SOIL and water

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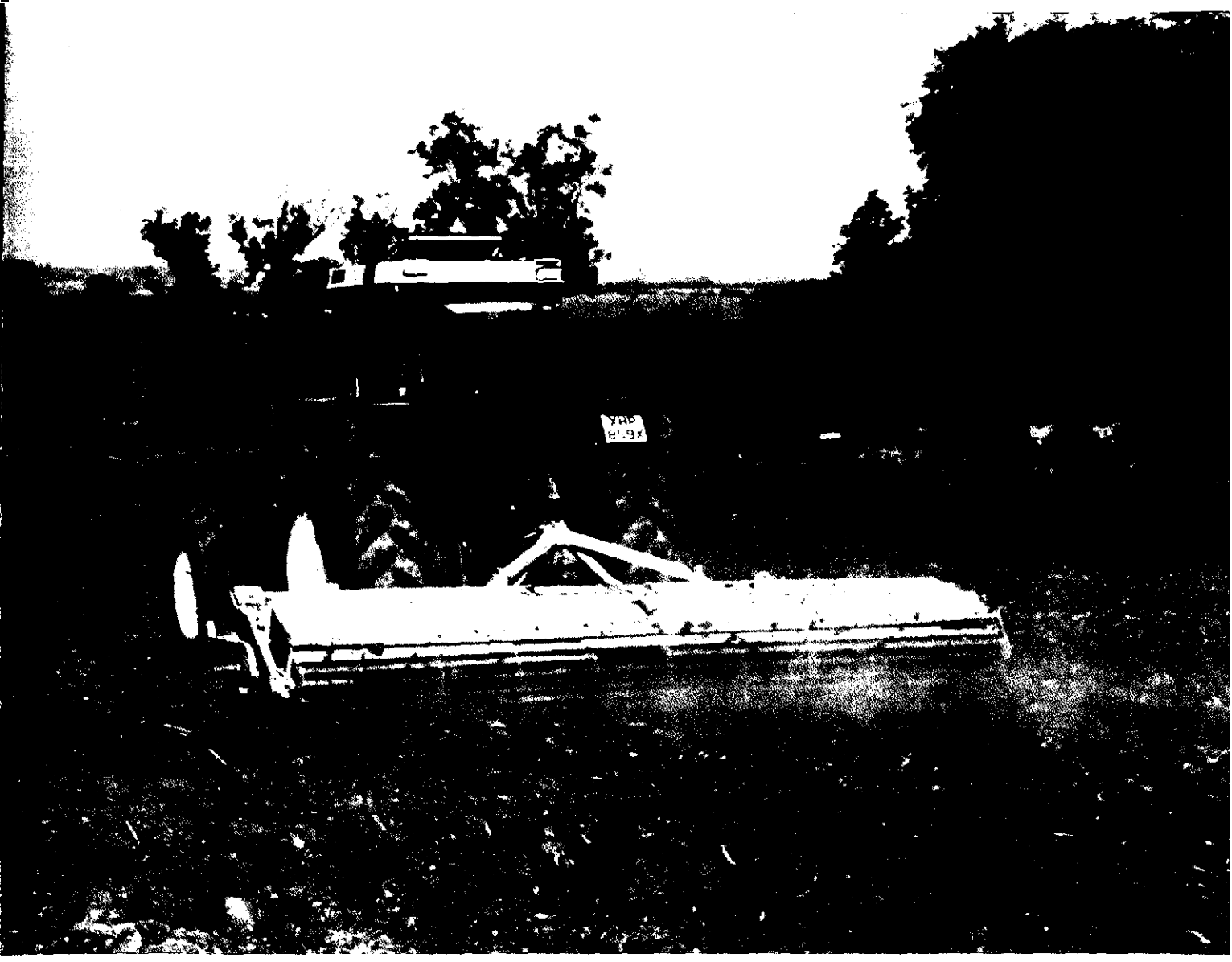
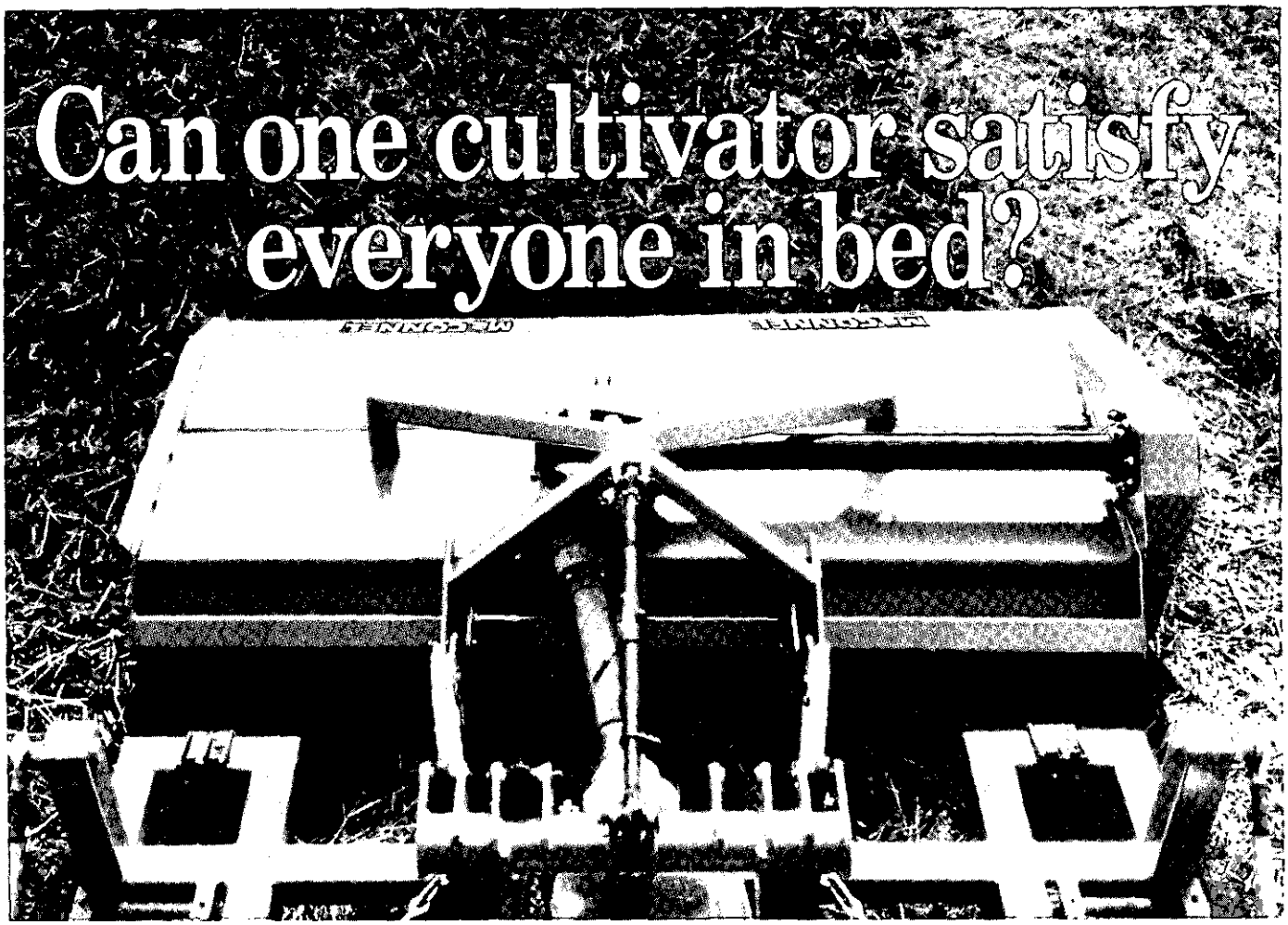


Can one cultivator satisfy everyone in bed?



The new McConnel Tillaerator. Heavy clay or light loam. Winter cereals or spring onions. Rain or shine.

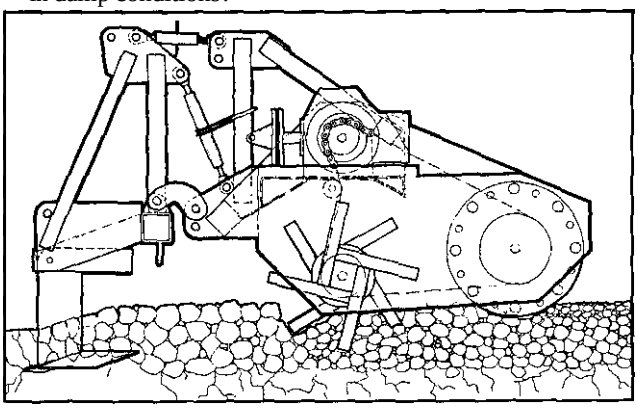
A well-prepared seed bed is essential to give any crop a good start in life.

Of course, a bed which suits one crop won't necessarily suit another: for instance, the tilthcan hardly be fine enough for onions, while winter cereals are more comfortable in a coarser bed. Can any cultivator, truthfully, promise to produce the ideal seed bed for all crops? Whatever the soil? Even in damp conditions?

One can: the new McConnel Tillaerator.

In the first place, the Tillaerator has a powered crumbler which, unlike the ground-driven types used on conventional machines, continues to break up the soil even when it's sticky. So it doesn't cause smearing or compaction. And, because the crumbler exerts no 'drag' it makes a marked improvement to tractor fuel consumption.

In addition, the Tillaerator's rotor/crumbler speeds are controlled by a four speed gearbox. If you need a fine tilth, you simply combine a high rotor/crumbler speed with a low tractor speed. For a coarser bed, you slow down the rotorl crumbler and speed up the tractor. The permutations it offers are almost endless and they allow you to prepare a seed bed that's coarse, or fine, or anything in between.



Send off the coupon for a leaflet. Or ask your McConnel dealer for a demo. Either way, we're sure we can satisfy you that everyttung we claim for the Tiaerator is true.

Please send me detailed literature ☐ the Tillaerator ☐
Please ask my nearest dealer to arrange a demonstration ☐

Name _____

Address _____

_____

_____ S&W7/83

Post Code _____

F. W. McConnel Ltd.,
Temeside Works, Ludlow,
Shropshire SY8 1JL.
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McCONNEL

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SOIL and water
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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 objectives are to further the condition, fertility and management of the soil and its resources.

The next issue will be published in October and will feature winter working, tyres and land reclamation.

COMMENT

KEEP IT SIMPLE

ONCE AGAIN the round of shows, technical demonstrations and research station visits are upon us, with the Government-sponsored technologist promoting his work to the tax-paying public. There is no question that these events are a marvellous opportunity for the passage of information, but are we as an industry succeeding in this aim?

The press has often been quick to jump on our backs and criticise the so called boffins, with their uninterpretable graphs and their preoccupation with regression analyses and 95 per cent significance levels, but the signs are that we are winning.

At this year's Royal Show Soils Centre, "Mr Average Farmer" appeared to be more in touch with technical matters than I have experienced at any other time. The soil-loosening message of Spoor and Godwin, the straw incorporation story and the avoidance of compaction by controlled trafficking were on the whole well understood. However, there are still exhibits, not just at the 'Royal' but other events as well, which fall far short of convincing even the most learned farmer.

Why is this? Well I feel there are perhaps two reasons. The first is that the farmer has only a limited time to digest information and if it is a particularly hot afternoon even the best-presented graph, if it has more than maybe three or four lines on it, will be difficult to absorb. Such material is probably passed into the consumer's short term memory and eventually lost. The second is that there are often too many words on display material, or they don't 'tell a story' or follow logically from one board to the next. All too often displays fail when the people manning them are at lunch or locked in conversation and unable to explain a particular point. Nothing can be more frustrating than wanting to understand but having no help.

It is difficult to be specific on display standards because they vary so much, however perhaps one could use a simple "starter" or summary board that keeps the message simple and attracts those with little time or less awareness of the subject and stimulates them to move on to the next. Tables should be kept to a minimum, graphs should illustrate trends and long words avoided as much as possible.

I know one can be criticised for going too far one way, but let's not be frightened of effective communication to get the message across. The learned farmer who wants more, only has to ask or pick up a report and while he is taking up your time, others can benefit from well-prepared demonstration material.

CONTENTS

COMPUTER ACCOUNTING FOR CONTRACTORS

DRAINAGE contractor. Mr Dennis Jones, Tarporley, Cheshire, has designed an accounting and costing system for drainage contractors in association with Symdell. It is available at a reduced rate to SAWMA Members.

The proposals include provision of sales, purchase, cash book and nominal ledger balances on a day to day basis, in addition to job costs and profitability statements. Information supplied by individual subscribers would also he used to provide an estimate of prospective job costs.

Symdell would supply the hardware, software and support services for a cost of £3,470 (plus VAT), and there would be a one-off programming charge equally divided between the number of members joining the scheme. For further information contact Dennis Jones on Bunbury (0829) 260438.

LOST AND FOUND

RELOCATING buried objects is simple with the Tracka-Marka, a small, inexpensive transmitter which, when activated, will continue to transmit pulsed magnetic signals for up to five years.

Signals will pass through soil, sand, snow, tarmac or concrete at depths of 1m to 1½m, detected by a hand-held receiver on the surface. Ideal for locating branches, junctions or inspection chambers in drainage systems or water lines. the Traka-Marka system is endorsed by many of the leading manufacturers of drain jetting equipment.

Full details are available from Woodbridge Electronic Services, 7 Hasketon Road, Woodbridge, Suffolk or telephone Peter Dummett on 03943 6134.

FACTORY FRESH IMPLEMENTS

HARROW king. Mr John Blench, is bypassing the dealer trade and is now selling direct to farmers who can negotiate substantial discounts on the list prices of a wide range of sail-working equipment.

The aim of the policy is to give farmers a better deal and help spread sales more evenly throughout the year, said Mr Blench. Discounts will vary from 30 per cent in the winter to 15 per cent in March, August and September. J. W. Blench can be contacted at 147 Station Road, Whittlesey, Peterborough. Telephone 0733 204455.

sawma news

BUSINESS AS USUAL

SINCE the last issue was published Council has looked at the financial future of SAWMA and as yet no decision has been taken to appoint another Technical Secretary. Mike Saull is still acting part time as the Technical Secretary and members will he kept informed of future developments. Meanwhile, business as usual, and we look forward to seeing you at the Autumn Cultivations demonstration

AUTUMN CULTIVATIONS '83

PLANS are well underway for the Autumn Cultivations demonstrations to be held at the NAC, Stoneleigh, on September 7/8th 1983.

Organised by the RASE/ADAS in association with SAWMA, the event has attracted most major cultivation machinery manufacturers. This year's event realises the need for farmers to view machinery working on different prepared surfaces. Thus the effect of straw incorporators working on a chopped strawlstubble surface should be of interest. Soil looseners will be compared side by side and a variety of technical plots will be established.

There will be 120 acres of working demonstrations including: deep soil looseners working sequentially; ploughs operating on stubble and chopped straw; cultivation equipment working on stubble, burnt and ploughed land: demonstrations of various straw incorporation techniques; static trade exhibits and a technical marquee with research and educational exhibits.

ON CAMERA

JUDGING from Royal Show interest, the joint RASE, ADAS and SAWMA "Soil Assessment" video should sell well.

Work on the production started in September 1982 and involved many months of planning, scripting and location shooting at five different sites. The result is a documentary approach that is aimed at encouraging and giving the viewer confidence in order that he will pick up a spade and do the job himself.

The thirty minute video, priced f38.00 plus VAT, is available in pneumatic, VHS or Beta formats and is aimed at colleges, young farmers and schools, though it should he of interest to many farmers.

There are three sections :—
A section outlining where to examine soils using different techniques and an introduction to the importance of texture. colour, stoniness and depth. Detailed assessment of four profile pits including a poorly drained clay and a droughty sandy loam profile. And a summary, where the video can be "halted to stimulate discussion on the profiles examined.

Lecturers and teachers are encouraged to press the pause button and hold the video at certain points; if used in conjuction with the supplied teachers' notes, it should extend the learning period by a further thirty minutes.

The video is available from:—
T. A. H. Jeanes, Audio Visual Unit, RASE, NAC, Stoneleigh, Kenilworth, Warwickshire.

ATBfilm crew 'shooting' Dr Bryun *Davies* and **Mike** *Saull* examining soil profiles at *Boxworth EHF,* Cambridgeshire.

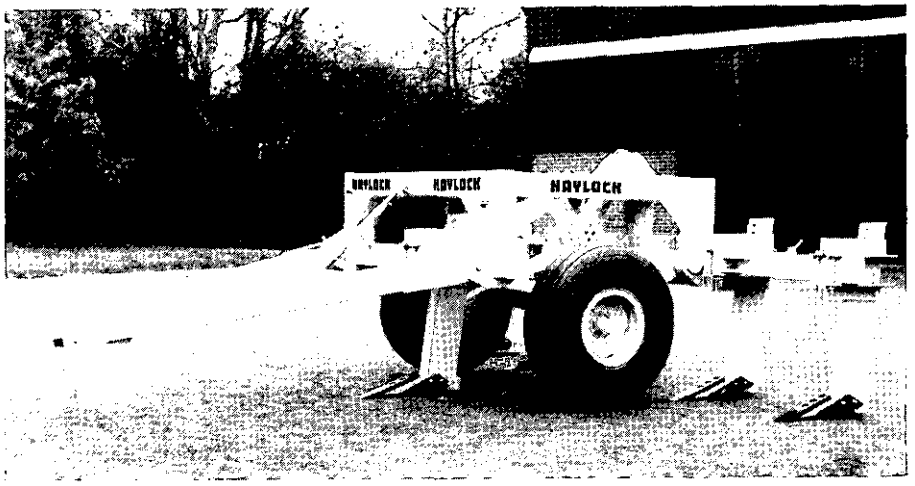
..PIPELINE...PIPELINE...PIPELINE..

SUBSOILING ACROSS THE RANGE

MOST subsoiling needs can now be met by the extensive P.J. Haylock range following the launch of a new trailed model equipped with 3, 4 or 5 legs and folding wings.

Developed for high horsepower wheeled tractors and crawlers, the Big Power Trailed Subsoiler uses standard Haylock subsoiler components on a heavy-duty box section frame mounted on two pneumatic wheels.

Depth control is by simple pin adjustment from 12in to 24in. Overall frame width in work is 4m. Prices, with subsoiler wing kits as standard, start at about £4,700. Details from the company at Bunwell, Norwich, Norfolk. Telephone 095389 345.



Haylock trailed subsoiler, available with up to 5 legs.

WASH AND JET UP

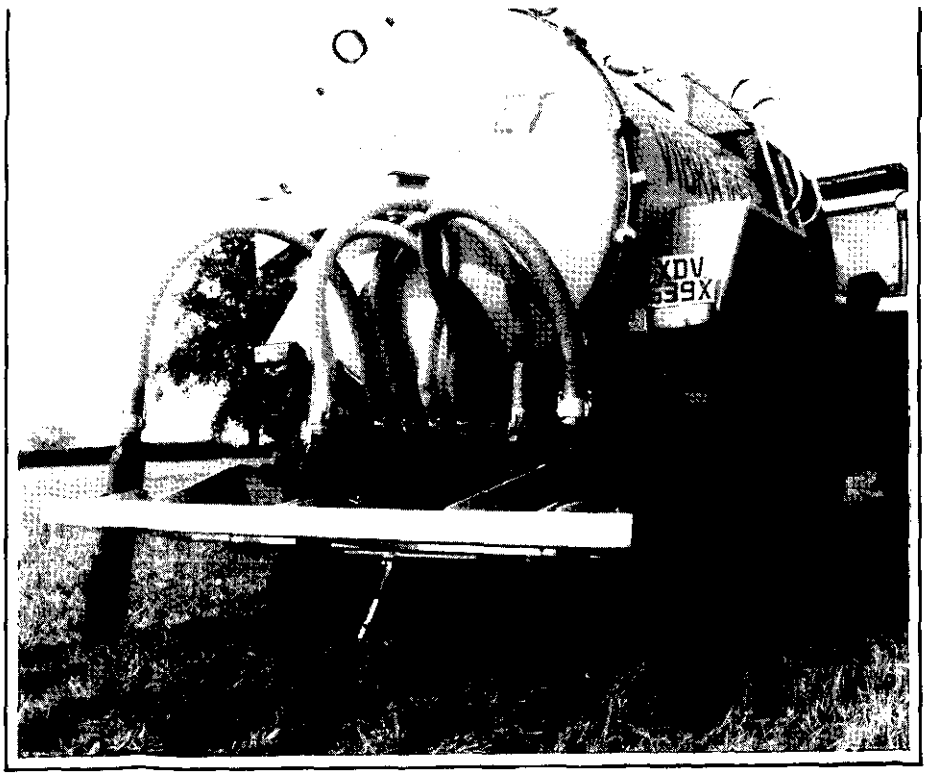
A TRACTOR-MOUNTED, hydraulically-driven drain jetter providing pressures of up to 2,500 psi (170 bars) and capable of cleaning pipes and drains of 300 metres in length has been introduced by G C Ogle & Sons Ltd, Victoria Road, Ripley, Derby. Water consumption of the new Champ Contractor is around 7 gallons a minute (32 litres).

In conjunction with the drain jetter, Ogle has also launched a powered hose reel carrying 300 metres of pipe which can be controlled at variable speeds and which is said to be simple to operate.

Usual cleaning jobs around the farm, such as washing down buildings, roads, vehicles and machinery can also be carried out with the Champ Contractor.

INJECTING

THIS totally self-contained vehicle for slurry or sludge injection into arable or grassland, with minimal surface disturbance or flooding, is produced by Twose of Tiverton. The Vibraject has a capacity of 9,100 litres (2,000 gal), injection rates up to 16,000 gal an acre, fourwheel hydrostatic drive, centre pivot steering and hydraulically-operated rear toolbar carrying the injection units. Comprehensive, fully-illustrated literature is available from the company at Lowman Green, Tiverton, Devon. Tel: 0884 253691.



GUIDANCE FOR FARM INVENTORS

CONTRACTORS, farmers and engineers with an invention or good idea that they think could help advance mechanisation on the land would do well to obtain a copy of the free booklet: 'Putting farm inventions into practice'.

Produced by the five agricultural engineering companies in the Wolseley-Hughes Group — Bruff, Cameron Gardner, Kidd, McConnel and Parmiter — it contains a host of tips and helpful advice on development, patent procedures, selection of a manufacturer, royalties and licencing agreements.

Copies are available from any of the above-named companies, or speak to Mr John Young on Tisbury (0747) 870821.

BUILT FOR THE JOB

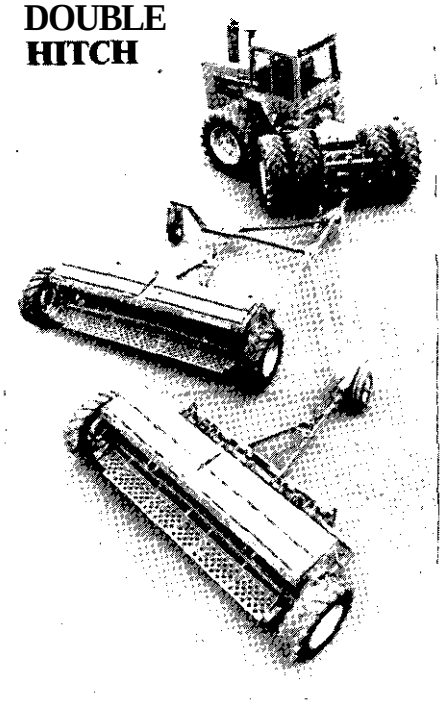
EXCEPTIONALLY heavy-duty subsoilers as well as trailed and mounted ploughs for forestry work, land reclamation and erosion control are manufactured by William Clark & Sons, Parkgate, Dumfries, Scotland.

The company's Twin Tine Subsoiler can operate up to 66cm (26in) deep, is mounted on a single pneumatic depth control wheel and has swivel-mounted blades with spring stabilisers on the subsoiler beams. Single and double tine mouldboard ploughs with turfing and draining options, capable of working to 60cm deep, are also available.

Literature sent on request. Phone Parkgate (038786) 241.

PIPELINE...PIPELINE...PIPELINE..

DOUBLE HITCH



TWO equal-size MF drills can be operated in tandem with a new dual hitch introduced by Massey-Fergusou at the Royal Show. Designated the MF 450, the hitch is designed to allow big acreage cereal growers make full use of their high horsepower tractors throughout the busy post-harvest period.

The combination effectively doubles the planting width for each pass across the field and can be put to work without drill modifications.

Price is £2,000.

NEW PLANT FOR GEITH RANGE

P. F. DOGGETT (Engineering) Ltd, the manufacturer of the "GEITH range of excavator buckets, wear parts, land drainage and stone picking machinery has opened a new plant at Weymouth Road, Winton, Eccles, near Manchester to service the North and parts of the Midlands.

The company plans to offer an extensive repair and rebuild service at its new address to supplement the general range of new and existing products which will be manufactured.

Recently, P. F. Doggett Ltd commenced production of its new "Geith" Standard Mole Plough. It is fitted with a replaceable tip and has two adjustable stands for fast and easy attachment to and removal from a tractor. Price is £195.

PLOUGHING FOR BRITAIN

THE 33rd British National Ploughing Championships will take place at Broadlands, near Romsey, Hampshire on 16 and 17 September, 1983. Ploughing will commence at 9.45 am on 16 September with class winners qualifying for the National Plough final the following day. First and second placed ploughmen in the National will represent Great Britain in the 1984 World Contest, to he held at Wispington, Horncastle, Lincs on 21 and W September 1984.

Further information from Ken or David Chappell, telephone 0302 852469.

WATERING THE WORLD

A NEW range of hose reel irrigators has been launched by Irridelco, one of the world's leading manufacturers of irrigation equipment. Known as the Hard Hose Travelers, the models have capacities from 14 to 153 cu metres an hour and are equipped with variable speed bellows drive, a winch-lifted two wheel jetter carriage and high grade polyethylene hose.

CERAMIC MOLE

Deranox Ceramic Mole expander is available as an option to the conventional cast iron type on mole ploughs built and sold by Michael Moore. Life is said to be at least four times greater. Prices are from £19 each according to size and quantity ordered.

Erosion on a grand scale

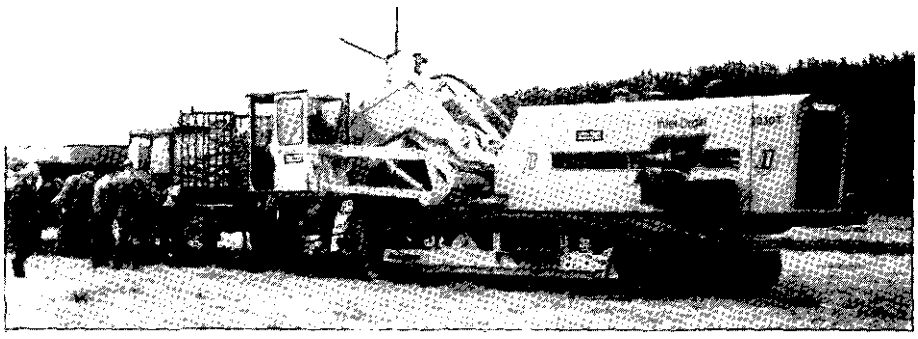
For the causes and the cures, read Dr Alan Harrison Reed's report on page 29.

Pipes down, yields up

NOW that prior approval of drainage schemes is no longer necessary, the Farmers Weekly International Drainage Event has more importance and interest for the farmer than ever before. This year's demonstration, on Mr Peter Bridgeman's Brunton Farm, near Alnwick, Northumberland, attracted an attendance estimated at around 8,000. More than 50 machines were seen working, dominated by new British designs.

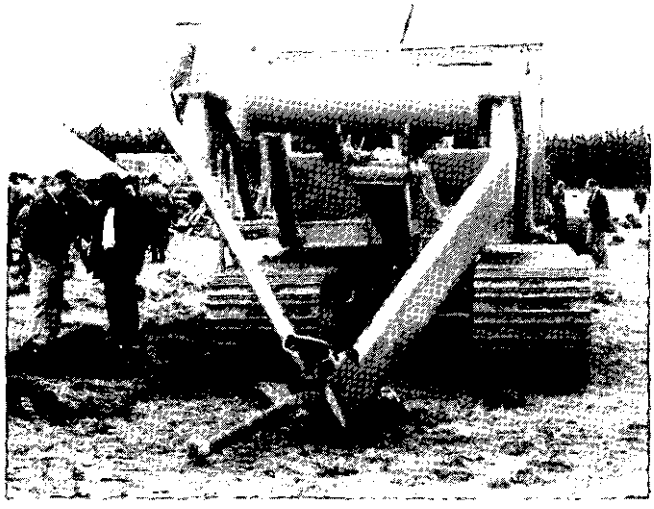
In the scheme designed by the Ministry LAWS division for mixed arable farming on the medium to clay loam of the site, laterals were placed at 13m spacing at an average depth of lm. Rainfall locally was assessed at 670mm (26.5in). Two 150-year-old systems, with horse shoe and round-section tiles, were revealed on the site. Soil survey data indicated that the subsoil was unsuited for moling. Both clayware and plastic laterals were laid, of 3in and 60 to 80mm sizes.

Featured below are some of the machines making a first appearance at the International Drainage Event.

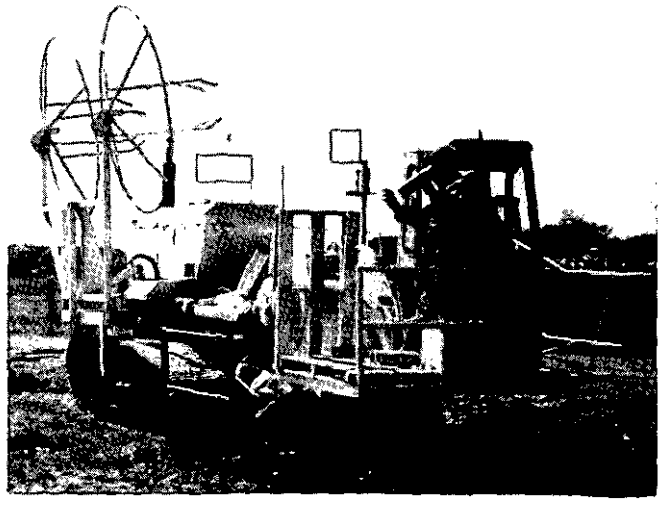


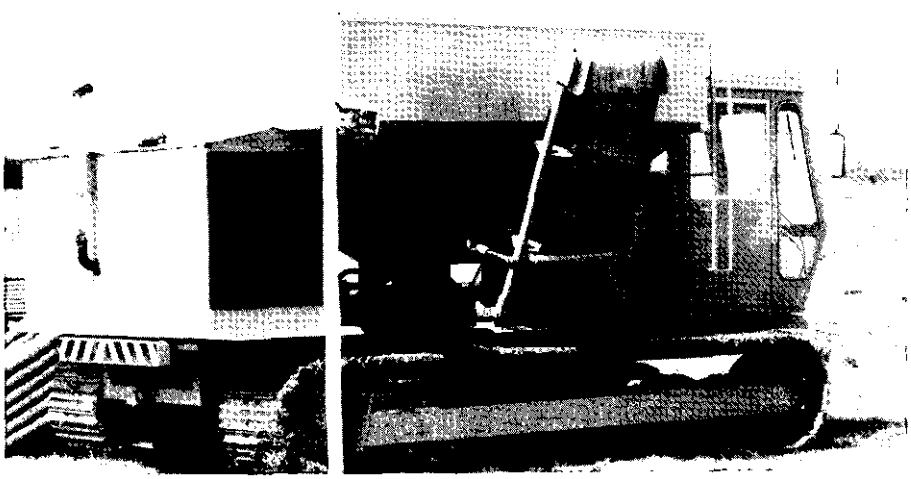
Inter-Drain's 2030T trencher laying tiles at the Alnwick demonstration. Offered with a choice of Detroit or Volvo diesel engines — 240hp to 320hp — the machine has a Fuller mechanical ground drive transmission with five forward and one reverse speed. Also standard is an elevating cab, hydraulic soil augers and separate hydrostatic drive to the oscillating tracks. Weighing between 18 and 20 tonnes, digging depth is 7ft with trench widths from 4½in to 16in.

This vee-shaped trenchless drainage plough was unveiled by John Mastenbroek and Co at the Drainage Event. The maker says it has proved to be most effective in improving water flow to pipes in difficult soils, as its design creates a greater area of fissured soil than a conventional trenchless tine, but with less surface heave or power requirement. Subsoil smear is also said to be minimal. Shown on a 25120 machine, the V-plough drainer will lay 60mm plastic pipe to 2m.

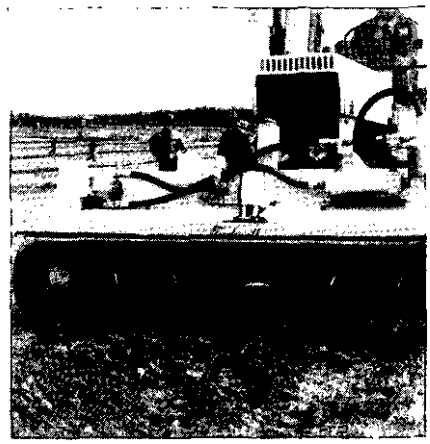


Hoes' 567-100 Superdrainer — a machine in the 'baby' self-propelled bracket ideal as a second machine or for limited access areas and the smaller drainage sites. Power is provided by a 94hp Ford diesel, with hydrostatic drive through an axle to the tracks. The digging chain is driven through a shaft and gearbox, and has five forward and one reverse speed. Trenches up to 300mm wide and 1.5 m deep can be dug, with spoil removed by a hydraulically-adjusted auger.



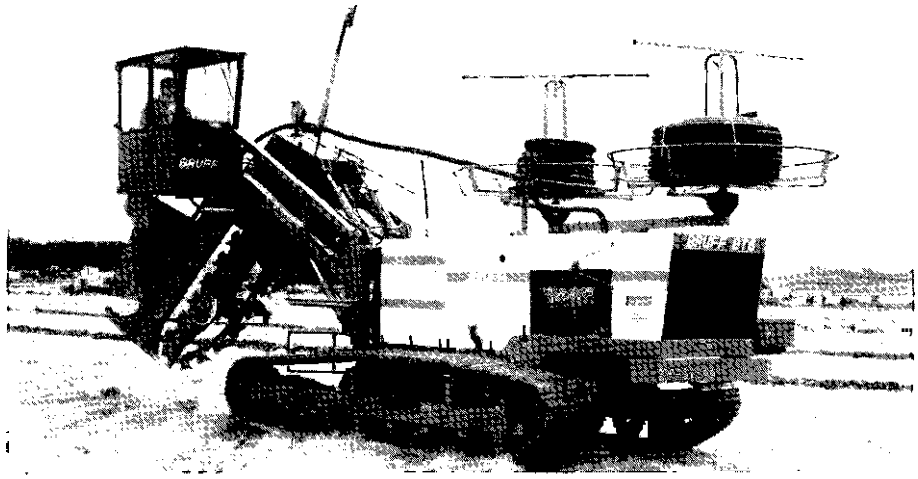


This 12 tonne gravel trailer from Mastenbroek comes equipped with tracks to help spread the load evenly across any surface. Track width is 60cm, with power coming from a rear-mounted 117hp Ford diesel driving a fully-independent hydrostatic transmission. A two range speed selector in the cab provides forward travel up to 5 mph, and steering is by single lever control. The CT10 tracked gravel trailer costs from £30,000.



Tuckwell's Rotary Backfiller for filling in drainage trenches is mounted on the front of a tractor and powered by a 40hp hydraulic pump on the power take-off shaft. Sales and service are handled by Multiloader, 16 College Grove, Malvern, Worcs.

Bruffs all-new BT6 trencher has no torque convertor or clutch, both being replaced by the latest hydraulic transmission development, the turbocoupling. Drive is transmitted from the rear of the 215hp engine to the digging chain by the short, simple, clutchless system. Also included on the machine working at the demonstration was an output maximiser which automatically adjusts track speed according to the loading on the digger chain. Bruff has also redesigned the chassis, track mountings, pipe beam adjustment, digging assembly and chain cutters. Basic price is £60,000.



Computers help drainage

CALCULATIONS required to determine the correct sizes of pipe for use as laterals, main drains and open-inlet pipe ditches can now be carried out by microcomputer using a programme written and used by the Land And Water Service division of ADAS. The programme uses the same calculation procedure as in the *Design of Field Drainage Pipe Systems (Reference Book 345)* which is now the current method of pipe design in LAWS.

Knowledge of how the computer works is not necessary when using the programme, because the operator has merely to type in answers to questions as they are asked by the computer.

As each part of the design is completed, a copy of the information fed into the computer, with the completed design, is printed out.

Optional extensions for this programme include one to calculate pipe drain spacings using a Dutch formula, and another to establish the best quality and method of bedding to be used for the larger diameter concrete and clayware pipes used for piping in open ditches.

A more complex programme, for water table modelling, was written for the minicomputer at the Agricultural Research Council's Field Drainage Experimental Unit at Cambridge. This is a considerably more powerful machine than the microcomputer necessary for the pipe-sizing programme.

Using the van-Schilfgaarde non-steady-state drainage equation, the water table modelling programme can predict water table position in response to different rainfalls. The model will look at any rainfall record, accept data describing the soils, and then examine the consequences of various drainage design options.

The user can vary the design until a satisfactory water table is achieved.

For the administrative task of storing and analysing all data on drainage grants, a large, main frame computer is used in the Ministry of Agriculture's main computing section at Guildford. Information was originally collected at the prior approval stage, hut with the abolition of prior approval in 1981, the opportunities for collecting such data are much reduced.

With a programme capable of handling large volumes of data quickly, the Ministry's records of every drainage scheme grant aided between 1971 and 1981 have made it possible to observe changes in drainage systems, including the gradual introduction of trenchless machines, the spectacular rise in the use of plastic pipes and the similar increase in the use of secondary treatments.

SAWMA acknowledges *the* help of *Mr* John *Gregory*, LAWS, *Preston*, and *Dr Adrian* Arm. *strong*, *FDEU*, *Cambridge*, in supplying *the* in. *formation* used in the preceding *article*.

Preventive measures against deep seated compaction

Prof Gordon Spoor

In his recent inaugural lecture on being given the chair in agricultural engineering at the National College of Agricultural Engineering, Silsoe, Bedford, Prof Gordon Spoor stressed that heavy loads on the land were already causing deep compaction. In the past, he argued, cultivations had been aimed at alleviating problems. The approach for the future, though, should he to prevent those problems arising.

SWEDISH work shows that natural recovery of deep seated compaction, below 350mm depth, is extremely slow, even in areas of deep frost penetration. Mechanical soil loosening helps, but does not immediately rectify structural damage. The greater the depth of the compaction problem, the more difficult and expensive the reclamation is likely to be. The continuation, therefore, of this reclamation form of management in the future needs to be seriously questioned and preventive management will require a reduction in the magnitude of the punishing loads and pressures applied to the soil. Such a change will almost certainly involve a cost.

A number of potential benefits are achievable if control can be exercised over the level of soil compaction and traffic. Figure 2 shows the yield depression resulting from medium size vehicle compaction in autumn, before ploughing, in Sweden. The compaction effect was mainly confined to the plough layer, and an elapsed time of five years was required without similar compaction, to alleviate all the damage done.

Crop response to deep loosening followed by appropriate compaction, but without wheelings, at a number of research stations, indicates the potential for yield improvement when traffic can be controlled. The benefits achievable in terms of reduced establishment costs and increased system capacity from avoiding the need for deeper working have been clearly shown.

Current moisture content working limits are controlled mainly by the tractor pulling the implement rather than the implement itself. Controlling the traffic opens up possibilities for extending the working period.

These potential benefits, coupled with the Increased difficulty and cost of deeper reclamation operations, further justify serious consideration of preventive management.

Preventive management must involve a reduction in the damaging effects of traffic, the modification of husbandry techniques and greater attention to sub-surface drainage. Traffic damage can be reduced by reducing contact pressures and loads. and by confining wheels to specific traffic lanes, thus restricting damage to local sacrificial areas.

While it may be unrealistic to expect significant weight reductions in future, unnecessary weight can he shed and consideration given to restricting the magnitude of future increases. The extent to which inflation pressures can be reduced with current equipment and tyres is limited. Very Low ground pressures (5-10 kPa) can be achieved on light, low-traction vehicles using existing tyres. This is not possible however, with the current

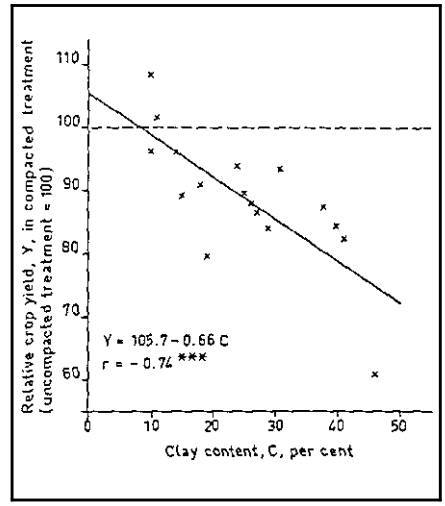


Fig 2. Yield depression following soil compaction during previous harvest

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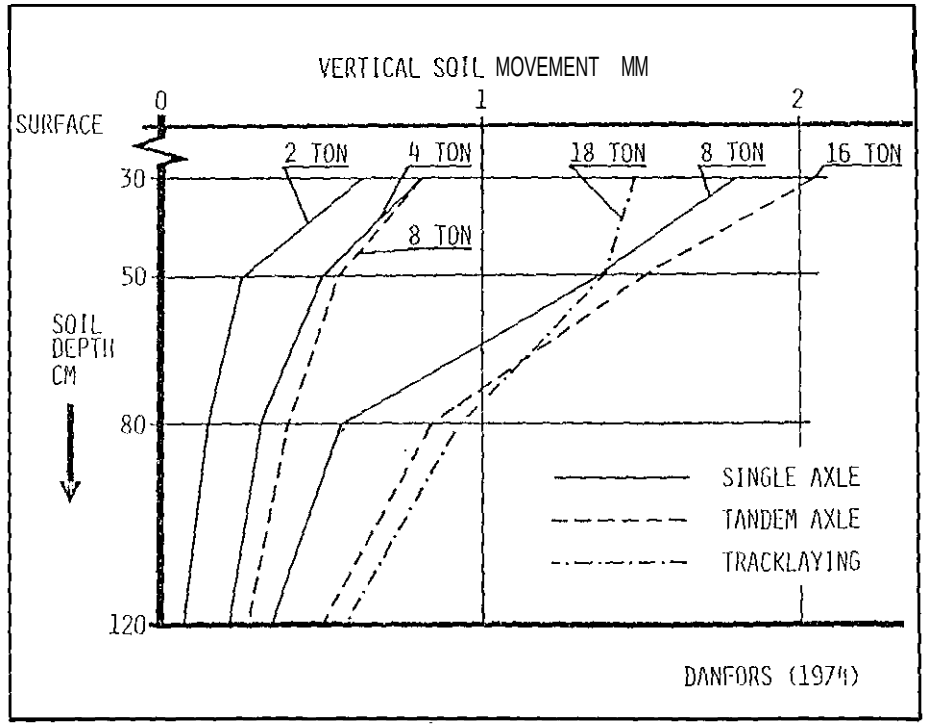
Fig 1. Vertical soil movement under loaded wheels and tracks



VII-3

Preventive measures

◀ 13

very high pressure equipment such as trailers, combines and other harvesters, nor on vehicles with high traction requirements. The use of dual wheels can help, but their application is frequently limited by width restrictions and design limitations in existing axles.

Many of these problems can be resolved at acceptable cost at the design stage, and there is a need for farmers to encourage manufacturers to minimise the compaction potential of their products.

In the meantime, every effort should he made to ensure that tyres of existing equipment are always operated at maximum allowable deflection and that adequate traction is achieved through minimum, rather than maximum, added weight.

Tramline and bed systems for the control of through-crop traffic after establishment and before harvest have proved very successful. Considerable damage is still done, however, by random traffic pre-establishment and at harvest, particularly with transport, and great scope still exists to extend the systems to these operations, with the ultimate goal of permanent systems. In situations where traffic control cannot be achieved, a reversal in the sequence of tillage operations should be considered, so that soil loosening, if required, becomes one of the last operations rather than the first, to minimise the risk to excessive re-compaction.

Relationship between cultivation working depth and cost of establishing cereals.

Cultivation depth mm	Relative cost	Relative output time/unit area
0	1	1.0
100	0.9	2.0
150	1.3	3.5
200	1.8	4.0
4W	2.8	7.0

(data derived from Patterson et al 1980)

Great scope exists for the better use and selection of tillage equipment to avoid the creation of new problems when overcoming the original one. There is similar scope for maximising the use of undisturbed soil strips during multi-pass operations, to maximise traction and minimise rolling resistance and compaction.

The long term maintenance and improvement of soil structure is mainly dependent on root and organism activity together with natural weathering action. This improvement can be hest achieved through minimum soil disturbance by cultivations and surface traffic, and good subsurface drainage below.

Subsurface drainage is therefore one of the most effective and necessary aids to preventive soil management, contributing by increasing the soil resistance to compaction as well as through improved aeration. Drainage problems are most severe and solutions most expensive in the finer textured soils where close drain spacings are required. Appropriate soil loosening measures and mole drainage have much to offer in these situations and possibilities should be explored for widening the use of these techniques in conjunction with other sub-surface systems.

The major effort required on the part of the farmer, therefore, in any move towards preventive management, lies in the area of field operation organisation. The manufacturer's part is in providing equipment of appropriate width and performance to match the field systems and to reduce the compaction potential of their equipment.

Crop response to deep soil loosening % yield increase

	Drainage only	Drainage and deep loosening
YESTER 1850 (Clay)		
Cereals	35	95
Turnips		100
ROTHAMSTED (Sandy loam)	Deep loosening	
Cereals	20-25	
Sugar beet	22	
Potatoes	0	
WYE (Silt loam)		
Cereals	15	
WELLESBOURNE (Sandy loam)		
Potatoes	0	
Broad beans	25-95	
Red Beet	-3-20	

REVIEWED

Making sense of pressures

VEHICLE ground pressure, tyre inflation pressures and tyre sizes, all combine to form a mathematical maze which the farmer must negotiate, electronic calculator in hand, if he is to match tyres and machines in an attempt to reduce damage to the soil.

Until recently he has had little help, either from vehicle manufacturers, tyre makers or even the advisory services. But now two groups have come to the rescue — ADAS with a booklet which explains the basics of tyres, traction and ground pressure; and a joint committee of the Agricultural Engineers' Association, the National Institute of Agricultural Engineering and Scottish Institute of Agricultural Engineering, which has established a definition of ground pressure and an agreed method of measurement.

The ADAS booklet, Tyres and Traction, keeps things at their simplest but still finds it necessary to include a few calculations, showing that anyone seriously concerned with soil care must not be afraid of a little paperwork. Overall, the booklet provides the warning that any wheeled vehicle is a potential source of soil damage and measures must be taken to prevent it.

Many tractors, trailers and other machines are fitted with tyres which do not provide the best performance or which cause unnecessary soil damage, says ADAS. The worst offenders are trailers, combines, fork-lift and front-end loaders, tractor front wheels, slurry spreaders, sprayers and root harvesters.

Test rig gantry built to provide a standard *measure* of ground pressure.

Use any of these machines on soft soil, and you can bet on damage, warns the booklet.

There are limits below which it does not make sense to reduce ground pressure. The tractor tyre is the means by which the engine power is transmitted to the land to produce a pull which can be applied to useful work. For good traction you need to have sufficient weight on the driving wheels — for more traction, more weight is needed.

NIAE tests have shown that there is an optimum weight for each job, and there is a formula for calculating it:

$$\text{Total weight on driving wheels (lbs)} = \frac{600 \times \text{engine power (hp)}}{\text{speed (mph)}}$$

Large tyres allow the tractor to carry more ballast to reach the optimum weight for the job and to use its power more efficiently. For a 75 hp tractor, larger tyres gives a 6 per cent improvement in work rate at the same weight and also permit a further 6-8 percent increase, depending on the tyres selected, when the correct ballast is used.

If the figure calculated from the formula shown above is divided by the number of driving wheels, it produces a figure showing the optimum load on each driving wheel. This figure, together with inflation pressures, can be used to select the correct tyre size from manufacturers' tables. Alternatively, a ready reckoner is available from ADAS.

The AEA, NIAE, SIAE joint work in establishing a definition of ground pressure and an agreed method of measurement, came as a result of vehicle manufacturers quoting values which had no common basis. It was felt that figures which were being quoted left the potential user of vehicles very little the wiser. as it was virtually impossible for him to determine what was, and what was not, a low ground pressure vehicle from the literature available.

A rig was constructed for tests and consists of a gantry over a weigh pad. The gantry supports a wheel axle which can be moved up or down by hydraulic rams. To measure ground pressure, the tyre and rim assembly to be tested is fitted onto the wheel axle. The surface of the tyre is painted with black ink and it is then pushed down by the hydraulic rams onto a sheet of paper laid over the weigh pad. The pressure is increased until the required weight is recorded and the area of the imprint on the paper is measured to give the contact area. This is divided by the recorded weight to give the average contact pressure.

Measurements have shown that the average contact pressure, or ground pressure, is equal to the inflation pressure plus a carcass pressure, the latter being constant for a tyre of a certain size and construction.

Ground pressure is defined as the contact pressure measured on a hard surface. This was considered valid because the aim of reducing ground pressure is to achieve minimum sinkage, thereby approaching the hard surface deflection of the tyre. If such a system of measurement is adopted by all vehicle manufacturers, users will have a useful comparison of ground pressures under conventional and low ground pressure vehicles.

The plastic slide calculator to assist in tyre selection for optimum work rate and minimum soil damage is available for £2 post free from MAFF (Publications), Lion House, Willowburn Estate, Alnwick, Northumberland NE66 2PF. The Tyres and Traction booklet is available from the same address.

In the soil at the Royal

A look at the latest ideas and equipment at the Royal Show for sound and profitable management of the land.

MACHINES for drainage came to the fore at the Royal Show with AF Trenchers taking the RASE Gold Medal — the Society's top machinery award — and Shelton Trenching Systems collecting a Silver Medal.

Both company's machines are designed for use by farmers wishing to rid the land of surplus water — the AFT 65 tractor-mounted trencher able to dig a trench for installation of clay or plastic pipe, the STS Trencher cutting a slit up to 20in deep to aid the removal of surface water.

Congratulations go to the companies and their products, which were reported in full in the January 1983 issue of Soil and Water.

Turning to cultivations, Flexicoil land packers have secured an excellent reputation for use with the plough, before and after drilling and with powered cultivators. Consisting of a spiralled steel coil, their action on the soil is said to promote both seedbed and moisture retention, helping to produce a more uniform drilling depth and better germination.

The latest addition to the range is a tractor front-mounted land packer specifically designed for use with dual wheel-equipped tractors working with a rear implement. In work, the packer firms the soil between the tractor's wheels to give more even overall cultivations.

Available in two widths (5ft and 6ft), four weights and with a hydraulically-powered front linkage, the front packers cost from £900 to £1,075.

Turnbuckle mechanisms for front furrow width adjustment and plough frame realignment are standard on a new four model range of reversihles from F. W. McConnel: the Fiskars Agrotrack series.

The mechanisms, on the Finnish-built ploughs, are said to eliminate the need to alter tractor wheel settings to suit the furrow width being ploughed and, instead, make the plough fit the tractor. A pivot point between the main frame and headstock provides front furrow lateral movement during turnbuckle adjustment enabling the leading furrow to be correctly positioned for work in relation to the tractor's rear wheels, irrespective of their setting.

The second turnbuckle realigns the main frame so that all furrows work at the correct angle to prevent crabbing and for minimum wear. Also introduced on the Agrotrak ploughs is the new Fiskars FK high performance mouldboard claimed to combined excellent furrow inversion with long life.

Available in two to five furrow versions, each plough can be adjusted to produce 12in, 14in or 16in furrow widths as required. Prices start at £2,147.

A stronger, more compact headstock, incorporating a turnover mechanism with only three pivot points and a minimum of moving parts is used on the DP7D and DP7E New Type reversible ploughs introduced at the Royal Show by Britain's leading plough maker, Dowdeswell Engineering Co Ltd.

The new headstock is based on the design introduced two years ago on the DP8 lightweight reversible ploughs, where it has proved highly successful, having a low profile to ensure adequate clearance between the tractor cab and plough, when raised.

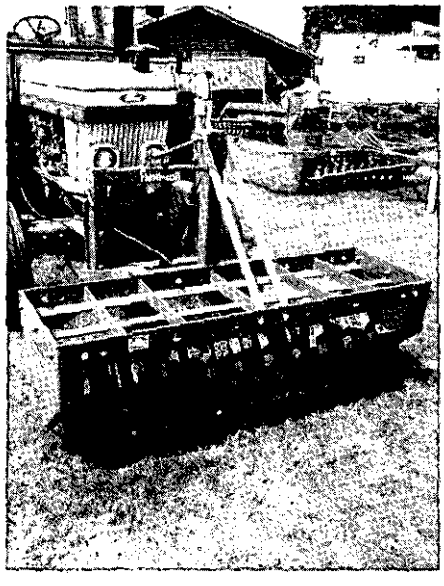
A single hydraulic ram, fitted at the rear of the headstock, is used to turn the plough, acting directly on an off-centre pivot point on the main frame so there are no other moving parts. Stresses have been reduced by incorporating the turnover bearings in the main frame instead of the headstock. This allows the two hearings to he positioned further apart, as well as nearer to the plough's centre of gravity.

The DP7D New Type (415 furrows) and DP7E (5/6 also as standard, uprated reversible shares, bodies with individual pitch adjustment and wider, stronger frames.

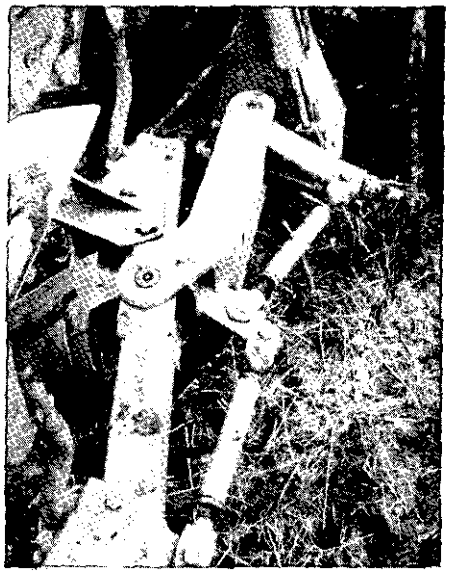
Kverneland (UK) Ltd has followed up its launch of the BB variable-width, semi-mounted conventional plough at last year's Smithfield Show with a reversible model — the LB — equipped with either 4 or 5 furrows.

The LB features the same unique on-the-move, hydraulically-adjusted furrow

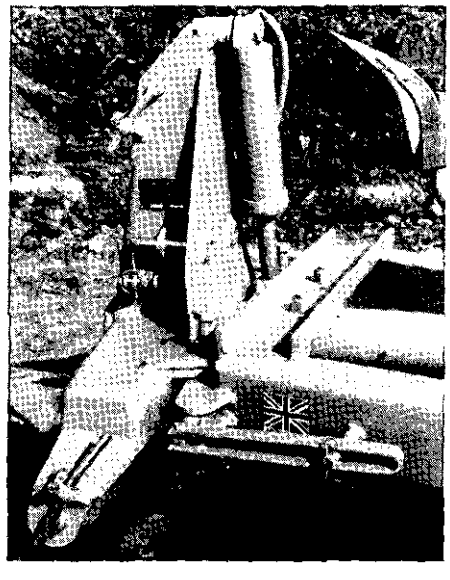
Front-mounted Flexicoil land packer firms the soil between the tractor wheels.



Fiskars front furrow width adjustment and frame realignment system.



Low profile headstock on Dowdeswell *DP7 New* Type ploughs.



width system as the BB, giving variations from 12 to 20ins. In addition to the auto-, matic repositioning of the rear furrows, the front body and rear depth wheel are also realigned so that the correct line of draught is maintained irrespective of furrow width.

Advantages claimed for the system include fast and simple furrow width setting and the ability to straighten crooked furrows and plough around field obstacles without having to stop or reverse. The design is also said to ensure maximum utilisation of available tractor power while allowing users to maintain the correct depth and width proportions.

Independent tests carried out in conjunction with the NIAE have shown that Kverneland vari-width ploughs can reduce fuel consumption by up to 5½ percent a hectare for every extra inch of furrow width ploughed.

Prices for the LB ploughs are from £4,730 to £6,122 according to final build.

Cultivations' packages, combining two or more implements to provide a series of soil-working treatments in one pass attracted much attention from the arable men visiting Stoneleigh.

Lely Import, already securing a fair share of the British market with its Roterra power harrow, unveiled additional attachments to enable the implement to produce a traditionally-rolled seedbed direct from ploughed land. The aim is to retain moisture for better germination and crop establishment.

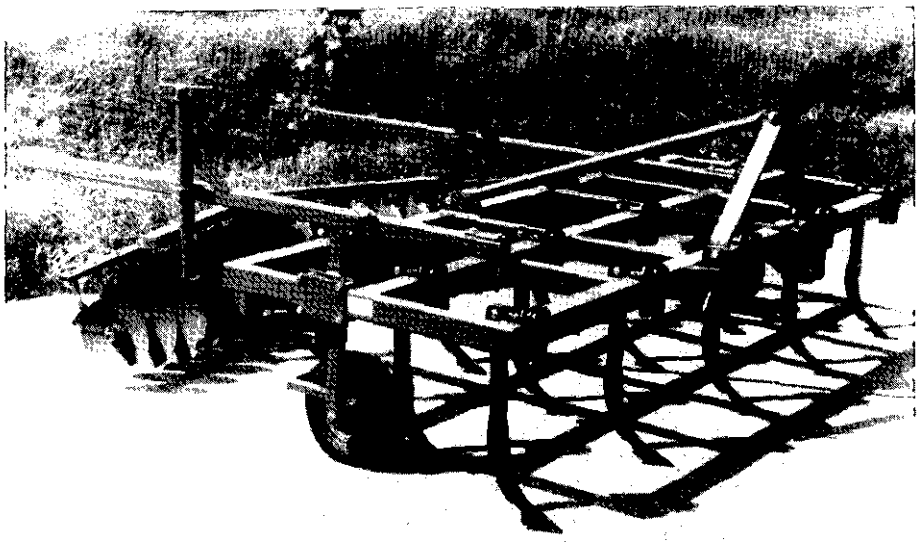
The firm's package consists of a front, bladed roller of spiralled vee layout which levels the soil, a clod comb positioned behind the Roterra which traps clods for further treatment, and a second spiral vee roller at the rear to firm the seedbed.

Fine adjustment to the depth of either roller produces the optimum working position for the Roterra's contra-rotating tines. The comb and rollers package is available for 2.5m to 4.5m machines for work this autumn.

Deep working, top working and drilling is the three-in-one purpose of a new outfit from McConnel designed around the company's Tillaerator top-surface, powered cultivator. The combination consists of a front, heavy-duty toolbar, with up to seven 18in shanks, attached to the Tillaerator by specially-designed brackets. At the rear, a universal linkage with full hydraulic services enables any 2.5m or 3m seed drill to be mounted on the Tillaerator.

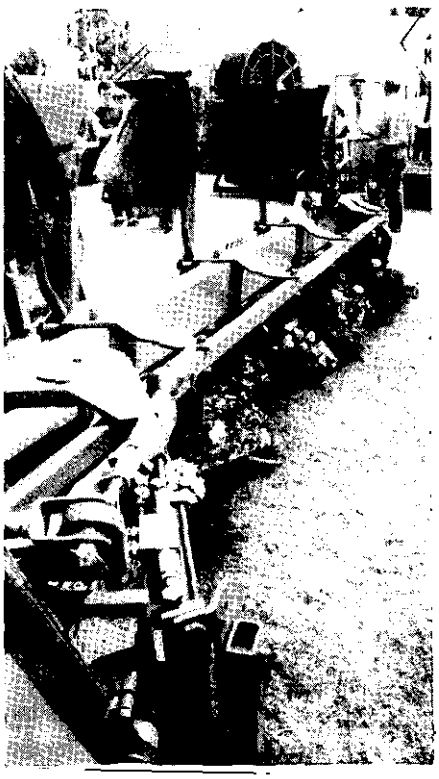
The purpose of the outfit is to give total soil working — from subsoil to the surface — in one pass, with simultaneous drilling operations to prevent possible recompaction of the land. All parts of the combination can he quickly separated to suit users requirements and soil treatment needed.

Rabewerk showed a hydraulic bridge link enabling a seed drill to be used with its rotary cultivators, and lifted in and out

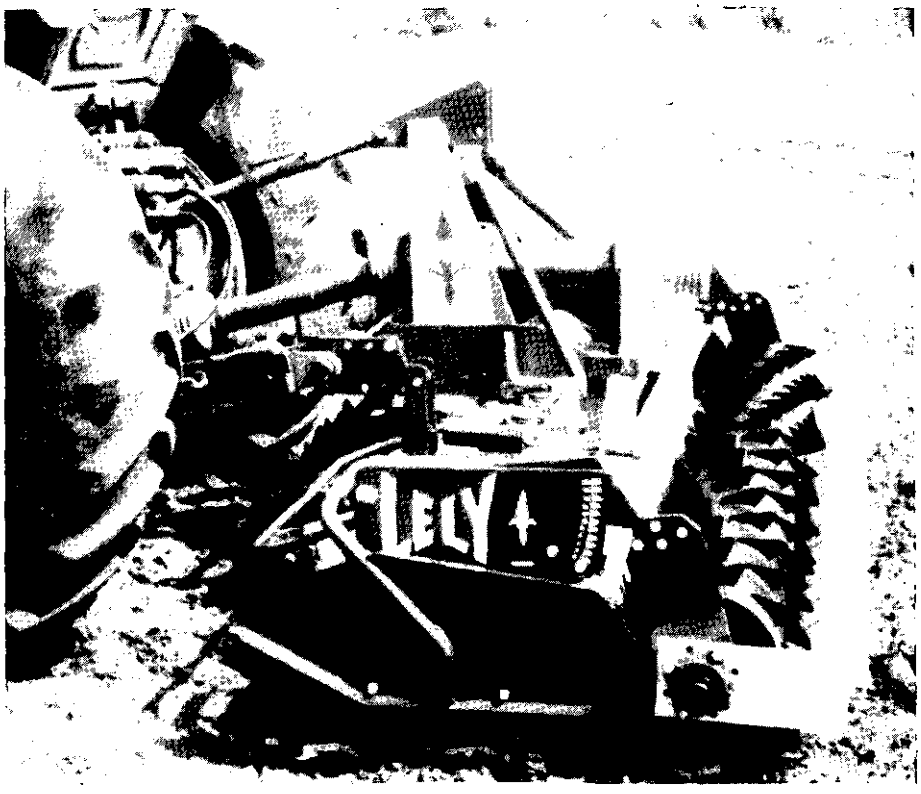


Richford Heavy Stubble *Cultivator/Disc* Harrow *Combination.*

Hydraulic cylinder gives *on-the-move furrow* widrh *adjustment* on Kverneland LB reversibles.



Rollers and clod comb enhunce rhe *Roterra's* seedbed *preparation role,* enabling *the* machine *to* produce a traditionally-rolled finish direct from ploughed land.



of work as required. The lightweight link costs £835.

A similar idea came from Bamlett with the Hydro-Pack. This drill linkage is suitable for the firm's Rau Rototiller and lifts the drill completely out of work above the powered cultivator when turning or for transport.

Three separate types of tillage attachment are now offered on Parmiter's Denver harrow range — spring tines for secondary cultivations, rigid breakback tines for both primary and secondary work and discs for primary work on heavy land. All are followed by adjustable zig-zag harrows and a 20in reversible crumbler to give three complete seedbed operations in one pass at a high forward speed.

Taskers unveiled a 4m version of its NIAE-developed Chisel Discs, complete with foldable wings. Purpose-designed for preparing a seedbed from stubble, the tractor-mounted implement has two banks of deep scalloped, hardened discs, both adjustable for angle. It costs £3,430.

Toughest

Claimed to withstand the toughest conditions, the Richford Heavy Stubble cultivator is a new low-cost implement fitted with either double coil or rigid tines followed by discs and a crumbler roll, if required. Pneumatic depth control wheels on the main frame ensure even working and clearances are good to prevent blockage.

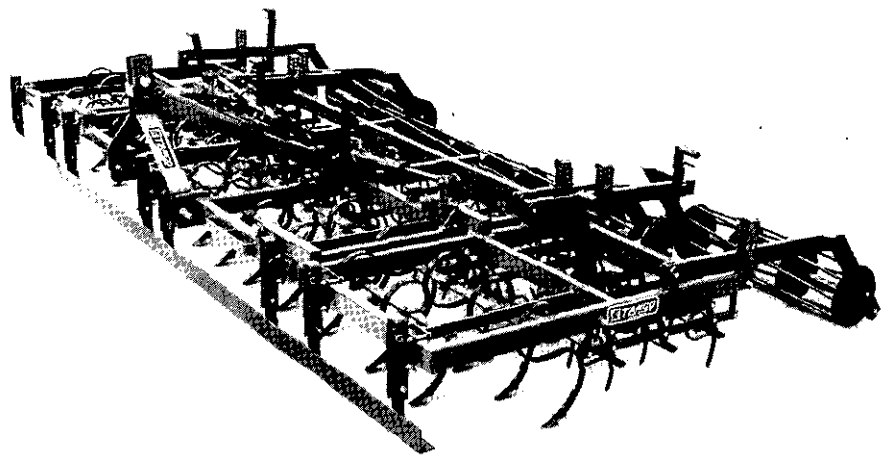
The implement costs from £996 for a 7 double coil tine unit to £1,803 for a 15 rigid tine shearbolt model. Disc harrow prices range from £914 to £1,285.

Tanco's Two-Season combination cultivator is now available as a 4.8m (16ft) model, fitted with hydraulically-folding wings. It has two rows of spring 'S' tines, three rows of adjustable fine tilth tines and a pressurised rear crumbler. Power requirement is from 110hp and price from £2,100.

Increases in output of up to 60 yercent compared with vertical tined rotary cultivators are claimed possible with Stockton Engineering's Power Discs. Designed primarily for minimal cultivations, the novel feature of the implement is the power take-off drive to the front set of 24in diameter, scalloped discs. This enables users to select a combination of forward speed and disc rotation to suit soil conditions and finish required.

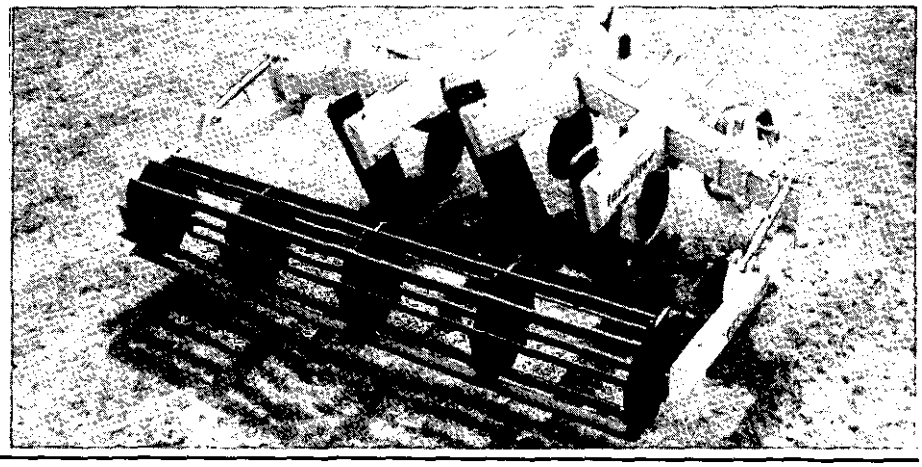
With a maximum working depth of 6in, the pto-driven discs can be used direct on stubble or ploughed land, with the drive assisting traction and reducing compaction. Gang angle is adjustable through 10 deg for either optimum burial (shallow angle) or soil mixing (steep angle). The implement is said to allow earlier field work than both conventional discs or rotary cultivators.

Power requirement is in the 90hp-plus bracket. Prices start at £4,593.



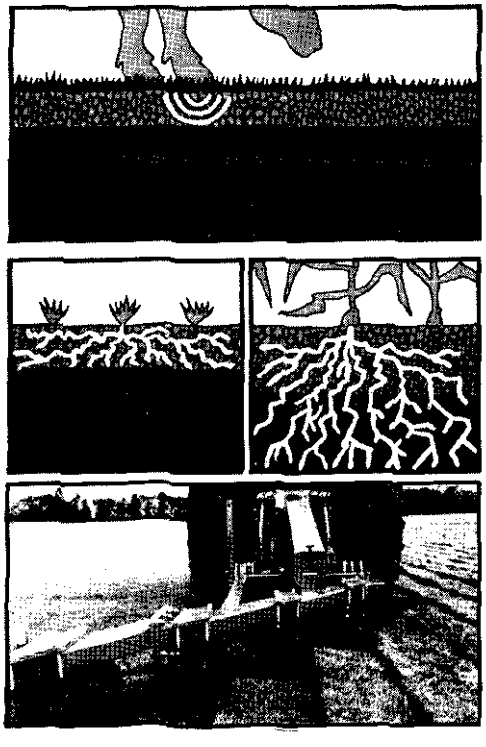
Now with hydraulically-folded wings, Tanco's Two Season combination cultivator (above! covers 16ft in one pass.

The Farmrite Loosen-Jt Cultivator (below) has been designed to remove compaction at depths between 8in and 20in. Soil is moved by a barpoint wing combination, with angle of leg approach altered by a simple adjustment on the beam connection point. Fired and swivel leg models are available, the latter in 2, 3, 4 or 5 leg configuration, complete with discs and depth wheels. Prices from £1,375.



Paraplow lets the grass grow under your feet. And theirs.

Telling you about soil compaction isn't news You're probably all too familiar with the dense soil barrier created by the weight of g ıg lives ıc farm vehicles ihat prevents surface water drainage and restricts grass growth.



What you may not realise is that you can now do something about it, with the Howard Paraplow Soil Loosener.

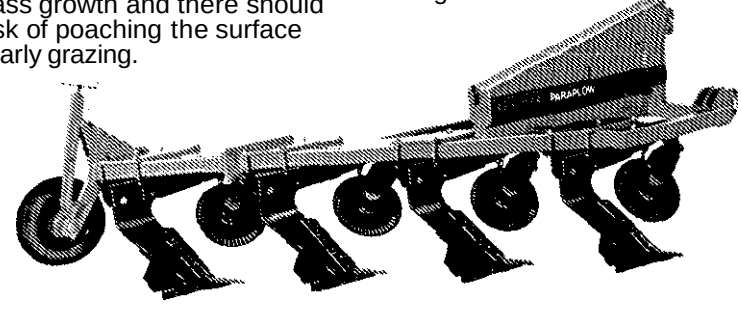
Jointly developed by Howard Rotavator and the Plant Protection Division of I.C.I., the Paraplow has 45" angled legs which cause a lifting and bending effect on the soil passing over them, allowing the compacted areas to crack and break following the natural lines Of weakness The Paraplow breaks up the compaction and restores the soil's natural system of cracks and pores to allow proper water movement and encourage healthy root development

After Paraplowing, you can expect earlier grass growth and there should be less risk of poaching the surface through early grazing.

Ask for the "I Don't Believe It" Demonstration

Before seeing the Paraplow in action, many grassland farmers have expressed doubt about the ability of the Paraplow to fulfil its promises So we have organised a special "I Don't Believe It" Demonstration to prove just how effective the Paraplow is Why not ask us to do a demonstration for you?

Write to us at the address below for your free copy of the new Howard Paraplow Technical leaflet which **provides in-depth information on the Paraplow's** performance on arable and grass land.



Winner of 11 National and International Awards.

HOWARD PARAPLOW
A NEW CONCEPT IN SOIL CARE

Howard Rotavator Co. Ltd., Mendham Lane, Harleston, Norfolk. IP20 9DP. Telephone: Harleston (0379) 853221. Telex: 975487.

Soil [illegible] in practice

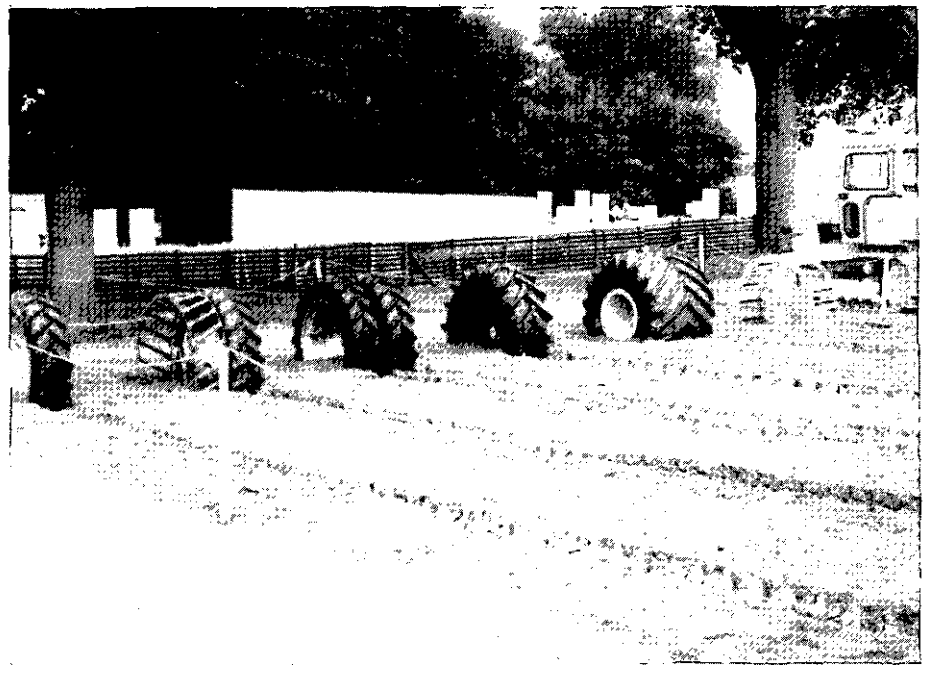
Once again, under the co-ordination of SAWMA, the Royal Show featured a Soils Centre. Four technical demonstration plots were prepared and research scientists and advisors staged fourteen exhibits in an adjacent marquee. Mike Saull reports the highlights of the event.

CREATING most interest was the SAWMA/NIAE/SIAE tyre demonstration. Five days before the Royal, different wheeling operations were carried out on an overcultivated seedbed that had been irrigated to field capacity. Using as a standard a 2 wd Ford 6610 fitted with standard 13.6-38 tyres, one pass with duals, cage wheels, Yield Wheel, 600/55-38 Trelleborg and 66 x 43.00-25 'Terratire' was compared with a Track Marshall Britannia Crawler.

The ruts left provided many with food for thought and as Dan Cherrington of BBC's Sunday Farming Programme stated: "destroyed a few old myths".

Mr Martin McAllister, of the NIAE, was one of the motivators behind the demonstration and he explained that the more flexible the carcass and the lower the inflation pressure, the less the ground pressure that would he exerted. Comparisons of penetrometer resistance at depth and the mean rut area allowed for more objective assessments. In comparison with the cage wheel, dual wheels operated at reduced pressures can give better results, though it is very important to reduce such pressures. The cage wheel appeared to cause little compaction, hut hardly supported the inner tyre at all, leaving a verv similar rut to that of the standard tyre:

Dr Ian Dickson of the SIAE recommended running duals at ahout 14 psi and stressed that manufacturers should consider fitting as standard a compressor and simple pressure gauge on tractors, to help farmers reinflate tyres they have deflated for field operations.



Comparison of the different impressions made by a variety of wheels and tracks.

Yield Wheel v Terratire

The Yield Wheel from Cab Craft created a lot of interest, especially when seen in operation. Results were most interesting when compared side-hy-side with the Terratire.

Mr McAllister commented that the Yield Wheel is a high speed, low draught wheel for secondary cultivations and is probably the best wheel available in those circumstances for reducing compaction.

For a low ground pressure application, in low draught situations, the Terratire will give the lowest ground pressure. It is already being used for many secondary cultivation operations, as well as spraying and drilling, hut he stressed: "it is not a tyre for heavy draught operations."

The SIAE states that the following points should be considered when choosing tractor and wheel equipment for minimum soil compaction:

Radial tyres are better than crass-ply tyres; **four-wheel drive is better than twa-wheel drive; wide tyres or duals give more uniform seedbed conditions; separate dual tyres by one tyre width, dual tyres are preferable to a tyre plus cage wheel. Dual tyres and crawler tracks give similar compaction; a cage wheel mounted alone is better than a lyre; fit larger tyres to undriven wheels; remember that combines and other machines need suitable wheels too.**

Soil aciditv

The Agricultural Lime Producers' Council sponsored this year's acidity plots at the show. The plots were prepared to show the effects of a range of pH values on the growth of oil seed rape and barley. The symptoms of distress displayed by the barley at low pH were clear for all to see and the resulting poor crop yield would have caused no surprise.

More difficult to display visually is the role played by agricultural lime in enabling the farmer to maximise crop yields. The aim is to improve yields by ensuring that maximum effectiveness is obtained from fertilisers, pesticides and herbicides. The key to this approach is the lime status of the soil.

Calcium deficient soils are acid soils and such soils retard root development, stunt and yellow crops and reduce the effectiveness of fertilisers. The effectiveness of some herbicides and pesticides is also lowered and crops may he more susceptible to disease. Acid soils also retard the activity of beneficial soil micro-organisms and increase the possibility of toxicity arising from the release of trace elements such as aluminium, manganese and iron. Clearly an acid soil can he a very expensive liability.

In 1982 it has been estimated that 3,600,000 tonnes of agricultural lime were supplied in the United Kingdom. with ALPC members supplying about two thirds of the quarry-derived lime. This level of lime use is falling short of the level estimated necessary to maintain the lime status at present farming levels by a figure of about 20 per cent.

The officially recommended pH for arable land is 6.5 for mineral soils and for grassland is pH 6.0. However, in practical terms it is probably better to aim for a slightly higher pH — say pH 7.0 for arable and pH 6.5 for grassland — thus allowing for seasonal fluctuations of the soil pH and possible over-winter seed bed leaching. Peaty soils should he maintained at 0.5 pH lower than these figures.

Of immediate concern is the under-liming which resulted from the difficulties experienced during the autumn 1982 liming season and the spring 1983 liming sea-

son. During both periods, above average rainfall resulted in reduced opportunities for liming and increased leaching of calcium from soils.

Hopefully, many farmers visiting the Royal Show will have become more aware of the important role played by agricultural lime in maximising crop yields and profit.

Fertiliser indices

Miss Gillian Goodlass and colleagues from ADAS Soil Science were on hand to provide information on computer prediction of NPK indices and how they can help correct fertiliser usage. The system is coordinated from a computer at Guildford, with each regional office having access via its own terminal. The idea is that soil analysis results, previous crop information and field location are fed in to the computer to predict fertiliser regimes for a specific crop.

This free service usually takes less than a week from receipt of sample by ADAS to receipt of a computer report by the grower. The actual soil analysis, however, costs £6.10 a sample.

Miss Goodlass estimated that the Shardlow office at Derby handles some 5,000 samples a year but demand is greatest in the Eastern Region where colleagues estimate that 15,000 are processed during the same period.

Soil maps

It is now possible for every farmer to determine the soils on which he works, as the Soil Survey launched its 1:250,000 scale (¼ inch to 1 mile) National map.

The complete map, which stood 9ft off the ground, dwarfed Soil Survey Information Officer Dr Bob Evans, who at the end of the Show was delighted to report a very good response with more than 100 individual sheets sold and many more ordered.

If you would like a current publications list contact Dr Evans on 0223-358911.

One of the tools of the surveyor and potentially the farmer, a soil auger, was available from the Van Walt Agricultural Services stand for the first time at the Show. The company, based in Surrey, markets the famous Edelman Dutch auger as well as penetrometers, rain gauges, root augers, infiltrometers and sampling kits.

Contact Vincent van Walt on 0428 54304 for more details.

It was, overall, a most stimulating Royal Show for those involved in the Soils Centre. The advisors and researchers in the field of soil science presented a practical and unified message, and I am sure that the visitor took home more than just some "Food from Britain".

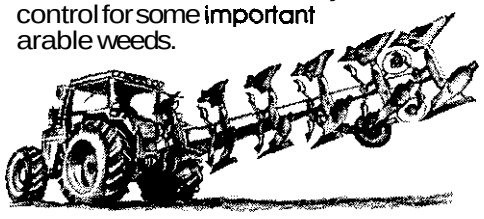
Our thanks go to Ford Tractor Operations for their generous sponsorship of the Soils Centre.

The top-of-the-range Edelman soil auger marketed by Van Walt.

Dowdeswell ploughing — effective and economical

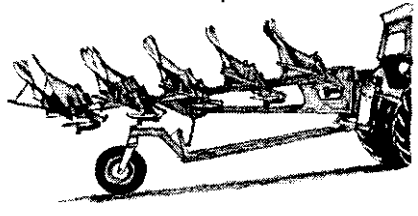
Soil management

Ploughing is Me best method of soil management between crops. Less effective systems of crop establishment have re in new wee and disease problems Ash and crop residues lefton the surface seriously reduce the effectiveness of many modern herbicides. But ploughing buries surface trash out of harm's way, reducing weed and disease carry-over. In fact, ploughing is recommended as the only effective control for some important arable weeds.



Modern ploughs

Ploughing is a technique Mat is continually developing and Dowdeswell ploughs are produced to meet the special requirements of modern farming. The Dowdeswell mounted and semi-mounted reversible ploughs are designed far high workrates. On suitable soils, ploughing and drilling can be carried out in one pass



DOWDESWEU REVERSIBLES

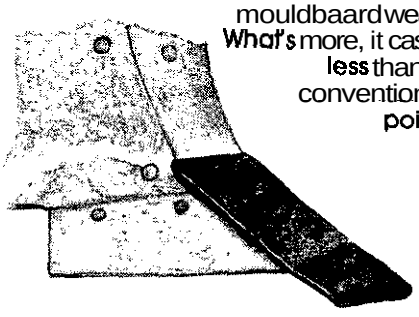
All Dowdeswell ploughs are **manufactured** to a high **specification.** Because farmers **work them** hard, **they** are based on **strongly frames,** precisely re wilh **steel castings** d **forgings built in** at a **stress points.** All plough **legs** are **shearbolt** d and **moving parts** are **kept** to a **minimum** to reduce wear and **distortion.**

Mounted ploughs — Me **DP1** and DP7 **are available with up to six** furrows and **the lightweight DP8 has** up to four **furrows. Dowdeswell's** famous **semi-mounted models** allow smaller **tractors** to handle bigger ploughs The **DP2** is for on-the land work **with** up to **ten furrows,** and Me **DP6 is** for In-Me-furrow ploughing wilh up to **eight furrows.**

For **special requirements** Dowdeswell can build **special ploughs.**

Better shares

To reduce ploughing costs, Dowdes-Well Introduced the reversible share as ndar d fitting. It lasts twice as long as a nven ional plough point, improves penetration, and as reduces mouldboard wear. What's more, it casts less than a conventional point.



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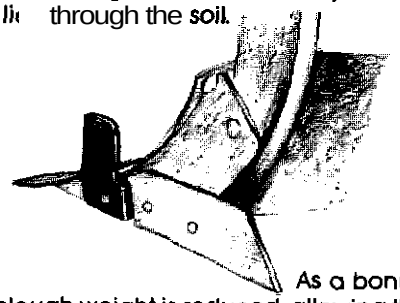

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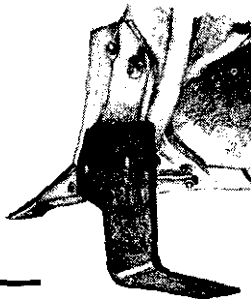

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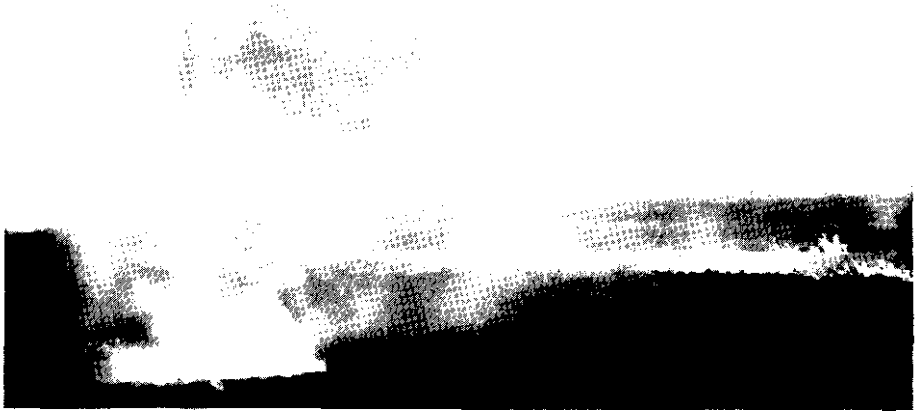
Coping with straw — the German way

GERMAN arable farmers have established a 'blueprint' cultivations system for dealing with after-harvest residues prior to autumn drilling.

The technique, based on the plough, has been developed over the past decade by growers in the Schleswig-Holstein region due to legislation which makes straw burning difficult, if not impossible, throughout the country.

British cereal farmers, already concerned about the safety and nuisance aspects of straw burning close to busy roads and towns, could face a similar position to their German counterparts if burning is banned in this country. For these reasons, Ministry adviser, Mr Brian Sanders and NIAE cultivations specialist, Mr David Patterson, visited Schleswig-Holstein last autumn. The object of their tour was to examine the effects of German methods of straw incorporation on farming practices in the region and to determine whether their cultivations techniques could be suited to our conditions, helping to provide a realistic solution to the environmental, safety and disposal concerns expressed by British farmers.

The following article is a summary of the subsequent report of the visit compiled by Brian Sanders.



Straw burning — rarely seen in Schleswig-Holstein. Photograph courtesy of Farmers Weekly.

STRAW burning is rarely carried out in Schleswig-Holstein. Strict national regulations and the penalties for contravention have made the 'matchbox' technique of ridding harvested fields of straw highly impractical. And even if a burning licence is granted by the authorities, a single objection from a local resident can result in the licence being revoked.

German farmers have, therefore, had to develop a completely different approach to that taken in the 1960s and carly 1970s. Each one of the 10 farms visited by Messrs Sanders and Patterson used straw choppers on their combines. Optimum chop length is about 5cm (2in), required a power input of between 15kW and 22kW (22hp and 30hp) to the chopper mounted behind the straw walkers. None of the farmers interviewed complained that this reduced output.

Cultivations

Three separate cultivations operations are normally carried out after straw chopping. These include initial incorporation immediately behind the combine; ploughing up to two weeks later and, finally, seedbed preparation and drilling.

Most stubbles are left between 10cm and 15cm (4in and 6in) long and in all cases, cereal straw yields were estimated to be the same as grain yields.

The Germans do not like either straw stiffeners or shorteners as they believe these can reduce the rate of decomposition and increase chopper power requirement.

The first operation — initial incorporation or mixing of the straw — is usually achieved with two or three passes of heavy-duty spring tines or discs to 10cm (4in) depth. Tines are generally preferred on the heavier or stony soils as they give a more uniform mix.

Discs, when used, are conventional 2 gang sets of 60cm (24in) diameter discs, the front being scalloped and set at a 20 deg angle. Work rates for both implements are in the range 0.8 to 1 hectare (2-2½ acres) an hour, per metre width. For improved straw chopping and mixing, discs or a power harrow are used in conjunction with a tined cultivator.

Ploughing was the main method of straw burial used on each one of the farms visited by the British investigators. The preferred technique is to place the straw/soil mixture, created during initial cultivations, evenly up the side of the previous furrow — not in the furrow buttom.

Most German growers achieve this by removing the conventional skimmers in favour of a trash board mounted on top of each body, which helps to leave the surface free of surface residues and the soil/straw mix sandwiched between each

27 ▶

Straw burning regulations in Schleswig-Holstein

Farmers wishing to burn straw must contact the authorities at least one week ahead to obtain a licence and must supply the following information:

- *Date of burning (not Saturday or Sunday).*
- *Area to be burnt.*
- *Enact location of field.*
- *The name of one person in attendance.*

The authorities inform the police who usually check that the listed requirements are met. If straw is burnt without permission, the farmer is fined and, if the fire brigade has to be called out, he pays their wages. Any delay in burning, for example, due to rain, means that the licence application procedure has to be repented.

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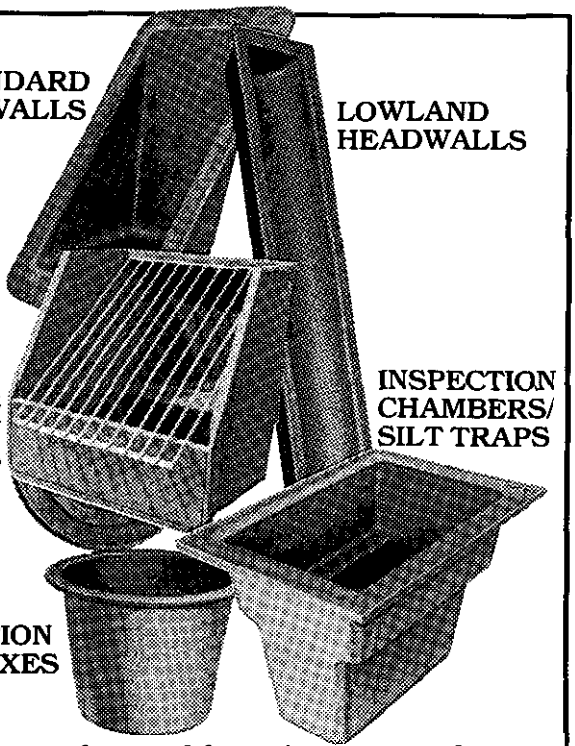

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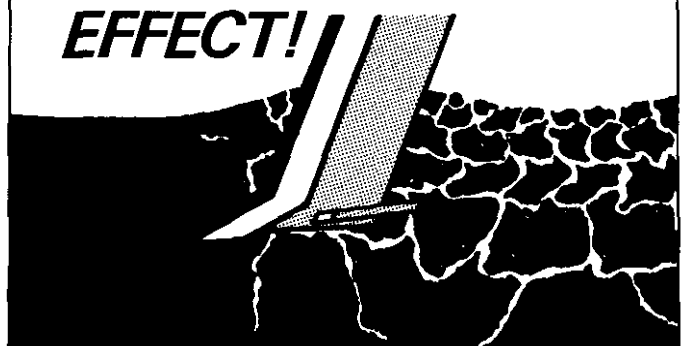

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furrow slice. Straw left in the furrow bottom tends to produce an anaerobic layer giving poor decomposition.

All the fanners visited normally ploughed at 30cm to 35cm (12in to 13¾in) depths — considered to be the ideal — working through 10cm (4in) of topsoil which had already been moved.

Furrow widths of up to 45cm (18in) were common and slatted mouldboards are becoming increasingly popular. Ploughing outputs ranged between 0.4 and 0.7 hectares an hour per metre width, with power requirement averaging 22kW to 30kW (30hp to 40hp) a body.

Moisture loss and insufficient soil firming were observed by Messrs Sanders and Patterson to be the most serious deficiences in German seedbed preparation. On all but the heaviest land, a furrow press is towed behind the plough. The cultivations' system employed had also produced a severe plough pan on much of the land, yet none of the German farmers seemed concerned and none contemplated sub-soiling.

However, great emphasis is placed on the production of an ideal seedbed: soil preparation and drilling follow immediately after ploughing, normally as consecutive operations in-the same field to avoid moisture loss.

Work on crumbler bars behind rotary harrows has revealed that a star-wheel type assembly can produce the necessary firming and fine tilth. Rahe, Krone and Lely harrows were the most common, with Amazone, Accord and Nodet taking the lion's share of the drill market.

Two of the larger farmers visited, expressing concern at the running costs and work rates of power harrows, had recently purchased Vaderstad spring tine cultivators. These have many small tines, adjustable for both depth and rake angle which helped to provide a fine seedbed and some top surface compaction.

Power availability

The amount of tractor power available to Schleswig-Holstein arable farmers is up to 100 per cent greater than similar UK enterprises. This was put down to the plough-orientated cultivations system and seen by the British investigators to result in considerable fuel, labour and capital expenditure compared with our farming methods.

Despite the obvious German success with both straw incorporation and seedbed preparation using the plough, Brian Sanders expresses a need in the UK for a lower energy-consuming method of dealing with harvest residues, especially on our heavy land.

However, he states that until suitable machines are developed, the plough would appear to be the only alternative for complete straw incorporation: "There is," he writes, "a need for a critical look at the ploughs currently available in the UK and their suitability for straw incorporation."

This suggestion forms part of a proposed action list for future development work by our Agricultural Development and Advisory Service researchers.

Other suggestions include investigating straw choppers, their performance, power needs and result of chop length on straw breakdown rate; also straw stiffeners or shorteners, and how they can effect chopper power requirement and the rate of decomposition.

Autumn nitrogen usage as a long term and practical element in assisting straw decomposition could also merit further examination, suggests Mr Sanders.

Current work

Four Ministry experimental husbandry farms are already engaged in a series of straw incorporation trials in the UK. More than six different cultivations systems are being examined, and first results indicate that straw chopping is an essential ingredient for successful fieldwork.

The techniques being examined range from ploughing to spring tine cultivating, and two more seasons' work are planned.

Other research centres are looking at nitrogen usage, weed control and possible diseases linked with straw incorporation.

Further articles in Soil *and Water* will update the work and assess the latest findings from the trials and research centres throughout Britain.

German farmers favour the plough.

ENERGY USAGE IN CEREAL ESTABLISHMENT

A comparison of German and UK energy inputs

Schleswig-Holstein

	MJ/ha	hp.hr/ acre
Initial cultivation/straw mixing (2 passes)	120	18
Ploughing (30-35cm deep)	235	35.5
Rotary cultivator & drill	100	15
Total	455	68.5

(The above figures were calculated from the information obtained during the visit by Messrs Sanders and Patterson)

United Kingdom (Typical Eastern region inputs)

	MJ/ha	hp.hr/ acre
Direct drilling	35-80	5.3-12
Reduced cultivations	130-230	20-35
Traditional cultivations (plough, cultivate, drill)	200-360	30-54

(There energy input figurer are measured at the implement, allowing for transmission and tractive losses of 45 per cent).

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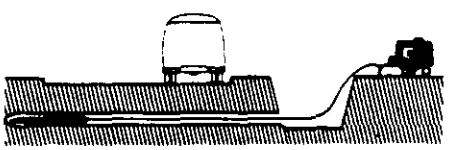

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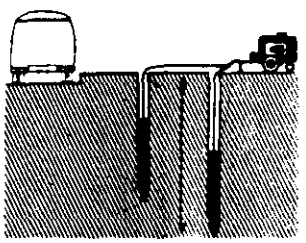

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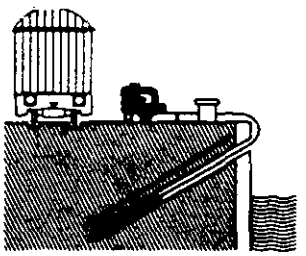

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VII-3

SOIL MANAGEMENT

The erosion risk of compaction

On more than 1,000 sites in the West Midlands where water erosion was recorded by the writer during the period 1965-1983, soil compaction and downslope cultivation lines were identified as major contributory factors in over 95 per cent of cases. Dr Alan Harrison Reed, Principal Lecturer and Head of Geography at Wolverhampton Polytechnic, examines the relationship between soil compaction and water erosion sequences on sandy and silty arable soils.

Fig 1. Severe confined rill erosion with overlapping base of slope fans with gullying towards the crest of slope. Length of fan over 122m and average width 20m, depth of material averaged 20cm. Estimated tonnage 750 tonnes. Rainfall rate 2.5-7.6mm per hour. September storm 1976. © Harrison Reed.

THE PAST decade has witnessed an increased awareness of the problems which can result from soil compaction. Today these problems are well documented, together with advice on ways of overcoming some of the worst effects of soil compaction. However, one important aspect of this problem has received little attention, namely the effect of compaction on increasing rainfall run-off, with its attendant risks of soil erosion.

Rain which falls at a rate greater than the surface soil's ability to accept it either runs off on sloping land (see Figure 1) or forms ponds where there is no slope (see Figure 2). Once run-off commences on bare soil, its movement will be conditioned by a number of factors, such as the extent of surface and subsurface compaction, the presence of tillage lines and wheelings, and their direction relative to slope, together with the characteristics of the slope itself (length, degree of steepness, and complexity). The effects of run-off are increased where fields have been enlarged and slope length and water catchment increased (Figure 3).

Most attention has been given to the investigation of the causes of poor crop responses which result from compaction, whereas the potential danger of accelerated run-off through compaction which can occur even on gentle slopes (2-3 degrees) during periods of heavy rainfall is often overlooked (Figure 4). Compaction problems can usually be rectified by subsequent cultivations, whereas the effects of marked erosion episodes are more serious, wide ranging and long lasting.

Two main types of compaction, natural and induced, are recognised in arable soils. The former results from raindrop impact and splash, and the settling of the soil after cultivation. The latter is brought about by the passage of machinery over the soil surface. The degree of natural compaction will be influenced by soil texture (notably in sandy and silty soils), by soil organic matter content and by the length of exposure to erosive rainfall (1mm per hour for compacted sandy arable soils).

All soils with inherently weak surface structures and low organic matter content (2 per cent and less) in a fallow state or partially covered by emerging or growing crops, are susceptible to damage. The impact of falling raindrops pulverises and disperses weakly structured soil aggregates and leads to the suspension of fine particles in the water. These particles cause a reduction in porosity when they enter the soil interstices. Such action results in a closer packing of particles and the formation of a thin crust or cap when the soil surface dries out.

Experiments carried out on sandy soils using $25m^2$ plots at our research station at Hilton, East Shropshire, have shown that naturally compacted sandy soils are characterised by a marked reduction in water intake during heavy rain (>1mm per hour) with a consequent increase in run-off after a period of exposure. When the rainfall rate exceeds the rate of infiltration (percolation) into the soil surface, low energy flow takes place on sloping sites, removing soil particles released by raindrop impact and splash. Where the run-off is concentrated into small channels or rills, more soil is removed because of higher energy flow within the channel.

Initial data from these plots, for a winter period or autumn period only, indicate losses ranging from 8 tonnes to 13 tonnes per hectare. Current monitoring in arable land last year and this, shows losses ranging from 11 tonnes to 19 tonnes per hectare for moderately sloping (7 deg) to strongly sloping (14 deg) respectively. (M. Fullen, PhD research project in progress). When data for two April storms are added (26 and 28 April 1983) however, the figure for the steeper slopes rises to 46 tonnes per hectare. By analogy with arable fields which have been subjected to induced compaction from machinery, the run-off potential is much greater and the risk of erosion is therefore greatly heightened.

Two interralated situations can be considered here; firstly, induced surface compaction, which leaves behind a pattern of wheelings and implement lines which vary with the type of crop being sown and partly with soil moisture status at the time of cultivations, and secondly, induced subsurface compaction and dense pan development from cultivations. This compaction increases bulk density and reduces the size and number of pores

Vol 11-3

Fig 2. Extensive ponding on sandy loam overlying sandy cloy loam with well developed cultivation pan. **Sugar Beet, April 1983.** © *Harrison Reed.*

and fissures in the soil, with consequent marked reductions in the amount of water which can seep through. This factor becomes more critical during storms. In primary wheelings on sandy soils, where a tractor has made one pass only, water intake during heavy rainfall can be reduced by up to 70 per cent. Where more than one pass has been made for spraying or top dressings, mu-off usually approaches 100 per cent during heavy periods of rainfall (see Figure 4).

The preponderance of low intensity rainfall has always been considered to be one of the major factors which minimise the risk of soil erosion in the UK. There is also the implication that erosion only occurs during periods of high intensity rainfall (> 25.4mm per hour) and as such rainfall is infrequent and short-lived, the erosive effect is localised. Today, there is a greater chance of low intensity rainfall being potentially more erosive because of the combined effects of low soil organic matter levels, loss of structure and increased compaction, which in turn lead to reduced water infiltration into the soil and consequently the risk of ponding or run-off.

Observations of erosion episodes in East Shropshire, on compacted sandy loams, loamy sands and silty loams, indicate that the intensity at which rainfall becomes erosive is reached at 1mm per hour or more and is usually associated with rainfall totals reaching or exceeding 10mm (approx 0.4 inches? per hour. A 10mm fall in five hours is sufficient to cause splash erosion and initiate low energy flow (sheet) erosion. Where cultivation lines run in the direction of slope, run-off water is channelled along tractor wheelings and incipient rills develop. If heavy rain continues, the rills will develop (confined rills) (see Figure 4) soil will be eroded from the steeper sloping parts of the field and will be deposited downslope or carried out of the field entirely.

Fields which have been enlarged by hedgerow removal and which are characterised by a steeper section hacked by a long, more gradual slope, are particularly susceptible to erosion damage where cultivation lines run down the slope (see Figure 3). Rates of rainfall of over 5mm per hour associated with thunderstorms, if prolonged, are capable of producing spectacular erosion. Tractor wheelings running in a down-slope direction may be converted into deep gullies of over 1m depth and 2m width, with soil loss exceeding 100 tonnes oer hectare (see Figure 5).

Erosion of arable soils by wind and water takes place annually in parts of the intensively cultivated areas of the West Midlands. In most years, the area affected is small in comparison to the total area of crops and grass, but the loss is nevertheless significant, as it tends to recur on the same sites and affect high grade soils (capability class 1-3). The area affected by erosion increases during adverse seasons (for example 1968-9, 1976 and 1983). The timing of abnormally wet or dry spells in relation to field conditions and the stage of crop growth is of great importance when assessing erosion hazard. A distinction is drawn between adverse seasons which can cause widespread erosion over a wide range of soils, and more isolated events such as localised thunderstorms. Both may produce spectacular erosion, and such events may have a long return period. However, the sum of less spectacular erosive events, throughout the year, may, in the long term, be more significant, as the return period for such events is invariablv shorter.

A detailed picture of the erosional history of' an area can be achieved only through accurate monitoring on a field-to-field basis, and this has been attempted in parts of East Shropshire. Three 'arable' parishes, Claverley, Rudge and Worfield, were monitored for erosion from 1967-1976. Of the total arable area of each parish, 27, 17 and 38 per cent respectively was affected by both water and wind erosion, with some fields eroding every year. As this approach has not been adopted elsewhere in the UK, it helps to explain why the problem of soil erosion is constantly under-played. If this monitoring technique were applied to other areas with similar sandy soils, land forms, crop-

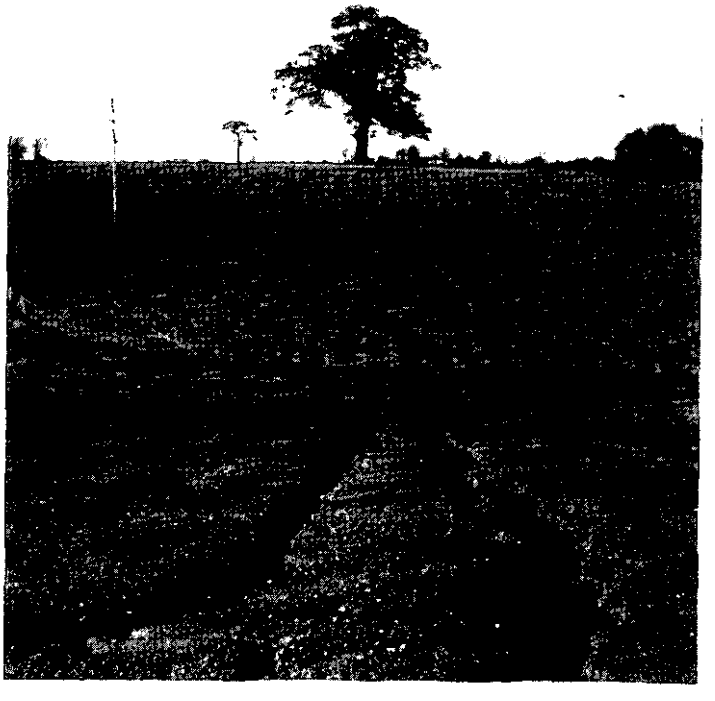
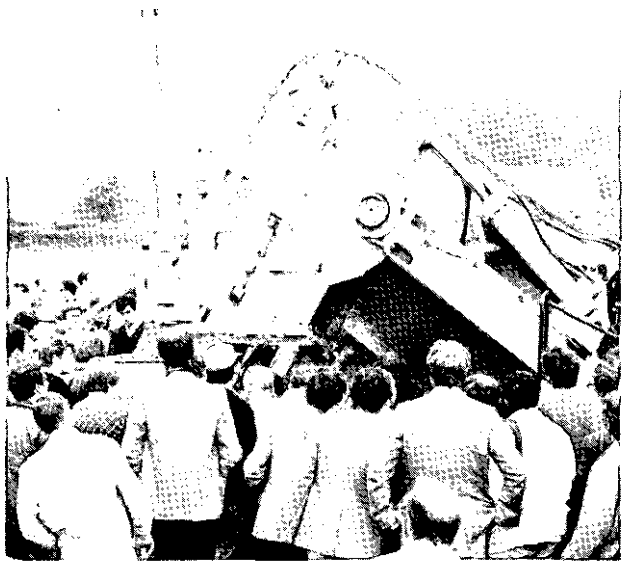


Fig 3. Severe rill and gully erosion on a complex slope partly occupying tractor wheelings. Note four sets of wheeling directions. Large catchment area beyond slope crest (tree marks former field boundary). Field surface severely splashed. Autumn groin September 1976. Estimated soil loss 150 tonnes per hectare. © *Harrison Reed.*



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V4-3

Erosion risk

431

ping sequences and management practices, it would be likely to identify soil erosion as a much wider problem than is currently accepted (Reed 1979). Soil erosion monitoring has been undertaken by the Soil Survey in conjunction with the Airphotographic Unit of ADAS. ***(Soil Survey Annual Report 1981).***

The survey of susceptible areas commenced in 1982 (see ***Soil and Water*** Vol 10 No 1, p 11) and will provide valuable evidence of the extent and frequency of erosion. However, from personal experience, photography at the scale of 1:100,000 registers rill and gully erosion clearly, whereas sheet and incipient rill erosion cannot be detected at this scale. This can lead to an undervaluation of erosion by between 30 and 40 per cent.

Certain management practices undoubtedly increase the risk of soil erosion, and although in good seasons, resulting soil damage may be only slight, in adverse seasons it may be of serious proportions. It is therefore prudent to avoid these practices or combinations of them if at all possible.

Because of the great weight of many modern tractors and some farm machinery, an attempt must he made to break up the natural channels produced by wheelings, particularly where field shape and crop type necessitate down-slope cultivation and planting. A winged tine mounted behind the rear wheels would help to break up the lug pattern of primary wheelings during the sowing of sugar beat. Subsequent spraying operations would then be 'positioned' along tramlines, the frequency of which can be reduced by using extended spray booms. Again, the use of rear-mounted tines would help dissipate the increased compaction associated with secondary and tertiary wheelings and reduce concentrated flow of rainfall run-off.

Careful consideration should he given to the possibility of carrying out field operations without removing 'key' hedgerows which suh-divide long slopes. This is particularly important where slopes angle increases locally, and this is hacked by a very large potential catchment area for storm run-off.

Where this situation already exists, strip cropping parallel to the contour will help to reduce run-off from low energy storms but will do little to offset run-off in high energy storms. Cultivation parallel to the slope should be avoided if possible.

Care should be exercised in seed bed preparation where rotary cultivators produce friable 'fluffy' and initially highly porous surface tilths which rest on a dense cultivation pan. Storm run-off concentrated along wheelings parallel to the slope can quickly cut a wide, trough-shaped depression from which all the surface soil is removed (see page 8). Further downward cutting by run-off water is limited initially by the upper pan surface, but this is soon excavated by concentrated flow into a deep Vee-shaped ravine.

From the foregoing points it is clear that minimal cultivations will greatly help to reduce erosion risk, with direct drilling being the most successful practice where soils and land forms permit.

Erosion-susceptible soils should not be exposed to splash erosion for longer neriods than necessary. and where feasible cultivations should be delayed as late as possihle (accepting a possible risk factor involved here in reduced accessibility time for cultivations).

Crop residues intercept and dissipate rain drop impact and reduce splash effects and run-off. Therefore they are useful in affording some protection to exposed soils.

All farm managers should invest in two useful tools — a spade and a penetrometer — both of which will help indentify surface and suh-surface compaction. Inspection should be carried out at least once a year in every field, preferably during dry spells in autumn — ideally after harvest and before winter cultivations.

If adverse weather reduces the accessibility time for field operations to the minimum, and cultivation takes place when soil moisture levels are too high, it is essential to inspect the subsoil after cropping and carry out subsoiling operations where necessary.

On a recent TV programme, Mr Michael Fish of the Meterological Office was asked whether this spring was the wettest on record. The commentator was amazed when he was told that it was not. "Why, then, had the ground been so wet," was the next question? My answer to this can be found partly in the widespread occurrence of soil compaction and its marked effect on limiting the natural percolation of rainwater, rather than in spells of freak weather. Induced compaction increases the risk of perched water tables, and this problem is increased on low lying land and in silty and clayey soils. On sloping land, severe sub-surface induced compaction encourages lateral movement of water as run-off, which when channelled in wheelings becomes highly erosive. Mr Fish also pointed out that people have short memories, for spring 1981 was very wet, though warmer, and spring 1979 was certainly much worse than 1983. It is now apparent that the widespread effects of soil compaction are being experienced in the intensive arable areas, and above-average periods of rainfall are having a greater adverse effect over a wider range of soils. This is leading to the more frequent occurrence of soil erosion. If remedial measures are not taken to reduce the effects of induced compaction, the present situation will develop into a problem of damaging proportions.

Fig 4. Confined rill erosion in primary and secondary wheelings. Greatest amount of sediment moving in secondary wheeling. Prepared for sugar beer, spring 1983. Sandy loom. © *Harrison Reed.*

Fig 5. *Gully development from tractor wheeling, down-slope cultivation. Data as in Figure 1. Depth of gully 1.5m 2-3m wide.* © *Harrison Reed.*

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NOVEMBER

9-10 Autumn National Sugar Beet Demonstration — Setchworth, Newmarket

20-25 **10th** International Congress of Plant Protection, Brighton

29 Drainage Conference — RASE/ADAS/SAWMA, at the NAC, Stoneleigh. Tel 0203 555100

DECEMBER

13-15 Irrigation short course — NCAE, Silsoe, Beds. Contact Pam Cook 0525 60428

JANUARY 1984

3-6 **Drainage** short course and Soil Management **course** — NCAE. Silsoe Contact Pam Cook 0525 60428

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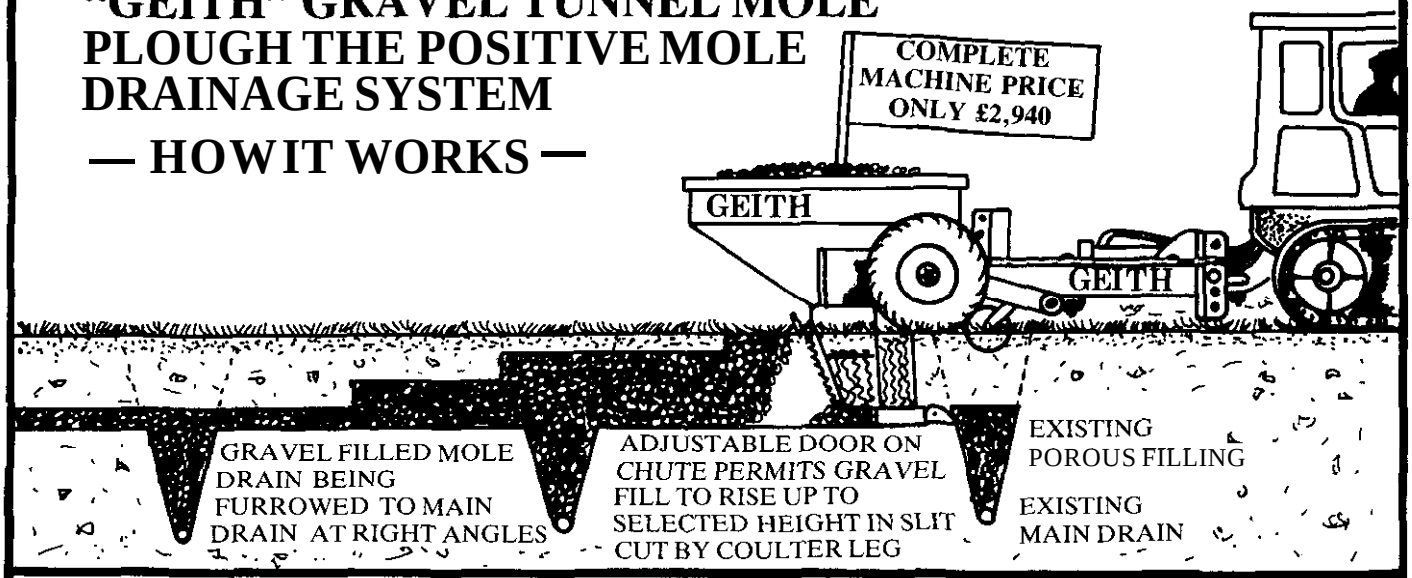

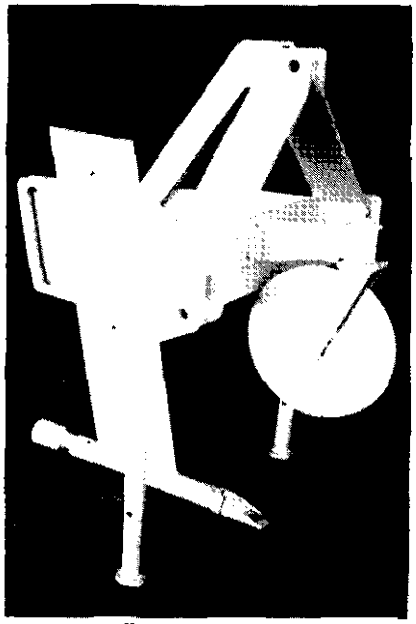

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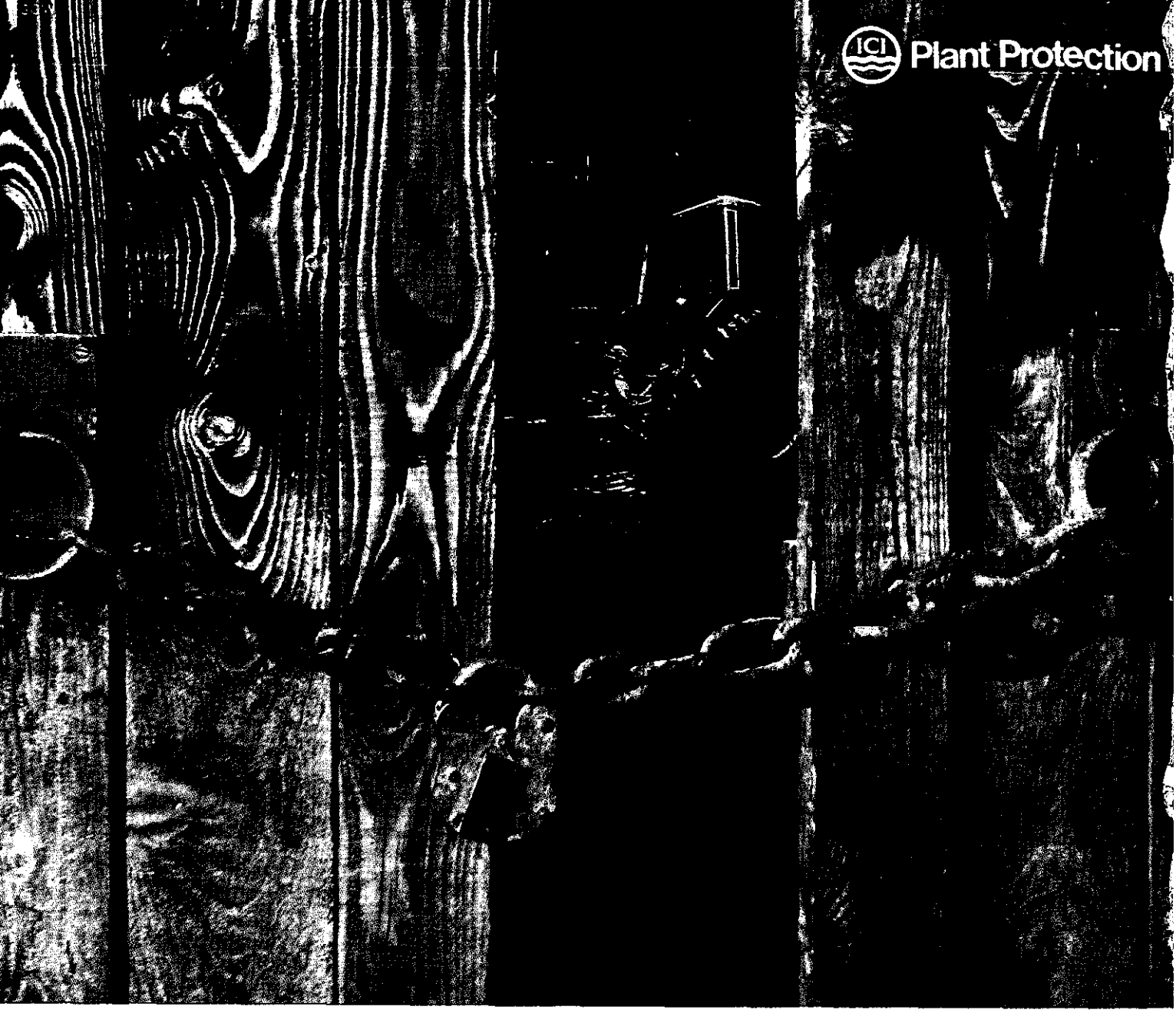

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