the remainder for wildlife.

Farm ponds are a valuable feature but they should not receive large quantities of drainage water otherwise they will become enriched with fertiliser run-off and where phosphate combines with high nitrogen, algal blooms may occur, resulting in eutrophication and the death of the pond. Ditches are themselves a wildlife refuge, especially in open country where other features such as hedges and trees are few and far between. Ditches should be cleared from one side only, on a rotation round the farm to give a chance for wildlife to recover.

Hedges are a feature much loved by the public, boundary hedges should remain, also old hedges and those required for shelter. Hedges and grass banks provide cover for game birds and for insect predators that help to control cereal aphids. Hedges should never be sprayed and sprays and fertilisers should be kept out of hedge bottoms.

Contractors participation welcome

The local FWAGs draw their membership from farmers, landowners,

NFU, CLA, Forestry Commission, ADAS, agricultural colleges, local Naturalists' Trust, NCC and Countryside Commission. The Chairman is almost always a farmer. The group will hold conferences, seminars and farm walks, they may well run a Link Farm to demonstrate conservation practices. Many have a full-time adviser. They can only operate through the goodwill and co-operation of farmers and landowners, that this is willingly given can be seen by their success.

Those counties with a Farm Conservation Adviser can, of course, deal with many more enquiries and they are able to cover more than the specific queries about hedges, ponds, trees, etc. Some 30% of all visits end with a full farm plan which will develop over a number of years and cover all aspects of conservation. The Farm Conservation Advisers bring together a wide range of expertise and would welcome help from contractors who will know what is possible, how best to tackle jobs and to make the best use of the available resources. Local contact with contractors would be welcome.

Conservation is not exclusive to any one group or profession, it needs a wide range of skills, sympathy and understanding.

Industry response needed

Subsequent speakers generally supported the view that Drainage can live with Conservation – but the industry needs to take a careful response and indeed to take the initiative in presenting its beneficial aspects. For example, the so called wetlands can really be described as rough grazing marshes. All the land has been drained in the past. There has been little land anywhere that has seen virgin drainage. Many waterways, drainage schemes are creating new habitats. There is scope here for yet a further valuable campaign by the LDCA.

Later speakers explored not only contracting opportunities but also the relevance to Drainage Contractors of quality control and current research. Mr. Roy Roberts, P. Wright Ltd., explained the specialised features and applications of impact mowing (see also Soil and Water, April, 1985). Opportunities for contracts in sportsfield work were dealt with by Mr. Dury, Notts C.C., whilst Ian Johnstone, NIAE and Derrick Clark, D W Clarke Ltd., spoke about prospects and pitfalls in overseas work.

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Pollution on the Farm – Whose problem? Who pays?

Joint Conference 12th November, 1985 – SaWMA MAFF, East of England Agricultural Society

This one day Conference at **Silsoe** College attracted some 90 delegates from a wide range of interests directly and indirectly involved with farming. However, considering the vital importance of this subject to farming itself and to the image of farming, it was disappointing not to see a higher proportion of farmers amongst those attending. There could be many reasons for this – perhaps one reason could be that farmers saw in **this** Conference that one of their main pleas – to have a voice for farming – was being acted upon – that people here were going to speak out fairly and truthfully about pollution problems and what can be, and is being, done about them.

In opening the Conference the Chairman, Mr. John North, was pleased to read out a message from the Minister of State for the Environment, the Rt. Hon Kenneth Baker, M.P. supporting the aims of the Conference and wishing delegates success in their deliberations.

The Rt. Hon. Kenneth Baker MP Secretary of State for the Environment

"In a small, densely populated island **such** as **ours**, we cannot escape the consequences of modern technological developments. Such developments, however desirable in themselves, can carry an additional cost which may not be recognised at all until the bill arrives. Pollution, of whatever kind, is such a cost.

"In the past we have relied too much on nature itself to pay the price. We now increasingly recognise that the healing resources of nature are not infinite and we must, as custodians of the resources in our **care**, take conscious and positive steps to control the by products and wastes of society's activities. If we damage our land and pollute our water through carelessness and lack of skill, we damage **both** ourselves and future generations.

"That is why **I** welcome this initiative of the **Soil** and Water Management Association jointly with MAFF **ADAS** and the East of England Agricultural Society.

"By bringing together the managers and users of land and by **drawing** on their skills and experience, your conference **will**, **I** hope, demonstrate that prosperity and development can go hand in hand with care and concern for the countryside – for the land itself.

"I wish you every success in your deliberations."

Mr. North recalled his own earlier association with the 1979 Royal Commission on Environmental Pollution and how at that time they had found basic assumptions in thinking such as; that the necessity of food supply takes precedence over environmental requirements and that the observance of good agricultural practices will ensure that any adverse environmental effects are reduced to a practical and acceptable minimum. A re-assessment was called for and we can now see significant progress both in attitudes and legislation. In 1985, particularly we

➤ have had the **Water Pollution Act** coming into full operation and the Food and Environmental Protection Act going through the House with consequent great significance for other aspects of pollution in the countryside and pesticides in particular. It is now up to all of us to carry forward the spirit of the legislation. We recognise that the environment is important and we have to protect it **both** for current and future generations.

Identification of the real problem areas Dr Norman Moore, FWAG Scientific Consultant.

Everyone is against pollution, but everyone is in favour of cheap food, electricity in the home and motor transport. We cannot have our cake and eat it, but most would agree that we should try. In other words, some pollution is inevitable but we want as little as possible.

Before looking at the different pollutants and their effects I must define the criteria by which I classify a particular pollutant as important. I think most would agree that a pollutant is a significant one if

➤ it has one or more of the following attributes –

- a It has significant effects on the life expectancy of human beings
- a It produces long lasting or irreversible effects on organisms in the area contaminated
- a It has measurable deleterious effects on living organisms over large areas of the country.

In other words, the importance of a pollutant depends upon its toxicity (chronic as well as acute), its persistence and its scale of use and distribution. Pollution can result from the ordinary use of a product or from misuse and accidents.

POLLUTION

Pollution by farming

Pollution by farming was insignificant until the post-war period. Today fertilisers and pesticides are used on practically every farm in the country and so are bound to have some pollution effects.

In the past, soil fertility was maintained by applying farm yard manure which supplied both the chemical nutrients (primarily Nitrogen, Phosphorus and Potassium) necessary for plant growth and humus necessary for soil structure. By using "artificial" fertilisers yields could be considerably increased. Today over 6 million tonnes of fertiliser are used per annum in the United Kingdom. The main concern about fertilisers as pollutants is when they get into water. They can reach water by accidental spraying of water courses, by leaching through soil and by the natural flooding of low lying fields which have recently received dressings of fertiliser.

Aquatic plants and animals are sensitive to changes in the chemistry of water. Fertilisers can alter the pH of water bodies, and by inducing rapid plant growth and decay can affect the supply of oxygen. As a result, fish and other animals can be extirpated locally by pollution by fertilisers.

The use of nitrogenous fertiliser has increased steadily since the mid-fifties and is now seven times the amount used in 1950 (unlike Phosphorus and Potassium whose use has remained fairly constant). The increase in the use of Nitrogen has been reflected in an increase of Nitrogen in rivers and groundwater. There is concern that this might cause an increase in the very rare disease of young babies known as metraemoglobinaemia, in which they are unable to deal with the transformation of nitrates into nitrites by bacteria in their bodies. There is also a possibility that nitrites might combine with naturally occurring amines in the human stomach to produce nitrosamines which are known carcinogens in animals.

Some phosphate fertiliser contains Cadmium as a significant impurity. No ill effects have been recorded from it, but as will be emphasised later, we should be concerned about Cadmium pollution in general.

Aquatic organisms have been affected by fertiliser at the same time as they have been affected by pesticides and drainage: it has been difficult to quantify the different effects. Damage could easily be reduced by more efficient application. The medical risks appear to be small, but too little is known about the effects of nitrates on human beings for anyone to feel entirely happy about the increasing amounts of Nitrate in the water supply, whatever its sources.

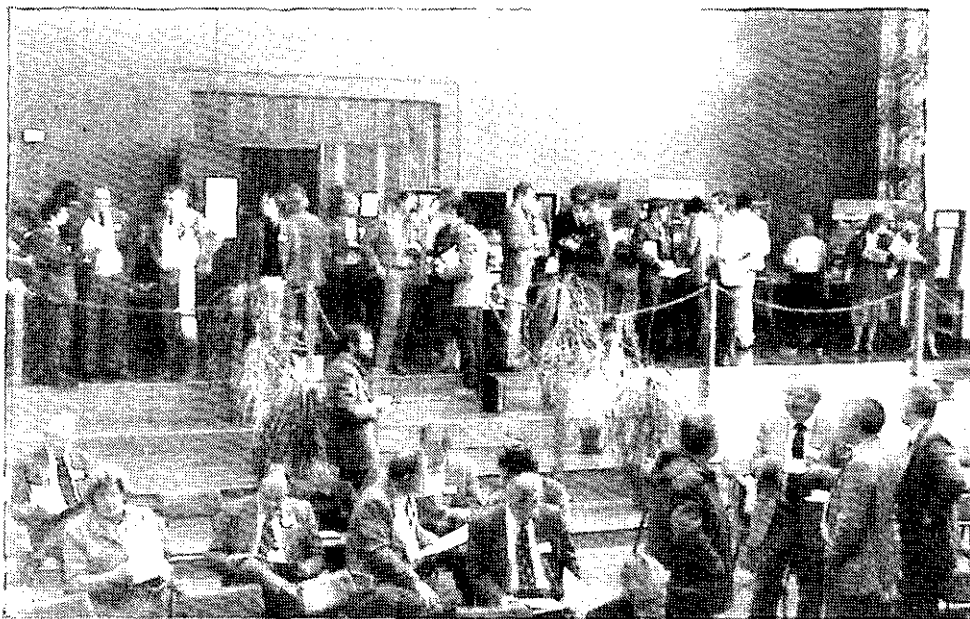
There are strict regulations about the siting of units which produce slurry and about its disposal. Nevertheless slurry frequently gets into watercourses and can have a devastating effect on aquatic animals. It only needs one isolated release of slurry to kill many of the aquatic invertebrates and fish in the river downstream. It may take some animals many years to re-colonise the river, and some of the rarer ones may never succeed in doing so.

Pesticides are used to kill weeds, fungal pests, insects, rats, etc. None is specific, and therefore their use always involves some risk to some non-target organisms. They vary greatly in their toxicity and persistence. They are now used very extensively: in England and Wales over 25,000 tonnes are used every year on a total area of over 15,000,000 hectares. Like fertilisers they have had profound effects on wild plants and animals living on the crop lands. Pollution by pesticides is caused in two ways:

- By misuse and accident. For example, pesticide drift can occur when spraying is done under windy conditions, and contamination results from dumping containers in watercourses and h) washing out spray equipment in them.
- By the use of very persistent pesticides which are transported in the air, or in water or in the bodies of animals to areas outside the crops.

Most pesticides are not very persistent, and many that are do not move much in the environment. The exceptions are the persistent organochlorine insecticides. These compounds combine persistence with solubility in fat. As a consequence they can build up in the bodies of animals, and under conditions of stress, can be released into the blood stream with fatal results. They can also be transferred from prey to predator, so that the predators are at special risk. It was the decline of predators, notably foxes and birds of prey, that gave warning of the danger of environmental contamination by these substances. Their use has been greatly restricted or prohibited altogether by most developed nations, and thus a very serious threat to wildlife, including fish which breed in freshwater and estuaries, has been averted. However DDE, the principal metabolite of DDT is still present in ecosystems and is still having biological effects. Some of these pesticides are still being used illegally - a matter which requires urgent investigation by the agricultural departments.

It must be emphasised that persistent organochlorine insecticides are not typical, and no new pesticide with their characteristics would



ever be cleared for use by the Pesticide Safety Precautions Scheme today.

Today, most of the pollution caused by pesticides results from poor application, especially from aircraft. Effects of drift on organisms in hedges, the edges of woods and in water must be considerable. They are extremely difficult to study and have received less attention than they should.

The principle effect of strawburning is on invertebrates on the croplands, however it does also cause pollution. Black smuts are a nuisance to those hanging out washing, and badly controlled fires damage or destroy numerous hedges and even edges of woods throughout cereal growing districts, despite exhortations for care from MAFF, NFU and the police. The irregular distribution of incidents demonstrates how much pollution depends on the actions of individual people.

Pollution suffered by farming

Pollution by fertiliser and pesticides can also affect farming. For example, polluted water can kill cattle, and herbicide drift, and in some cases volatilisation of herbicides can affect sensitive crops in neighbouring fields. However, the main pollution suffered by farmers comes from industry.

Watercourses can be polluted by industrial effluents of many kinds as well as sewage. The annual input may be low but the release of a highly toxic substance on one occasion can do much damage locally.

The very toxic metal Cadmium is released into the atmosphere by zinc smelting and other industrial processes. It is a common impurity of sewage sludge as well as phosphate fertiliser. The amounts of Cadmium on most farms does not raise immediate concern, but Cad-

POLLUTION

mium cannot break down into harmless constituents. Sooner or later we shall have to be concerned about its accumulation on farmland since it can have serious effects on the human kidney. These types of pollution are sporadic and localised, much more uniform is that caused by the combustion of fossil fuels.

In Britain the atmosphere is significantly polluted by Sulphur Dioxide & Nitrogen Oxides. The acids which these produce when oxidised are deposited in both wet and dry forms. In Britain the ratio of acids in rain is 7 Sulphuric Acid to 3 Nitric Acid. During the last thirty years severe local pollution in industrial areas has been reduced so that it is now only about a third of what it was in the late 1950's. This has been achieved by increasing the height of the chimney stacks of power stations, etc. Pollution has been widely dispersed, and as a result in large areas of Britain the pH of rain has fallen from about 5.6 to 4.6 or less.



On most soils increased acidity is adequately buffered by the soils themselves. However, when the bedrock weathers slowly and soil has a low buffering capacity, acidification can have severe effects on aquatic ecosystems and at least some effects on the growth of trees. The trees themselves (especially conifers) concentrate pollutants and so lakes and rivers become especially impoverished in areas which have been afforested. On agricultural land in these areas the effects of acid rain are masked by the application of ammonia based fertilisers and by liming.

The effects of acid rain are extremely complicated and not fully understood. Species vary greatly in their response to it. For example, the Scots Pine is much more sensitive than the oak. Lichens and mosses are particularly sensitive. Increased acidification in rivers and lakes can lead to the total extinction of their fish populations. Increased acidity leads to the leaching of metals from the soil, and it seems probable that the toxic effects of aluminium may be at least as important as a reduction in pH in reducing fish stocks.

Laboratory work done on the effects of acidity on agricultural crops demonstrates a great variation in response between species. It is extremely difficult to assess losses in the field. In some areas Sulphur is deficient and would have to be applied were it not present in the rain. It also has some beneficial fungicidal qualities.

Much of the work has been done on the effects of single substances, but in the field, plants and animals are confronted with mixtures of pollutants. There is some evidence that quite small amounts of Sulphur Dioxide

can affect grass in the presence of Nitrogen Oxides. It affects aquatic systems and forests. Its extensive occurrence makes it a significant problem. Much more research needs to be done on it.

Many forms of industrial pollution affect farming near factories & power stations. Regular emissions may be enough to affect the type of farming practiced. For example, pollution by Cadmium from Zinc production may mean that no cattle can be kept on land adjacent to the smelters. Accidental discharges from atomic power stations have resulted in the prohibition of the sale of milk from farms affected. Each of these types of pollution can be important locally, but have little effect nationally. However, a major increase in any one kind of activity can turn a local problem into a national one. We have to be on the look out for such changes.

Conclusions

Serious pollution can result from uses sanctioned by society and from misuse which would be condemned by any objective observer. When there is evidence that a previously accepted use is dangerous. Government and its agencies have to intervene. It did so in the case of the persistent organochlorine insecticides, and it should do so now in the case of acid rain. We cannot afford to wait until all the details of mechanism are determined. Farming cannot fail to benefit from a reduction of fossil fuel pollutants.

Most pollution results from scores of incidents each relatively trivial on its own, but in aggregate very important. Some accidents are inevitable, but their number and the amount of misuse could be greatly reduced. In the case of pesticides it is to be hoped that the recently passed legislation will be supported by effective surveillance in the field. In the long run improvement can only come through better education and that can only be achieved by sharing knowledge about facts, the purpose of this Conference.

Conference proceedings to be published

The following two pages cover only brief extracts from the contributions by succeeding speakers. The full report of the Conference proceedings will be published shortly.



The discussion panel: L to R – Norman Moore, Ralph Baker, John North, David Stickland, Tim Evans, Nigel Dudley, David Eagle (behind), Roger Phillips, Arthur Staniforth.

Dr. Tim Evans. Thames Water Authority

Slurry: Nitrates Dr. Evans explained how, as a Soil Scientist with Thames Water Authority, he had been responsible for achieving environmentally acceptable, cost effective disposal of sewage sludge. The aim had been to optimise the fertiliser benefits without causing pollution risks. The significant perceived risks were heavy metals, pathogens, nitrate, run-off and smell. By planning and strict control, using the DoE's Guidelines on **Sludge Disposal**, these were either prevented or (especially for smell and run-off) very closely controlled.

Data on serious farm pollutions in England and Wales as reported by Water Authorities shows there is a clear rising trend over the last 10 years.

Some of the incidents are overflow of lagoons, failure of stores through age or design, run-off from badly managed land application or failure to design for foul water run-off from yards and other hard surfaces.

Odour is an increasing problem – at least, the number of complaints described as justifiable is increasing very fast and so a precaution. The Institute of Environmental Health Officers surveyed odour complaints in 1982. Details are given in Table I.

Odour Source	Pigs		Cattle		Poultry		Total	
	No.	%	No.	%	No.	%	No.	%
Buildings	224	22	65	18	163	36	452	25
Slurry storage	169	17	98	28	78	17	345	19
Slurry spreading	526	52	122	34	190	42	838	46
Animal feed production	84	8	4	1	11	3	99	5
Silage Clamps	10	1	68	19	8	2	86	5
Total	1013	56	357	20	450	24	1820	100

Table I Premises causing justifiable complaints in 1982 Source IEHO

Sub-surface injection can effectively control odour, run-off and pathogen dissemination but, especially on under-drained fields with gravel backfill close to the surface, it can increase the risk of leaching losses. In one case slurry was actually discharged from field drains because of infiltration through gravel backfill. In general however it is proving a very promising technique and of course it lessens the visual impact of the operation and risk of taint on grassland.

Conclusion

There is pressure for an EEC Directive on farm wastes and Holland has proposed limiting farm waste applications at 200kg N.ha^{-1} ; if this were applied to the UK it would mean that about 20% of the total agricultural land area would be treated each year with waste from housed livestock – with increased cost and inconvenience to farmers and indeed the local community with larger areas for odour production and possibly lorries carting wastes off for disposal elsewhere.

The following recommendations are presented:

- That even more effort is put into establishing qualitative criteria for farm waste disposal and for control of nitrate pollution in order to forestall a draconian EEC Directive and treatment systems to remove nitrogen from wastes.
- Avoid autumn seed-bed N and excessively early spring N that make crops look good rather than contributing to saleable yield.
- Avoid N application before drought.
- Discuss plans for slurry and waste disposal or treatment with Water Authority hydrogeologists.
- Pay more attention to the maintenance and design of waste and foul water stores.

Farmers and Water Authorities both have problems and both will have to pay, but there is still the question of whether we overpay to overprotect.

Mr David Eagle, ADAS Pesticides Residues Unit

Agrochemicals: Pesticides may have both direct and residual effects. By 'direct effects' is meant the immediate or short term effect of a chemical on the pest, disease or weed which it is applied to control. In the case of insecticides direct effects may include the death of non-target insects as well as pests.

Possibility of Pollution of Soil and Environment

Insecticides: Apart from two minor uses of aldrin there are now no permitted uses of very persistent organochlorine insecticides in agriculture although dieldrin is used in wood preservation. The insecticides which have taken their place are mainly organophosphorus, carbamate and synthetic pyrethroid types. Their persistence varies from a few days to several months.

Fungicides: With few exceptions fungicides are much less toxic to mammals than insecticides. Some can persist for several weeks but they are mainly short lived and are readily metabolised by mammals.

Herbicides: These range in persistence from that of paraquat which is active on green plant material but is rapidly inactivated by clay in soils, to several months for some soil-acting herbicides. Although remaining in the soil for a considerable time even the most persistent soil-acting herbicide degrades completely and there is no pollution of the environment. Paraquat residues remain inactive in soil clay particles with little or no degradation. Although retained in the soil unchanged it is held so tightly that it has no biological activity. Even the sandiest mineral soils have the capacity to inactivate paraquat (and the related product diquat) applied to normal rates for several decades. If the clay became saturated with paraquat, residues would be less firmly held and would degrade.

Risks of Pollution of Water

It can be concluded from these considerations that if properly used modern pesticides do not pollute the environment. The main risks from pesticides are from mis-use leading to drift or spillage etc. It is also particularly important to avoid pollution of water. Most agrochemicals are adsorbed by the soil so they do not readily move through the soil with drainage water. This is an important safety factor for chemicals which adsorb strongly and includes nearly all of the insecticides and fungicides and the majority of the herbicides. Adsorbed pesticides are only likely to reach water courses if there is erosion of soil particles.

Herbicides in the hormone weedkiller group used mainly on cereals do not adsorb strongly and so there is a potential risk of leaching or run-off. However, the persistence in the soil of herbicides in the phenoxy acid group which is the most widely used and includes mecoprop and MCPA, is very brief. Most of it degrades within about a week so there is little opportunity for residues to leach into streams or ground water.

Conclusion

Modern pesticides, in particular the less persistent insecticides that have been developed over the last 15 years or so, do not present a hazard to the environment like the now banned persistent organochlorines.

Mr. Arthur Staniforth – Reading Agricultural Consultants

Atmospheric pollution. Straw burning is practiced for speed and cheapness and it claims to show greater yields. Disadvantages can be long term deterioration of some soils, possible effect on herbicide action.

Pollution from burning can be assessed by scientific measurement or by study of public reaction. Public reaction is not scientific but it is the more powerful yardstick in practice and it is this which has forced attention to the problem.

Better management of field burning can reduce the risk of pollution but the more certain way is incorporation or alternative uses for the straw – as fuel, for paper, for lining under silage, even for export.

Needless to say such uses must be economic and this implies the need to develop better systems for collection, transport, storage and handling.

Dr. Roger Phillips, Head of Waste Eng. NIAE

Clean-up techniques – Dr. Phillips covered the range of possible pollutants and pollution situations – pollution of water (by nitrates, organic matter, pesticides); atmospheric pollution (dust, odours, smoke) and soil pollution (excessive levels of potassium, phosphorus, heavy metals, pesticides).

The basic way to prevent or cure any pollution is: by management care; by technology; or by a combination of these – and, almost always, prevention is easier and cheaper than cure.

Ways of reducing nitrate leaching were tabled as follows:

technique	comment
Careful timing of application(s) of nitrate fertiliser	Financial as well as environmental incentives How is timetable decided? Difficult for farmer to stick to timetable?
Use controlled-release nitrate fertiliser	expensive at present
Use ammonium fertiliser (sulphate or urea) instead of nitrate	only feasible early in growing season
minimum autumn cultivations	stubble can be problem during direct drilling
Incorporate straw after harvest	expensive?
grow an N-fixer with a non-fixer?	already demonstrated with grass/clover: longer term for cereals
N-fixing cereals?	very long term

To reduce the risk of pollution from pesticides and herbicides:

technique	comment
Follow guidelines!	
Choice of formulation	
Electrostatic charges	Still under development for tractor mounting
Less persistent chemicals	being introduced steadily
Biological agents	developing rapidly

Dr. Phillips pointed out that grants may be available towards the cost of anti-pollution equipment.

Mr. David Stickland, Organic Farmers and Growers Ltd.

Organic Farming – There is a lot more to organic farming than just not using chemicals, although one of the rules is that farmers are not allowed to use any soluble salts or any agrochemicals. Rotations must be carefully planned to make sure soil borne diseases are kept under control. Shallow ploughing is the rule to encourage built up in top soil of organic matter, aerobic bacteria and other beneficial organisms.

Organic farmers concentrate on achieving soil balances, such as carbon to nitrogen ratio, and on having proper availability of calcium rather than just a correct pH value. Serious efforts are made to build up organic matter. Getting these factors right will cut down on pollution.

The fertilisers used by organic farmers are all soluble in water (with one exception – the limited use of Chilean nitrate of soda) and they have to be broken down by soil acids and bacteria before they are of use to the plant. There is no way they can be leached out of the soil.

Other products, such as liquid seaweed, will never pollute anything for obvious reasons. Slurry is the most likely pollutant used by organic farms – but, of course, this applies right across the farming scene.

Many other products are coming on the market such as worm casts, enzyme products. These, along with new techniques now being explored, will lessen even further the risk of pollution.

Mr. Nigel Dudley, Earth Resources Research Ltd.

The Environmental approach

Most farmers would agree and support the motion that a pollutant that is messing up agriculture should be controlled by legislation. It is becoming increasingly obvious that the same rule must work in reverse – that pollution from the farm must also be controlled. That's a fairly fundamental factor in the environmental point of view. It is no longer sufficient to rely on good will voluntary codes or on economic principles.

Four main reasons why legislation is a necessary part of pollution control:-

- Although a lot of farmers are aware of environmental problems there are others who are not aware, or are not aware
- A larger number of farmers are still fairly ignorant about some aspects of pollution.
- A lot of pollution aspects are very complex. Balanced judgements are needed by independent people and a system for ensuring such judgements are adopted.
- Britain is part of the EEC and a lot of pressure for environmental control is coming from the EEC. Our voluntary controls are actually breaking EEC regulations.

And when legislation is introduced it has to be workable. It is a shame there are still too often two camps – farmers and conservationists. All involved have to get together and sort out a common agreed approach.

Mr. Ralph Baker, Somerset farmer and member of Wessex Water Authority

Responsible Management. The conference is sub-titled 'Whose problem, Who pays: The answer to both these questions is the farmer. Perhaps free advice may be available to help solve the problem. Perhaps grant aid may be available. In the end the management skill of the farmer will be the biggest factor in solving the problem and easing the cost of pollution avoidance.

In the long term it is probable that capital investment to avoid pollution must be undertaken. But there are certain guidelines which a good manager can follow whatever the investment status.

1. Identify all potential pollutants on the farm.
Chemicals purchased e.g. herbicides, insecticides etc.
Naturally occurring wastes e.g. farmyard manures, silage liquors.
2. Ensure secure storage either by lock and key or by bunding.
3. Understand the processes which make a potential pollutant into a nuisance.
4. Take steps to avoid that process occurring.
5. Plan the sequence of events following accidental spillage.
6. Plan the sequence of events following planned disposal.
Planned disposal onto suitable farm land is likely to remain the most economic system of disposal.

Silage effluents and vegetable wastes cause severe problems if care is not taken. Proper control and storage is essential.

Farmyard manures are increasingly becoming the major cause of agricultural pollutions. Slurry must be bunded against water coming in or leachate going out.

To sum up, keep potential pollutants in secure compounds, properly bunded against accidents and away from water until application time. Apply potential pollutants to farm land at the minimum rate necessary and properly diluted. Apply to soils of known absorbability at the most effective time of year for maximum plant utilisation appropriate to the type of plants growing or to be grown.

FIELD MEETINGS

Staverton Court Farm, Gloucester Straw Incorporation with primary cultivation implement; Conservation

The Field Meeting at Messrs. Newtons' Staverton Court Farm was organised for SaWMA members by Mr. Richard Newton. The visit, at end September, 1985, was divided into two parts, dealing separately with conservation issues and with a novel double-action cultivator. The farm – mixed arable and dairy – extends over 440 acres and the soil is of the Evesham Series clay covering a Lias clay subsoil penetrating to a depth of 360 feet (revealed by a operation in search of oil).

Conservation

Resulting from the loss of many trees in the area due to Dutch Elm disease and as a contribution to posterity, Richard Newton and his family decided some years ago to take a small area of arable land and allow it to revert to a more natural state.

An excavated pond, incorporating a small island, forms the central feature of this development. The spoil from the excavation was used to form a shelter bank on one side, while the remainder of the land was planted

ment, the result of three seasons' development, demonstrated its capacity of producing, in one pass, a rough seed bed 8 feet wide requiring only one further operation with either a light cultivator or roller, depending on season and soil conditions, prior to drilling.

The power frame of this comprises five stout tines mounted and staggered in two rows i.e. three in the front with the remaining two in the rear row, capable of working at a depth of 12-16 inches. These tines are followed by a 100 inch wide rotavator, operating at a depth of 6-8 inches, driven by a centrally-mounted diesel engine of 105 BHP recovered from a scrap yard for the princely sum of £150.00 – all part of the interest in conservation.

A further part of the demonstration was arranged to indicate the implement's capability in terms of straw incorporation and, even though partial incorporation was achieved, it was generally agreed that the straw would have to be chopped into much shorter lengths to realise the true potential of the

LETTERS TO THE EDITOR

Dear Sir,

Pollution on the farm, Whose problem? Who pays?

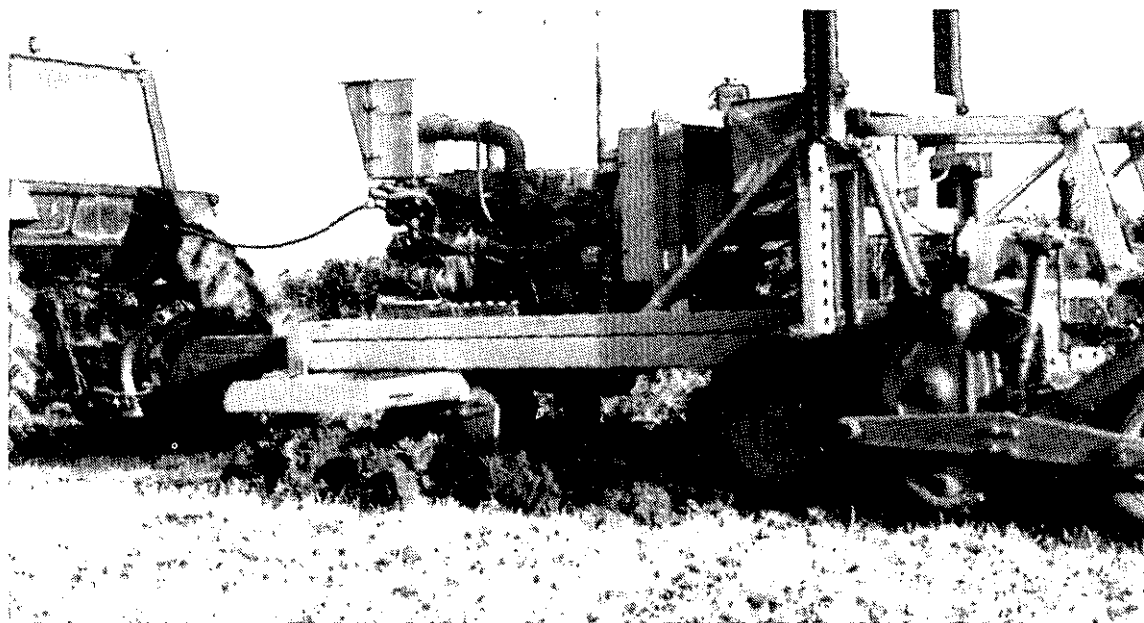
I was most interested when attending the conference held at Silsoe College on November 12th. There was an admirable mixture of speakers although only 7 of the 90 participants (7.8%) were actually farmers.

It is all very well for speakers to sally forth 'willy nilly' with un-scientific and empirical statements – enticing farmers to 'go organic' and to recommend totally out-dated products or indeed the 'magical' seaweed. If the farmer is to pay the of curing or preventing pollution he must ensure that he has the necessary resources. He will have these by using up-to-date products and technology which will enable him to obtain high and consistent yields.

And to Academics. Friends of the Earth and so called conservationists I would ask "are you so sure that the present cereal glut will continue?" Don't play with our heritage by assuming that it will.

Yours faithfully

Vincent van Walt
Van Walt Agricultural Services



The Newton double action cultivator – breaking out hard ley after Gramoxone.

out with a variety of deciduous and coniferous trees.

Notable amongst the lessons learned from this exercise is the need for good weed control, combined with careful selection of the species to be planted. For example, the Scotch pine has been found to be much more tolerant of the alkaline soil conditions than other species of conifers.

Double-action cultivator

On another part of the farm, we were able to see in action the double action cultivator developed by Richard Newton. This imple-

machine in this respect.

It is of particular interest to note that the land examined had no close-spaced drainage system, as would be expected in this type of soil. It relies on old drainage channels probably installed over 100 years ago and the natural drainage provided by the well structured soil. Indeed, the soil scientists who accompanied the party were unable to find any sign of mottling in the top 24 inches of the soil profile.

The results being achieved by Richard Newton with this equipment are certainly impressive and, in his own words, the system

had given him "greater reliability and versatility" than any other system he has used, to which he has the added benefit of economy, in terms of time, labour and overall cost. It is also pleasing to note that Bernewode Designs Ltd. of Aylesbury have recognised the potential of this type of cultivation system and have now developed the NEWBERN POWER FRAME, based on Richard Newton's ideas.

In summary, a most interesting and instructive field day which provided much food for thought and our thanks are due to Mr. and Mrs. Richard Newton for their kind hospitality.

DIARY

FEBRUARY 1986

- 18-19 "Pesticides Legislation and its effect on your business"—Conference, UK Agricultural Supply Trades Association, St. John's Swallow Hotel, Solihull, Warwicks
- 25 Better use of nitrogen—The Prospect for Grassland—One Day Conference—RASE/ADAS/AGRI National Agricultural Centre, Kenilworth, Warwick

MARCH 1986

- 4 Organic Farming—The Natural Alternative—One Day Conference, NAC, Kenilworth, Warwick
- 9-16 International Exhibition of Farm Machinery—including the First Exhibition on Agricultural Data Processing—Porte De Versailles, Paris, France.

APRIL 1986

- 7-11 Irrigation—Short Course, Silsoe College
- 14-18 Soil Conservation—Short Course, Silsoe College
- 16-18 Hydraulic Design in Water Resources Engineering, Land Drainage—2nd International Conference, Department of Civil Engineering, University of Southampton

MAY 1986

- 14-15 Farmers Weekly International Drainage Event—Stratfords Farm, Marston Trussell, Northants
- 20-21 **Spraytec 86**—Advances in agrochemical application technology—NAC, Kenilworth, Warwick

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APPOINTMENTS

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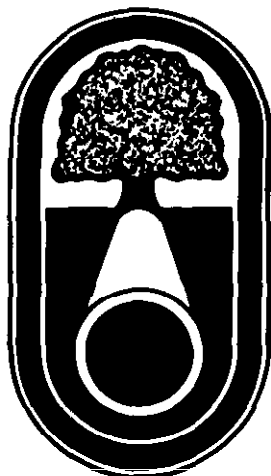
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