SOIL and water

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TILLAGE – WHAT NOW AND WHAT NEXT?

One day Conference Thursday 5th February 1987

V14-4

SOIL and water

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COMMENT

Get the best out of your Membership

Arrangements for the Tillage Conference are now moving into top gear. Enclosed with this issue of 'Soil and Water' is a prospectus and application form. Further copies of these can be supplied and the programme is also carried on the back cover as yet another reminder.

Tillage – the techniques and the scope for cost reduction is a vital concern today and we are expecting a good attendance at this Conference.

Don't delay – send your application in straight away.

This Tillage Conference is just one item in the programme that SaWMA is arranging for 1987. Besides this, we shall again be arranging a number of Field Meetings at venues of interest to members. Field Meetings are an activity where your Management Committee feels our Association can be particularly helpful to members. Such visits offer opportunity for members not only to see new soil and water management techniques, but also to discuss with the innovators and with fellow members their own interests and ideas.

Visits are arranged for your benefit

If you think we're selecting the wrong venues or you have ideas about other, perhaps more interesting venues, then let us know and we'll see what we can arrange. But if we've made the right choices then come along – support the Association and get the full benefit from your membership.

The right selection seems to have been made with the meeting arranged for mid-November at Silsoe College. At the time of going to press already about fifty members have signified their intention of attending.

Two other visits are already planned for next Spring.

A visit in May to see Mr. David Dowler's gantry system of cultivation will form a valuable follow-up to the February Tillage Conference and to the work we are currently reporting from the National Soil Dynamics Laboratory in the USA and from AFRC Engineering at Silsoe.

Also a visit is arranged to Thamesgro Land Management Ltd in Berkshire. This is a new company set up to tackle the restoration of derelict land. Besides direct improvement of land, their activities provide a further 'bonus' in taking the pressure for development off greenfield agricultural sites. A particular feature of their work is the "growing" of fertile top soil by the selection and treatment of on-site mineral material.

Other visits are also in preparation. We are particularly working to arrange something nearer home for our more Northerly members.

So come along and get the most out of your SaWMA membership.

Subscriptions 1987

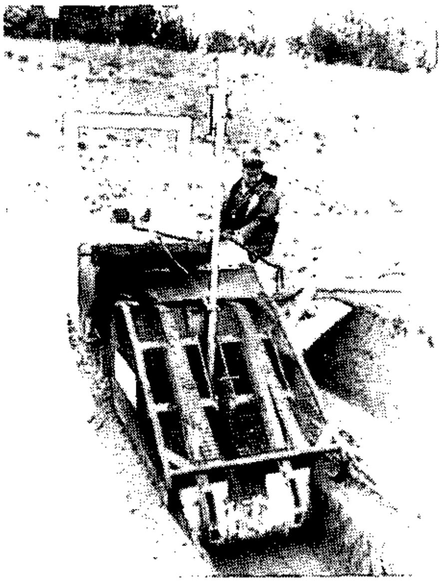
Finally – don't forget – the 1987 subscriptions are due by the beginning of the year. Please act promptly and send your subscription in straight away without further reminders.

Front Cover: "Direct Drilling" – streamlined soil management for cereal crop establishment – Further comment see page 5

CONTENTS

AFT Trenchers for Thames Water

A. F. Trenchers has successfully tendered for and supplied three British built filter bed trenchers for the Thames Water Authority by adapting their standard production tracked trencher to suit the specifications laid down for filter bed trenching.



Filter bed trenching is carried out to ensure rotation of the sand and is part of the re-sanding process.

To meet the specification requirements the standard frame digging shaft drive position was moved to allow for twin digging chains to be mounted and trench 80cms wide up to 50cms deep in the central position. Sand disposal rate is 0.86cu.metres/min.

Having conducted some earlier levelling trials with laser control TWA decided to have the Spectrophysics EL1 laser levelling package fitted to each trencher. The laser uses a rotating spot beam with a range of 300 metres which controls the depth of trench over the whole bed area. This ensures each trench is dug absolutely level and so avoids any damage to drainage pipes installed below sand level.

The same laser is used to level the final depth of sand over the whole bed, providing a constant reference for this and the trenching work which is carried out at the same time. A. F. Trenchers are at Gosbecks Road, Colchester C 0 2 9JS.

ATB appoints new director

Mr. John Clayton, Chairman of the Agricultural Training hoard has announced that Don Newman, currently the Agricultural Training Board's Chief Training Adviser, has been appointed director designate to succeed Richard Swan on his retirement at the end of the year.

Mr. Newman, 60, joined the ATB in September 1969 after a period of practical farming which followed a career of teaching agriculture overseas. Shortly after joining the Board he was appointed National Training Adviser (Livestock) and held the posts of Head of Technical Services and Head of Field Operations before being promoted to his present post in 1981.

The current director, Richard Swan, retires 31 December, 1986 following 40 years in agricultural education and training. He received the OBE in the 1986 New Years Honours for his services to the industry.

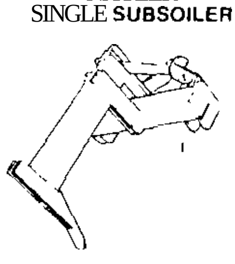
Bourgeins latest laser-graded Trench Equipment

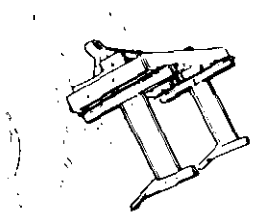
A Bourgein TF700 has been supplied to Jackson Field—the main contractor—at work on the Costello Sports Centre in Hull. The trencher is being used to install a split drainage scheme.

Drainage trenchers offer a neat and economical solution for draining land where conventional diggers are not suitable. For still greater accuracy and speed this latest trencher available from Bourgeins includes fully automatic laser control.

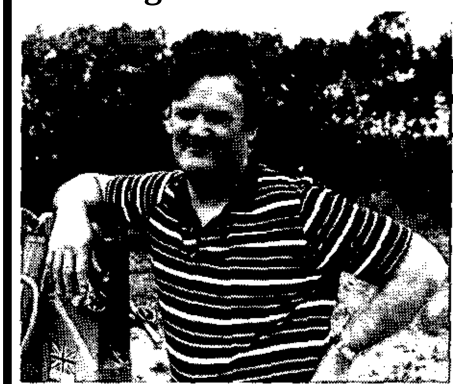
Ideal to carry out all specifications in the sports/leisure field, Bourgeins offer the equipment for sale or for hire and they envisage a demand also from the construction, farming and allied industries.

For further information: Mr. Roger Bourgein, Managing Director, L. D. Bourgein (Oxford) Ltd., Tel: (0865) 735420.





Roger Dowdeswell



We are sad to record the death of Mr. Roger Dowdeswell, founder and Head of the Dowdeswell Group of Companies.

At a time when British farming is totally concerned with adopting the best and most economic tillage techniques and equipment, the loss of Mr. Dowdeswell and his innovative abilities will be particularly felt.

Roger Dowdeswell had set his objective that his companies should offer the British farmers a full range of British-made tillage equipment.

Mrs. Diana Dowdeswell, succeeding her husband as Chairman of the Group, has announced that his aims will still be pursued and that the Dowdeswell Group will continue to plan ahead to meet farmers' tillage equipment needs.

We extend our sympathy to the Dowdeswell family in their sad loss.

AFRC Engineering —new name for NIAE.

As from 1st October the new name for the National Institute of Agricultural Engineering is the AFRC Institute of Engineering Research, or, more briefly, "AFRC Engineering':

Under this new name the Institute forms one of the team of eight AFRC Research Institutes, each responsible to a different sector of the agricultural and food industries.

With the new name goes some extension of the Institute's activities—now to include not only agricultural and horticultural work, but also food process engineering and other food work as well as fuel and fibre production.

The new title also recognises that the Institute works not just nationally hut also with and for companies that are multi-national. Work for developing countries will continue to be a strong feature.

New officers appointed

At the 1986 Annual meeting of the British Clayware Land Drain Industry, Mr. Kevin Rothery of Henry Oakland & Sons was appointed chairman, with Mr. Ken Denton of the Hepworth Iron Company as vice-chairman.

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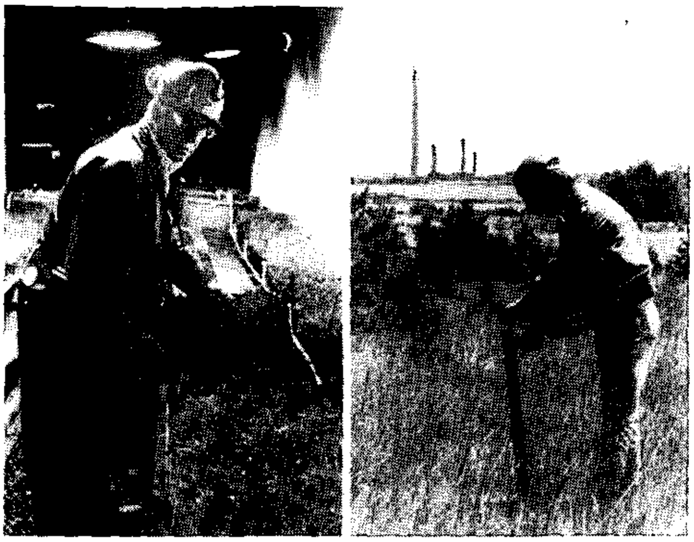


Into gardener. Alex *Gray*, left, *harvests* the *crop* on *the* 4,600 foot level of the mine while *Jim* Savage, a student in the agricultural department, uses a planting tube to position the seedlings in the company's *tailings reclamation area.*

Re-afforestation starts 4600 feet underground

The first crop of tree seedlings surfaced this summer from Inco's Creighton Mine, near Sudbury, Ontario, as part of a forest management project undertaken by Inco and the Federal Government of Canada. About 30,000 Pine seedlings were exposed to natural sunlight after being harvested on the 4,600-foot level of Creighton No.9 shaft. This is the first large scale production of a renewable resource from Inco's underground mining operations.

The 14-week-old trees were seeded and grown in an underground nursery. Specially designed lights and feeding systems provided the optimum light and dark periods and nutrients for growth. The temperature was maintained at 24°C by the natural heat of the rocks at that depth.

Plan 100,000 seedlings per year

The success in growing pine tree seedlings in an alien environment underground means the greening of Sudbury effort can move along at an increased pace. Next year it is expected 48,000 seedlings will be grown at the underground nursery and replanted at Inco's tailings reclamation area. Within four years the annual harvest should be around the 100,000 mark.

Over the years the reclaimed land as well as the wildlife population, have increased in size dramatically thanks to the combined effort of the company, the Ministry of Natural Resources, Sudbury wildlife conservation groups and employee volunteers, who conduct the annual bird census in the tailings basin.

Tillage–Scope for Cost Savings A View from ICI Plant Protection.

In these increasingly uncertain times arable **farmers look** even harder at all inputs required for successful cereal growing.

One of the areas offering the most significant potential for reducing costs is crop establishment. Farmers are increasingly questioning the amount of cultivation required to maintain good soil structure and establish high yielding crops.

Reduced cultivation systems, rotational cultivations and modified forms of direct drilling are now being developed and adopted. Each concentrates on the physical mangement of soil with the role of weed control being taken over by weedkillers.

Many of the options currently available will be discussed at the SaWMA conference 'Tillage–What Now and What Next?'–to be held in February at the Rothamsted Research Station–for details see insert and back cover.

Soil Survey moves on

Since the drastic cuts in its Government funding announced in early 1985 it is pleasing to report that the Soil Survey of England and Wales is developing new life and making good progress in extending the commercial application of its activities.

Now known as the Soil Survey and Land Resource Centre–a name which reflects the wider scope of work now being undertaken–there is also to be a move to new Headquarters. An announcement from the Agriculture and Food Research Council (AFRC) and the Cranfield Institute of Technology (CIT) confirms that, subject to the negotiation of satisfactory terms, the Soil Survey and Land Resource Centre will be transferred to Cranfield's Silsoe College with effect from 1st April, 1987.

This follows the recommendation of Council's Advisers (Minster Agriculture Limited) that the Survey should become a department of a commercially orientated academic institution, such as CIT, which will help it to maximise its potential.

As an indication of the wide range of their capabilities there is much of interest in the 1985 Annual Report of the Soil Survey. The National Peat Inventory is nearing completion and may be expected to be particularly useful to conservation and environmental interests. The Survey has carried out consultancy work concerned with land management; potential of conserved land, irrigation systems, acid rain studies, archeological investigations and many other topics.

Management of a silty soil

Study by Letcombe Laboratory shows no evidence of greater risk with direct drilled crops

In the classification of soil suitability for direct drilling produced by Dr. R. Q. Cannell and others in 1978, silty soils were placed in Category 3, comprising those soils in which there is a substantial risk of loss of yield after direct drilling, especially of spring-sown crops.

With the object of studying longer-term behaviour of such soils under direct drilling for a number of years, the late and greatly lamented Letcombe Laboratory, in 1973, initiated a 10 year experiment. The site chosen was a well-drained, stoneless silty soil overlying river terrace gravel in the Kennet valley in Berkshire. The soil series is the Hamble series and the soil was uniform on the experimental area; the depth of the soil down to the underlying gravel was greater than 80cm (32in.)

Silty soils are often weakly structured, have limited potential to shrink and swell, and compact easily. On the face of things, therefore, they are certainly poor candidates for the direct drilling system. Nonetheless, deep silts are very often highly productive, if their fertility is maintained, partly and importantly because of their high water-retention capacity.

Three cultivation treatments were compared, viz, shallow-tine cultivation, (henceforth referred to as ST), direct drilling (DD) and conventional mouldboard ploughing (P). There was also a reference area which remained under grass during the period of the experiment (GRA) and on which comparative measurements were made. Autumn-sown cereals were grown each year on the arable plots.

Final year results

An article recently published by J. T. Douglas and others in the Journal of Soil Science (1986, 37, 137-51) describes a study of the soil's properties in the crop year 1982-83, the tenth year of the experiment. The results of this final year study are reviewed below Graphs and tables shown here are reproduced by kind permission of one of the authors, M. G. Jarvis.

The main measurements undertaken were—soil porosity, bulk density, permeability, structure, (by field assessment), strength, (by cone resistance measurement with a penetrometer), water content and potential, aggregate stability, organic matter content (total biomass carbon content) and distribution and earthworm population. Hourly records of rainfall over the experimental area were kept from July, 1982 to August, 1983.

Ploughing and shallow-tine cultivations were carried out in the third week of August, 1982 and winter barley (the third in successive years) was sown on all plots on September 20th, 1982.

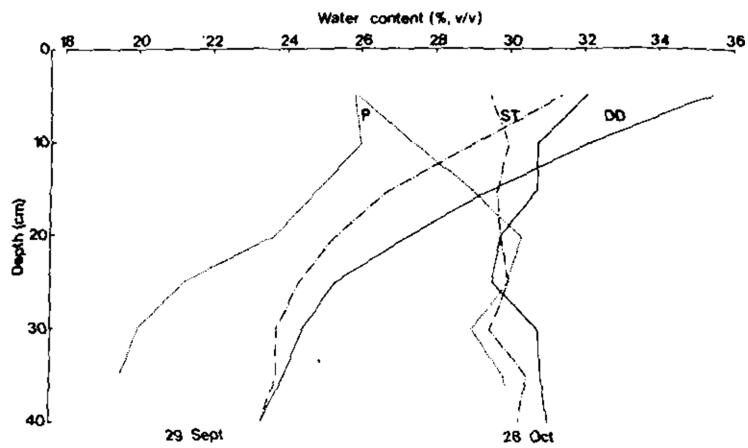


Fig. 1. Water content in *upper 40cm* of soil one (29 September) *and five* (28 October) weeks after *sowing*.

There was moderate rainfall after sowing in September and heavy rainfall (double the long-term average) in October. Soil water content increased very considerably between one week and' five weeks after drilling, and the upper subsoil soon approached field capacity. At the 5cm depth on October 28th. 1982 the water content was least on the ploughed plots (26% v/v) and greatest under direct drilling (32% v/v).—See Fig I.

Surface resistance to weathering

It is evident from field assessment that on this silty soil different cultivation treatments over a period of 10 years have produced differing structure regimes in the upper 50cm of soil. In the top 10cm aggregate **development** was poor on the ploughed plots (P) intermediate in the ST and DD treatments and durable with well-formed 'peds' in the Grass Reference area. The trend in aggregate stability was similar and was considered to be attributable to variations in organic matter levels. An interesting point concerning aggregate stability was that, despite seasonal deterioration in structure brought about by wetness, the surface of the DD soil, and to a lesser extent that of the ST soil, were more resistant to weathering and were better able to regain stability than was the ploughed soil.

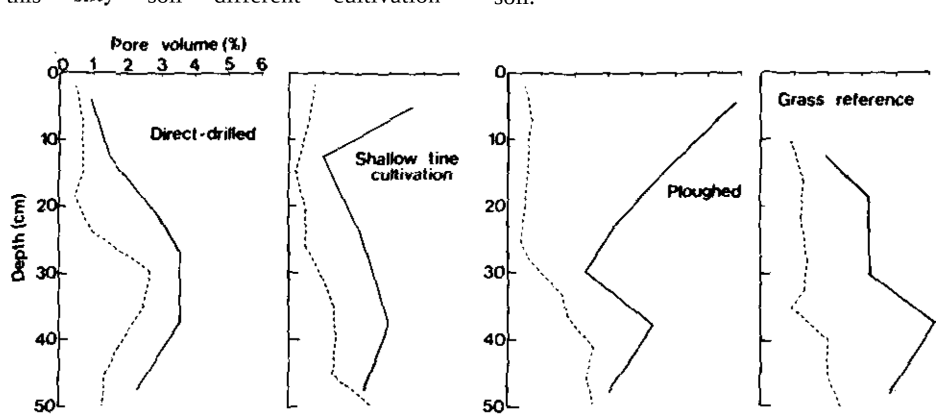


Fig. 2. Volume of pores of diameter *>200 µm(–)* and *cylindrical pores of diameter >1000* pm *(– – –)* in Spring 1983.

Strength and Porosity

It must be borne in mind that silts are normally weakly structured. It is not surprising therefore that, in the lower topsoil, there were no perceptible differences in structure due to different cultivation treatments even over a 10 year period. Nonetheless there were some differences in soil strength, density and

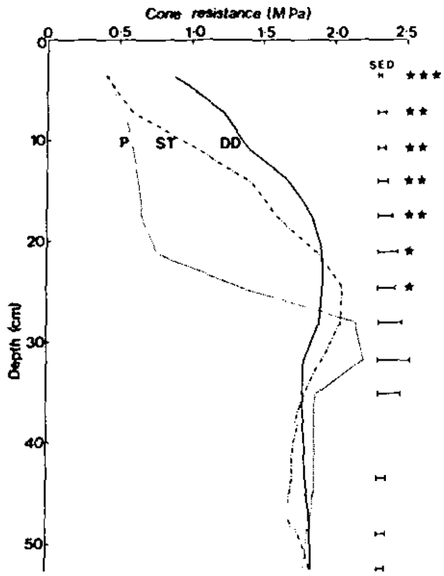


Fig. 3. Cone resistance *profiles* in January 1983, with standarderrors of *the* difference between *two means* and level of significance of differences.

porosity. For instance, the density and strength of ploughed soil were lower than on the undisturbed topsoil of the ST and DD treatments. On the other hand, because the volume of airfilled oores was lowest in the DD soil, this soil would become water-filled more rapidly than would be the case on the ST and P treatments (see Fig.2).

The graph displayed in Fig.3 illustrates two important items. (The measurements were made in January. 1983 when the soils in the experimental area were wet but drained to near field capacity).

● That in the surface soil, and in fact down to 20cm depth, the DD soil displayed greater strength than on either the ST or the ploughed soil.

● That at the topsoil/subsoil boundary the ploughed soil was rather more comoaacted than on the ST and DD treatments.'

Improved stability from accumulation of organic matter

Although the total earthworm population in the experiment area was relatively low, assessments made in 1983 (the 10th year of the experiment) showed there was a significant number of earthworm channels within 7.5cm of the DD soil surface, considerably more than in either the ST or ploughed soil.

The earthworm channels in the DD soil would have assisted the flow of water into and through the soil, wen though there were fewer air-filled pores in the surface layers of the DD Soil.

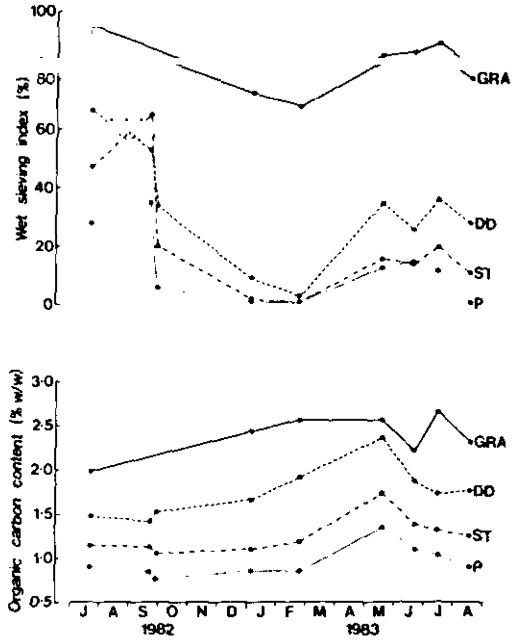


Fig. 4. Seasonal variation in aggregatestability and *organic* carbon *content*.

The most stable of the arable soils throughout the period July, 1982 to August, 1983 were those which had been direct drilled, with the ploughed plots least stable and the ST soils intermediate. Moreover, stability increased during the period between February and May, 1983. Both of these factors (i.e. the greater stability of the DD soils and the increase in stability referred to above) were considered to be associated with accumulation of organic matter. Figure 4 below shows a sharp increasein both stability and organic matter levels between February and May, 1983, and Figure 5 indicates that in DD treatments (and to some extent ST treatments) organic matter is concentrated mainly in the top 3-5cm of topsoil.

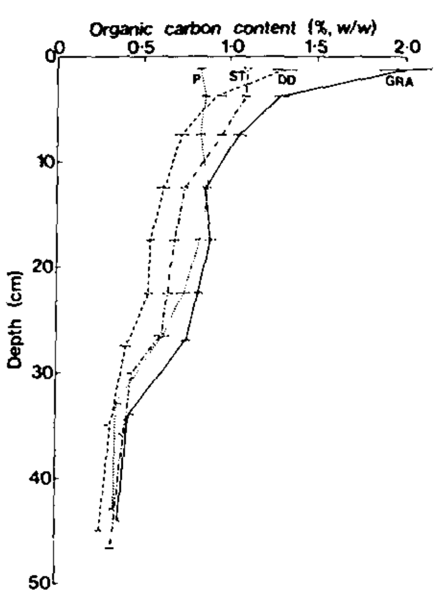


Fig. 5. *Profiles* of organic carbon content in *March* 1983 with standard errors.

Appropriate management can give category 2 performance

The authors' conclusions from the results of this study may be summarized as follows:

- There is no evidence that direct drilled crops on this *silty* soil are at greater risk than those sown by other methods.

- Although this soil type was classified correctly as 'Category 3' i.e. 'soils least suited to direct drilling', it can, with appropriate management, perform as a 'Category 2' soil, i.e. a soil likely to give similar yields of winter cereals after either direct drilling or conventional ploughing although the yield of spring crops is likely to be decreased appreciably with direct drilling.

  Low soil strength and –decreased stability in early spring, which occurred in this experiment, may mean that crops sown in the spring by any method are at risk, and sequential direct drilling in the spring would be likely to lead to a progressive deterioration in soil Structure.

- It was not surprising to find that under continuous grass for ten years the soil structure improved, largely due to a higher organic matter content with consequent improvement in stability. Greater porosity, (especially of large pores), under grass was improved hy the creation of burrows by the larger earthworm population found in these plots.

- A period under grass should increase the versatility of this type of soil for subsequent arable croppings. Simplified methods of cultivation (direct drilling, shallow tine cultivation) which do not disrupt the grassland pore system could then be used to take full advantage of the well-developed surface soil structure.

Tillage and Straw Incorporation

Bruce Ball* reports on current research experience at SIAE

Although a wide range of cultivations have been used to incorporate straw, the best distribution of incorporated straw in the soil and the type, depth and timing of cultivations required to achieve this distribution and to maximise the rate of straw breakdown are still unclear.

Zero cultivation, i.e. direct-drilling, has been shown to be successful after burning straw on many soil types, particularly for winter cereals, both in Scotland and in England. However, direct-drilling is unsuitable in the presence of straw because the products of straw breakdown are toxic to the germinating seed. Broadcasting of seed can help to achieve separation of the germinating seed from the incorporated straw and has already been shown to be successful with reduced tillage treatments or with conveutioual ploughing. Continuous tillage of soils of weak structure can lead to compaction and erosion, particularly with winter crops.

Straw incorporation in Scotland is considered important in preserving soil structure in addition to providing an alternative to burning. However, most straw in Scotland is baled and used for livestock.

Investigation of alternative systems

Against this background, SIAE undertook two projects. One concerned the development of a new type of rotary cultivation machine which, in addition to normal operations, would also incorporate straw. The second prototype version of this machine is currently under performance assessment and the design will be commercially exploited by Falcon Agricultural Machinery Ltd.[1]

The other project, reported here, was to set up an experiment to investigate alternative cultivation and sowing systems for straw incorporation in order to identify cheap, quick methods from a range of ten treatment combinations of incorporation depth, timing and method. These treatments were replicated fourfold. The SIAE prototype soil incorporator was not available at the time. The results of the first two years of this experiement are summarised here. Winter barley was chosen as the test crop since this cereal is widely grown in continuous rotation and requires quick cultivations in the short period available between harvest and sowing.

The soil was a medium clay loam (24% clay), typical of many arable soils, of Winton series in land use capability class 3wc. The average annual rainfall is 866mm. The soil and climate result in marked sensitivity to compaction when sown with a winter barley.

Straw treatment: The straw was chopped by a tractor-mounted chopper in the first season and by a combine-mounted chopper

*Scottish Institute of Agricultural Engineering
Bush Estate, Penicuik, Midlothian EH26 OPH

Incorporation treatments Early	Late	Incorporation and sowing cost (£/ha)	1984/5 grainyield (t/ha)	1985/6 grainyield (t/ha)	1985/6 plants perm'
Plough to 20cm	None	124	8.0	4.1	320
None (stubble only)	Plough	119	7.5	3.3	340
Rotavate	to 20cm	163	8.4	5.1	320
Disc + tine'		151	8.0	4.3	350
None (stubble only)	Shallow	109	6.5	4.2	340
Rotavate	plough to 10 cm	153	8.2	4.7	330
Rotavate²	Rotary dug to 20cm	175	7.5	4.7	280
None (stubble only)	Rotavate	88	7.4	1.7	250
Rotavate	after seed	115	7.9	2.9	300
Disc + tine	broadcast	125	7.2	3.4	350

Treatments were sown by conventional drilling unless otherwise stated.
1. This cultivation was replaced by early ploughing to 20cm in 1985/6, with the seed subsequently broadcast. 2 This cultivation was omitted in 1985/6 and rotary dug at the early stage.

Table I: *Incorporation treatments:* costs, yields *and plant populations*

in the second season. Both machines gave relatively long chop lengths ranging from 5 to 30cm with an average of 15cm. When baling was used, removed the loose straw, but left a stubble of 10-15cm length.

Incorporation treatments: The ten treatments are summarised in Table 1. In Scotland, the relatively late harvest of cereals gives only a short time for incorporation and for straw breakdown to commence before sowing the next winter cereal. This time may be as short as two weeks. Most straw toxins are produced in the first four to six weeks of straw breakdown. Thus, winter cereals are usually sown during a period of active breakdown. The depth of straw incorporation is thus critical—too deep and the soil temperature is so low that breakdown is slow—too shallow and the germinating seed encounters toxins. Thus tillage treatments were chosen to give a range of depths of burial of straw and a range of degree of spread with depth.

The main incorporation treatments were conventional ploughing to 20-25cm depth, disc plus tine cultivation to 20cm depth (Glencoe Soil Saver), rotary digging (Lbladed rotors to 10cm depth, tines to 20cm depth), shallow ploughing to 12cm depth and rotavation to 5cm depth. Three of the treatments involving ploughing were preceded by a shallower, initial incorporation by rotavation to 5cm depth or disc plus tine cultivation. Incorporation generally began 2 days after harvest of the previous winter barley. The second stage of two-stage incorporation was applied 1-2 weeks after the first. Lbladed rotary cultivators were chosen because they further chop the straw and cut the stubble root balls. The conventional plough was modified by the removal of skimmers and fitment of trash boards. This prevented the deposition of the straw in a horizontal layer on the furrow bottom. The straw was distributed more as a diagonal band throughout the furrow, as seen in the profile section, (Fig.1). Ploughing of previously rotavated soil and straw spread the straw throughout the plough layer (Fig. 2) and apparently required less draft than ploughing undisturbed soil.

Secondary tillage was more successful with a rotary cultivator with tines rotating

Fig 1: Ploughing *with trashboards leaves straw distributed* in *diagonal* bands.

on vertical axes since less straw was dug out of the soil than with tines rotating on a horizontal axis.

Sowing treatments: The treatments where most straw was present near the surface were broadcast with a pneumatic boom fertiliser spreader of 12m working width. This spreader ran on perennial tramlines. Where the seedbed was wet and/or loose in the tramlines, compaction and rut depths were minimised by broadcasting seed using a tractor fitted with Terratires (Fig.3). These tyres were not fitted on ihe conventional drill used to sow the other treatments. No nitrogen fertiliser was spread in the autumn.

Plant populationc In 1984/5, the treatments had little effect on plant population. In 1985/6, the broadcast and rotavated treatment contained the least number of plants because of cloddy seedbeds and slug damage. The 1985/6 season was particularly difficult because of wet conditions during incorporation and sowing. In both years, the plants yellowed two weeks after emerging, indicating nitrogen deficiency, though this more or less disappeared after a further four weeks. In the second season, a prolonged wet and frosty winter caused extensive winter kill of the crop in many of the shallow incorporated and broadcast plots.

Crop yield: The relatively heavy yields in 1984/5 (Table I) were difficult to measure because the crop was extensively lodged. The light yields in 1985/6 reflect the wet winter and spring. This is shown by the generally greater yields in 1985/6 where incorporation and cultivation were deep, improving topsoil drainage on this sloping site, than where cultivations were shallow. In both years, surprisingly, treatments where the stubble only was incorporated yielded less than where the straw plus stubble were incorporated. Measurements of soil suction using tensiometers and of carbon dioxide in brass pots buried in the soil indicated that the rotavated straw + stubble + ploughed treatment was better drained and supported greater microbial activity than the stubble only + ploughed treatment. The two most successful treatments were rotavation plus conventional ploughing and rotavation plus shallow ploughing. Both treatments contained uniformly distributed straw within the plough layers.

Incorporation and sowing costs: Estimates of machinery and labour costs for each treatment are included in Table 1. The costs saved by using reduced tillage in the broadcasting treatments may have been worthwhile in 1984/5, but were clearly exceeded by yield losses in 1985/6. In both seasons the extra cost of initial incorporation (~£40/ha) resulted in a worthwhile yield benefit for both types of ploughing, particularly in the difficult season of 1985/6.

Straw **Decay:** Determination of the lignin content of straw samples dug out of the soil at intervals after first incorporation and comparison with the content in fresh straw allows estimation of the rate of decay of straw through a season. The extent of decay just after sowing and in spring for the first season treatments involving normal ploughing are in Table 2. The straw was only slightly decayed at sowing and decayed to a large extent during the winter. The initial incorporation by rotovation increased the rate of decay after sowing near the surface. The lesser extent of decay in the stubble only treatment probably resulted from the greater resistance of stems and stem bases to decay than of leaves and chaff.

Drainage and Aeration: The presence of straw, as mentioned earlier, can improve topsoil drainage. We observed that if ploughing concentrates the straw in strips (Fig.1), aligned with the field slope, the strips can act as mole drains. Thus the spreading of straw evenly throughout the topsoil may not be completely advantageous: Measurements of carbon dioxide and nitrous oxide in Autumn 1984 indicated that aeration was slightly poorer on the ploughed treatments where straw was incorporated. However, the entire ploughed layer was better aerated than the compact undisturbed layer below the rotavated only treatments. Thus, the effect of the comoact. undisturbed layer overrode the effects of straw on drainage and aeration.

Broadcasting: In the second season, broadcasting was introduced as an alternative to drilling after direct ploughing-in of straw. This treatment performed as well as drilling. This agrees with earlier experience that broadcasting is a quick, cheap substitute for drilling. However, its use in conjunction with shallow tillage gave severe yield reductions

Fig 2: Ploughing *after rotavating;* straw spread *throughout plough layer.*

in 1985/6 because of the general failure of the non-ploughing treatments rather than the broadcasting technique.

Conclusions so far

For this medium textured soil, from two seasons results:

- Ploughing is the most reliable and effective method of straw incorporation.
- Rotavation before ploughing speeds-up straw breakdown and gives economically worthwhile yield benefits.

	Depth *(cm)*	Two weeks after sowing *(late september)*	In early Spring *(early March)*
Stubble, ploughed to 20cm	2-6	16	35
	15-20	17	32
Straw and stubble, ploughed to 20cm	2-6	18	36
	15-20	22	35
Straw and stubble, rotavated and ploughed to 20cm	2-6	23	40
	15-20	21	35

Table 2: Percentage straw decay

Fig 3: Tractor fitted with Terratires to minimise compaction and rut depth.

The most reliable method of reducing tillage to incorporate chopped straw is by shallow ploughing, to at least 10-12cm depth with purpose-designed bodies and/or frame.

- Shallow incorporation of straw by rotavation can give yield reductions caused by winter kill associated with poor drainage.
- Broadcasting is a satisfactory substitute for drilling when used in conjunction with incorporation of chopped straw by ploughing.

Note 1. See Pascal, J. MacIntyre, D. and Ball, B (1985). Tillage for straw incorporation in Northern Britain. In: Straw, Soils and Science. (ed. Hardcastle, J.E.Y.) pp 8-10, Agricultural and Food Research Council, London.

Soil Resources of Yorkshire –Potential and Problems

B. Wilkinson, Regional Soil Scientist, ADAS reports on the British Society of Soil Science Conference.

Approaching 100 delegates registered at the Charles Morris Hall, University of Leeds, 8-11 September. Foilowing the address of welcome by Professor J. Elston, two background lectures were presented: Professor G. Jones spoke on "The Geography of the Leeds District" and R. I. Bradley, Soil Survey, on "The Climate and Soils of Yorkshire".

Restoration Warpland and National Park

Delegates subsequently had the choice of various alternative excursions:

"From Coal to Tomatoes" (Leader C. Rudd, ADAS); Visiting the working ash disposal (PFA) site at Skelton Grange Power Station and St. Aidens Opencast Coal Site highlighted the impact on the environment of coal extraction and the disposal of pulverised fuel ash. The soil surveys, field and laboratory assessments and the civil engineering and agricultural detail of land restoration were all considered. PFA on this site had been pumped into a lagoon, settled, dewatered and later given a topsoil cover before restoration for agricultural production.

At Drax Power Station PFA was transported in the dry state and built up into a mound. After receiving soil cover, the plateau was restored to grass and the slopes planted with trees and shrubs. Physical and chemical problems associated with the restoration and utilisation were discussed.

"Soils of the Humber Warpland" (Leader J. Atherton, Hull University and R. I. Bradley, Soil Survey): Visiting the southern part of the Vale of York, namely around the Goole and Thorne-Waste, delegates were able to study the warp soils developed on the large tracts of alluvium deposited by the tides along the Humber and Trent estuaries. The practice of warping was discussed and the two dominant soil series, namely Blacktoft Series (heavy warp) and the Romney Series (light warp) were studied via six exposed soil profiles. Geological, pedological and historical aspects were covered. The agricultural attributes and limitations of these fertile soils were assessed.

"Soils and Land Use in the Malham **Area** of the Yorkshire **Dales"**– **Leader** B. Wilkinson, ADAS). The Yorkshire Dales National Park is best known for its magnificent limestone scenery but problems related to the balanced management of the natural resource arise because of the need to reconcile environmental, conservation, agricultural and recreational interests. The soil scientists visited the Malham Tarn Field Centre situated in an area of outstanding geological, landscape and scientific interest. The Tarn is the focus of an internationally important nature reserve. The soils of the area support an outstanding range of plant and animal habitats ranging from woodland/grassland to complex wetlands. A range of profiles developed on the limestone were exposed and studied.

On an upland farm running up to 400m the application of the 2 pasture system of grassland improvement in relation to livestock farming was studied. Acidity and low nutrient status represent major factors limiting the potential of the soils plus the harsh climatic conditions.

Conservation Grade Farming

Other alternative excursions were a visit to the Sports Turf Research Institute at Bingley and a visit to a farm involved in conservation grade production.

Topical and interesting papers were also presented and the Conference discussed the importance of increasing the voice of the British Society of Soil Science on national issues involving the soil and the environment when policy decisions were involved. The dramatic reduction in public funding for research and advice related to soil science was deplored.

Personalities in Soil Management

Mr. Anthony Forsyth, Moorlands Farm, Kineton, Warwicks

Chairman of Council, Mr. Anthony Forsyth is the very epitome of everything SaWMA stands for. He clearly fulfills the Association's objectives of "promoting the highest standards of care and management of the soil, consistent with proper concern for the environment and to the benefit of agriculture':

Early pioneer of direct drilling

Mr. Forsyth joined SaWMA as a founder member in 1974. He joined because, as he says, he "needed to learn': He had already been practicing direct drilling and a no-ploughing policy since the late 1960's and indeed was a pioneer of these practices in his area. Participation in the Soil and Water Management Association offered an opportunity to keep up to date with them and other new techniques affecting soil management.

Farming on the heavy Warwickshire lias clay–"you don't have to be horn to it–but it helps"–Mr. Forsyth suggests the main requirements for success are to have a lot of patience and a lot of motivation. Both qualities are essential–it's no good just being motivated, you've got to be ready to treat your soil patiently; to handle it with care.

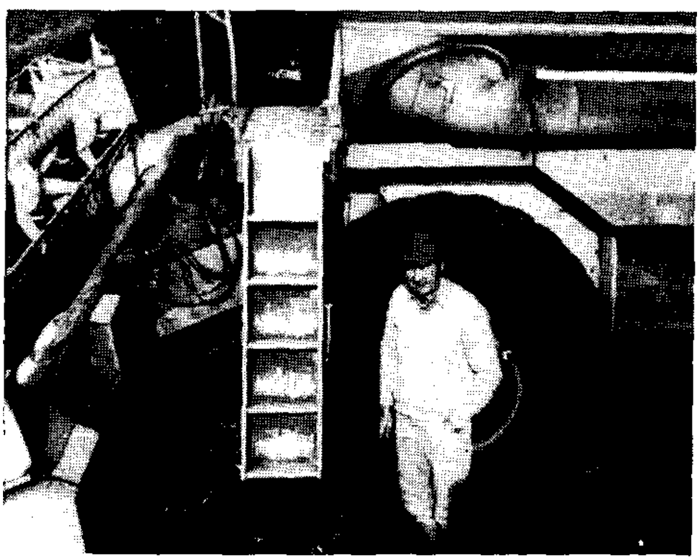
With 5500 acres under their control, the Forsyth enterprise (he farms in partnership now with his younger brother, Mr James Forsyth and his cousin, Mr David Forsyth) has good opportunity to show its skills in land management. Farming, in the family, goes back a hundred years and more but Anthony Forsyth started, like many farmers' sons, in contracting. He was running his own business at age 19 and then, in a couple of years, he took his first farm, as a tenant.

The business grew, both in contracting and in farming, but by the mid-1970's the Forsyths had so well demonstrated their abilities that the contract customers were looking to them more and more to take over full responsibility. The outcome has been a share cropping scheme, with Forsyth Farmwork carrying out all the cultivation, harvesting, other field work and management of crops on about 3700 acres in the surrounding area.

Minimising Compaction

Care of the soil is evident in all aspects of Mr. Forsyth's farming. A comprehensive programme of under drainage was carried out in the mid-seventies and now allows for regular moling every five years on the heaviest ground for proper maintenance and maximum benefit. Soil compaction is kept to a minimum. "This lias clay only compacts by man's work; the ideal is to solve a problem by not creating it".

This line of reasoning took Mr. Forsyth some years ago into another area of innovation. Faced with the problem of not having any means of effectively applying fertilisers and sprays in the damper months without serious risk of soil damage, he turned to helicopters and cut out wheel traffic altogether. Fosse Helicopters Services Ltd. performed well for several seasons–but it was eventually overtaken again by the developing technology in ground machines which now offers a much wider choice of low ground pressure alternatives. And at harvest, the combines which, for many farmers, still prove the most serious cause of random compaction, here are now all fitted with low ground pressure Terratires. As Mr. Forsyth showed me, scraping the soil with his foot, even in the combine wheelings a tilth can readily be achieved with minimum cultivation effort.



The six New Holland ***TF44*** combines ***are all fitted with*** lgp ***Terratires.***

Indeed, apart from the benefits of soil condition, Mr. Forsyth sees minimum cultivation effort as one of his most important objectives. His lias clay is an expensive soil to work so soil working must be kept to a minimum. Farmers generally are now faced with the need to reduce the cost of input to crop establishment.

In this context, we are very pleased to have Mr. Forsyth as one of the farmer speakers at our Tillage Conference now being organised for February, 1987. We may then expect to hear much greater detail about his ideas and their practical application.

Speaking as Chairman of SaWMA Council, Mr. Forsyth said that he welcomed the initiative of the Committee in choosing

Tillage as the theme for the 1987 Conference–and particularly, the emphasis to he placed on all aspects of cost reduction.

Winners of Farming and Wildlife Award

Returning to the "objectives of SaWMA", there is again no doubt that Mr. Forsyth is farming "with proper concern for the environment". An old railway line across the farm has been left as a wild life habitat. "The Victorians did a good job when they devastated the countryside': commented Mr. Forsyth. Elsewhere many trees have been planted; dead elm trees have been replaced ("if one takes something away one should also put something back"); ponds have been dug and copses planted.

There is more than just 'proper concern' however. Mr. Forsyth is an active promoter and supporter of farming and wildlife interests. He chaired the farmers committee set up to raise funds to establish a FWAG adviser and he continues this good work as Chairman of the FWAG Adviser's Steering committee. With his father's encouragement, the Forsyths put in for the Farming and Wildlife award and after coming joint runners-up in 1981 they won outright in 1983.

A further element of SaWMA objectives is the passing on and publication of information of practical value to those concerned with good soil and land management. Mr. Forsyth's participation at the forthcoming Tillage Conference is evidence of how seriously he accepts and fulfills this SaWMA aim. Somehow, too, he even finds time to act as an occasional consultant overseas–but "only if I'm asked': he says. He's not seeking to make a job of it!

Overall, Mr. Forsyth says he has been particularly inspired by his father's maxim that "Necessity is the mother of invention". This must be true–but the father of invention must surely be a readiness to learn; a capacity to reason and an ability to construct. We wish good luck to Mr. Forsyth, Council Chairman of SaWMA, and every success to Forsyth Farmwork in their future activities.

Soil Loss from Tractor Wheelings

Monitoring soil erosion on arable land over the last 20 years Dr Alan Harrison Reed has recorded an increasing problem of rainfall ruu-off from soils compacted by tractor wheelings. Where sloping land is cultivated in the traditional up and down fashion, rainfall run-off becomes concentrated along wheelings and cultivation lines, often resulting in soil erosion which can be serious during prolonged heavy rain. In this article he gives an account of his work to date and indicates the measures needed to overcome this potentially serious erosion problem.

Fig. 1 Comparison of wheelings and tracks, Arable Centre, Royal Show 1983. centre, Terratire. right, Yield Wheel. Copyright A. Harrison Reed

The problems of machine induced soil compaction have received a great deal of attention in the last decade, yet one aspect, namely rainfall run-off from wheelings, has been largely overlooked.

Research on compaction has tended to focus on ways in which 'point' pressure on the soil surface during cultivation can be reduced by using larger 'balloon' tyres, dual wheels, wheels with cages or by using tracked vehicles.

Soil compaction in wheelings reduces water intake and encourages run-off.

However, on over 14W sites where soil erosion has been recorded by the writer, soil compaction from tractor wheelings and down slope cultivation practices were identified as major contributory factors in over 95% of cases.

It is significant to note (Fig.1) that large tyres leave large imprints on the soil surface, particularly when cultivations take place on very moist soil and wheel sinkage produces prominent depressions or ruts. This, coupled with the fact that soil compaction along the wheeling so severely reduces rainfall intake (and irrigation water), that over 80% of incoming rainfall fails to percolate into the soil. Run-off from tramlines is appreciably higher after the second pass, reaching 100% during prolonged heavy rain.

How erosion develops

Rain which falls at a rate greater than the soil's capacity to absorb it (soil infiltration rate), either runs off on sloping land (Fig. 2), or forms ponds where there is no slope. Even on sandy soils on flat sites wheeling compaction results in water standing for days at a time. On sloping sites, however, where wheelings run parallel to slope (up and down cultivations) or diagonally, rainfall run-off water becomes channelled in the wheelings and the high energy flow which results is capable of removing and transporting large tonnages of soil. (Fig. 2)

This problem is particularly serious where fields enlarged by hedgerow removal have short steep slopes backed by a long more gradual slope and cultivation takes place parallel to slope. During heavy rain (> 1mm per hour) turbulent flow commences in the wheelings over the entire field area. Small rills develop which are confined within the wheeling. If heavy rain persists, rill development removes all the surface soil (Ap or plough horizon) and incipient gully development takes place (channels cutting into the 'B' horizon) (Fig. 3). If at this stage the rainfall does not abate or it actually increases in intensity (> 2.5mm per hr.) the wheeling can become a gully which will rapidly develop headward up the slope and widen by side wall collapse.

It is important to realise at this stage

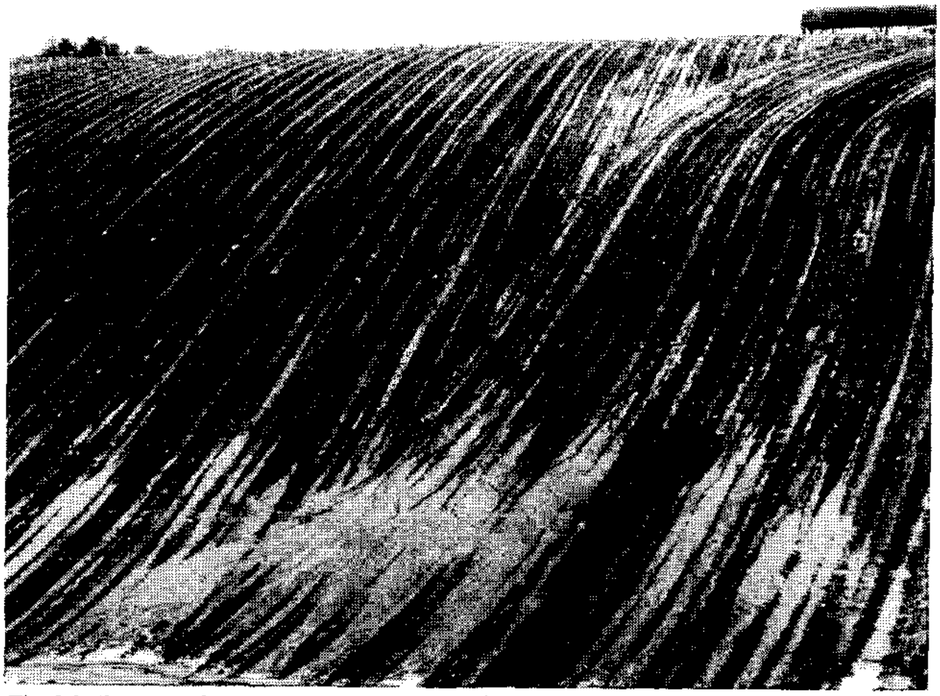


Fig. 2 Soil erosion from tractor wheelings, confined rill erosion *Copyright A. Harrison Reed*

that not only are the soils on the slope being severely depleted and lowered but also large quantities of subsoil material will be spread over more fertile soils at the bottom of the slope (Fig.3). Today there are an increasing number of occasions where the eroded soil is being transported off the farm onto highways and into water courses and onto private land.

Critical loss of soil moisture

Another important factor central to the compaction problem concerns the loss of soil moisture through rainfall run-off.

Field conditions are often described as being wet (i.e. the soils are at field capacity) when in actual fact the wetness is confined only to the plough layers. Because of wheeling compaction and plough pan development very little incoming rainfall passes through this dense zone of soil.

A consequence of this phenomenon is that subsoils fail to be recharged during wet periods and perched water tables develop on flat sites, reducing the time available for timely cultivations. Conversely these compacted soils can dry out rapidly during short dry spells.

Shallow soils on slopes are very much at risk from a combination of subsoil compaction and enhanced rainfall run-off. Over a period of time these soils become thinner and textural changes can result. For example, coarse loamy soils can become coarser as the loamy parts are washed away.

Experiments to measure soil loss

Data from initial plot experiments to measure soil loss have supported years of field observations in the West Midlands by the writer (1964-1986). 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 (compacted by raindrop impact and splash until capped or crusted) are characterised by a marked reduction in water intake during heavy rain (9 1mm per hr.) with a consequent increase in run-off after a period of exposure.

Plot management involves one cultivation with a 5hp rotovator followed later by treatment with Roundup to control weeds. Monitoring run-off collected from an array of plots which straddle a moderate to strongly sloping field (8-15 degrees) reveals that average soil losses range from 15-17 t/ha/yr rising to over 40t/ha/yr during adverse seasons such as 1976 and 1983.

Fig. 3 Soil erosion from *tractor wheelings:* severe rill erosion in background, gully erosion in foreground.

Copyright *A. Harrison* Reed

Soil loss tolerances greatly exceeded

It is important to stress that these high tonnages result from soil surfaces which have little or no induced compaction from heavy machinery and yet they exceed by a wide margin the accepted 'T' values (or soil loss tolerance) for British soils.

Soil loss tolerances have been worked out for soils in the USA and a figure of 2t/ha/yr is a soil loss tolerance figure which can be applied to soils in lowland Britain. Tolerance is defined as the maximum rate of annual soil erosion that may occur and still permit a high level of crop productivity to be obtained economically and indefinitely.

Initial measurements of plots which have one set of wheelings traversing them parallel to slope reveal that large amounts of sediment can be transported equivalent to 1kg of sediment per metre length of wheeling (tractor weight 4½ tonnes) during rainfall falling at rates less than 1mm per hr. Primary wheelings (made from one pass only) show early development of incipient rills which produce a large amount of run-off and a heavy sediment yield.

Further experiments are planned in the autumn to measure run-off from simulated tramlines.

Remedial measures

There are a number of general management techniques which reduce the risk of erosion from cultivations and wheelings. More specific recommendations may be required for individual field layouts where rainfall run-off erosion is a problem.

1. Cultivation direction

- Wherever possible all cultivations should be **across** the slope is. parallel to the contour.

- Soil should be turned **upslope** using a reversible plough. Ploughing downslope should be avoided.
- Where long gentle slopes have been joined to short steep slopes (usually by hedgerow removal) avoid cultivating or wheeling in a general downslope direction. This will reduce the risk of rainfall run-off collecting over a large area of wheelings.
- Avoid excessive wheeling in ground preparation prior to seeding (see fig. 1). At this stage a chance storm would cause a great deal of soil damage.

2. Cultivation practice

- Wherever possible minimal cultivations should be practised, particularly on soils with weak structures (sands and silts).
- Avoid forcing tilths with rotary cultivators and keep soil surface as rough as preparations for seed beds permit.
- Dense subsoil pans should be broken up to facilitate ingress of rainwater and reduce risk of increased surface run-off. Consideration should be given to utilizing ploughs which carry an offset subsoiler at the rear of the mouldboard which breaks up the smeared and compacted soil layer. The suhsoiler is usually set 3-4″ (approx. 7.5cm–10cm) below the share.
- Where field operations necessitate a great deal of trafficking during winter months (for example, field vegetable crops) subsoiling operations should be carried out more frequently to repair damage.
- Rainfall run-off from wheelings on slopes can be minimized by mounting a tine behind the rear wheels of a tractor or trailer to break up surface compaction. The tine must he set deep enough to penetrate and break up the wheel compacted zone. Where tramilines are used and rainfall run-off is a problem, tines should be used after each pass.
- Where soils and land forms permit, direct drilling should be used as this practice reduces the risk of soil erosion:
- Soil susceptible to splash erosion; notably sands and silts, should not be exposed by cultivations for longer periods than necessary and crop residues should be used where possible to dissipate raindrop impact and splash.

Cultivation methods limited by tractor design

There is now abundant evidence in Lowland Britain and Western Europe to assess the damage which is being done to soils in continuous arable use by the related problems of low organic matter levels soil compaction from heavy farm vehicles and enhanced rainfall run-off from wheelings and compacted soils.

Although many of the techniques referred to above can help in reducingsoil erosion risk, managers with land holdings in sloping or rolling terrain (which represent by far the largest group in Britain), are restricted in their choice of slope cultivation methods by limitations in the design of modern tractors.

When due allowance is given to all the developments in tractor design in the post-war period, modern machines–despite all their sophistication–are still difficult to drive accurately and safely across slopes. (As slope angle increases accuracy and stability decreases). Modern **equipment** is designed to travel up and downslope.

Self levelling chassis for tractors

There is therefore the need for a radical reappraisal of tractor design particularly concentrating on two important components. These are: a self levelling chassis and drive wheels which are capable of cultivating as well as transporting, and which can be used on a public highway. Without this latter facility such equipment is not a practical solution for many farms with dispersed land holdings.

A self levelling facility, would enable contour cultivation of sloping terrain and this in conjunction with other suitable conservation practices would result in a significant reduction in rainfall run off and hence in soil erosion.

From a soil conservation point of view, the yield wheel (by CAB CRAFT)., has much in its favour, as it leaves a broken soil surface rather than a rut thus enhancing the infiltration of rain and reducing the risk of channel formation by run off water. However, its major weakness limiting its usefulness on the farm stems from the inability to use the wheel on public highways as the cultivating/traction blades cannot be retracted.

Much further research needed

A great deal of further research into these problems is necessary. At the moment, the farming community is not receiving enough practical advice on the one hand to improve land management practices which reduce erosion risk, and on the other, the limitations in the design of modern tractors referred to above, still ensure that up and down hill cultivation practices will remain the only practical solution on all moderate to strongly sloping arable land.

Fig. 4 Soil erosion from tractor *wheelings:* gully erosion producing large *spreads of gravel* down slope.

Copyright
A. Harrison Reed

Research and Development – EEC Funds mav be available

Companies in the United Kingdom, in general, spend significantly less on research and development than their overseas competitors.

Obviously, it would help to change this situation if money were available to augment companies funds. The problem, however, is to locate such money and to find out on what terms it is available.

EEC Concern

For some time now, the Commission of the European Economic Community has been concerned that Europe may be left behind in matters of research and development, and to try to avoid this, a number of European schemes have been launched. Statements were made originally that sums of up to £150m were available, but now no specific sums are mentioned as the budget alters from year to year.

The main pressure for European collaboration has been the mounting cost of individual projects, often far greater than any one country can afford. Also faced with aggressive competition from groups of companies elsewhere that are able to afford to develop rival products it is now, in many industries, a case of collaboration or die.

Scope for agriculture

Collaboration involves both Governments and industries, and in many cases, academic expertise as well. Military weapons systems and civilian programmes figure in the growing list of joint projects, some of the better known of which are "Concorde", "Jaguar': "Tornado': "Airbus" and "Ariane". Whilst we have learned many lessons in tryipg to organise collaboration in Europe, it is evident that we have some way to go before we become adept in this area.

Some of the schemes are unlikely to apply to agriculture, but in the field of Non Nuclear Energy projects already underway concern conversion of crops to fuel, solar energy generation, generation of wind energy and the production and management of geothermal reservoirs.

The EUREKA project

However. the scheme that seems to offer the most scope to UK agricultural manufacturers is EUREKA – a framework for promoting collaborative projects in advanced technology. This scheme was set up by agreement between 18 European countries and the Eurooean Commission on 6th November, 1985, and the aim is to improve European competitiveness in world markets in civil applications of new technologies, by encouraging industrial and technical collaboration within Europe.

Through EUREKA, governments and the European Commission can assist the development and commercial success of collaborative projects in a number of ways:

- by providing for a process of information exchange on potential areas for collaboration between firms and organisations in different countries.
- by promoting a more open, integrated European market; seeking to remove barriers to market penetration such as incompatible standards in different EUREKA countries, or public purchasing restrictions.

Under the Department of Trade and Industry's Support for Innovation (SFI), UK firms participating in EUREKA are eligible for support of up to 50 per cent of their share of applied research costs, and up to 25 per cent of their share of development costs. Only one UK firm need be involved in a project to qualify for assistance at the higher level. In other respects, the terms of assistance in each case will be determined under the normal SFI criteria.

However, EUREKA is not primarily a programme for funding R & D, and EUREKA status of itself does not guarantee financial assistance. It is expected that EUREKA projects, having a commercial purpose, should still rely mainly on finance from the capital markets or commercial sources.

How to apply

In order to define a EUREKA project, to achieve EUREKA status and to be eligible for the benefits listed above, projects should have certain attributes:

- co-operation between participants in more than one EUREKA country.
- an identified benefit from pursuing the project on a co-operative b sis
- the use of advanced technologies
- the aim of securing a significant technological advance
- appropriately qualified participants, technically and managerially.
- adequate financial commitment by the participants
- development work carried out in EUREKA countries and its results exploited to the benefit of EUREKA countries.

EUREKA projects are circulated to EUREKA members and in addition to information on specific projects and project proposals, details are also circulated of expressions of interest from firms who wish to collaborate in a particular field.

In some cases the hest approach may be for a number of firms interested in the same field to set up a forum to discuss a particular sector or market area with a view to identifying areas for collaboration.

Any organisation that has a proposal for a EUREKA project, should approach their usual contact in the Department of Trade and Industry. It must be emphasised that no work on any project should be started before approval is given, and the target time for approval is 45 days from receipt by the D.T.I.

Current projects and proposals

By the end of 1985, 26 EUREKA projects had been announced, of which France was involved in 22, and the UK nine. A further 62 were announced on 30th June, 1986 at the Ministerial Conference held in London. 39 proposals and projects are currently under discussion.

- Use of high powered lasers for the detection and destruction of impurities in finished products and in waste products

  Timescale : 5 years
  Participants : Belgium, France, Netherlands, &interest expressed by Germany, Italy & Switzerland

- Development of a range of expert systems, software and ancillary hardware for use in crop management on farms.

  Three years: Netherlands and UK

- Developing a systematic approach to further reduce pollution levels with the River Rhine Basin as a model example

  Four years: Belgium, Netherlands and interest expressed by UK

- Development of inoculant bacteria to be used in improving plant growth and yields and in the biological control of pathogenic organisms, "in-vitro" culture, and encapsulation and coating techniques (for normal and artificial seeds).

  Not yet determined: Belgium, Italy and Spain

- Development of sensors for measuring gases of meteorological importance – notably oxides of nitrogen and ozone.

  12-18 months: Finland, UK and interest expressed by Spain

Some examples of EUREKA *projects and proposals.*

Silsoe Soil Management Course

Students find practical applications and benefits

report by Geoff Baldwin

Mr. Mark Tatam and Mr. Miek Williamson are typical of today's progressive younger farmers. In farming all their lives, they are alert to the nature of their own land but they know there is always something more to be learnt and always more than one way of looking at things.

So it is not surprising that Mr. Tatam and Mr. Williamson are now among about 150 "students" who have attended the Soil Management Course at Silsoe College.

Disciplined thinking leads to good decisions

Speaking with some of these students I have asked them what prompted them to go on the Soil Management Course. The students come from a variety of backgrounds but, as I expected, the general view is that they were looking not for some radical new idea which they had never earlier thought of—but rather, in attending the course, that they would develop a greater understanding of the different situations presented in the soil and a greater awareness and anticipation of the likely effect of alternative management.

Farming a variable soil with mixed arable crops

Mr. Tatam and Mr. Williamson attended the same course and, although their farming circumstances are in many ways quite different, they have both found benefits which they are sure will help them in their future farming.

Mr. Tatam, after a period farming Hall Farm, Gainsborough in partnership with his father, took over full control three years ago when his father died. The 280 acre farm on the "cliff' at the edge of the North Lincolnshire Heights, presents two contrasting soil types—bottom land of varying clay loam overlying heavy boulder clay whilst, on the top land there is a fairly shallow limestone soil overlying free-draining limestone. The bottom land has benefitted from underdrainage, particularly with using backfill, and this can now be maintained by regular moling. It has made a big improvement to its workability.

Having the clay soil on this bottom land and with quite a lot of variation in texture, Mr. Tatam felt that the Silsoe Course lectures and laboratory work on the composition and behaviour of clays had been particularly interesting and helpful.

On the practical side, Mr. Tatam said that he had already been seeking to follow the Silsoe ideas on tyres and compaction. Such arguments are already well publicised. Even so, there are many aspects in a state of flux, for example, in the range of tyres and wheels offered or approved by manufacturers.

Ideas for the future

One effect of the course for Mr. Tatam is that it has made him more aware of the upper levels of the soil. More attention needs to be paid now to getting the right structure here. Light traffic, perhaps on duals, may be beneficial—the compaction effect could be similar to that after flat rolling. Mr. Tatam is exploring the effect on his land of furrow pressing behind the plough. Trials in 1985 gave good seed bed conditions but perhaps too fine for Autumn sowing in some seasons.

With a fifth of his acreage in sugar beet, Mr. Tatum is also looking closely at tram line cultivation techniques for this crop. Tyres and row widths for drilling still need to be sorted out and also the ensuing effect on harvesting.

BOOK NOW

the next

Soil **Management Course**

5th-8th January 1987

Silsoe College, Beds MK45 4DT

Two thousand acres of heavy clay

Over in Leicestershire I found Mr. Williamson equally progressive though working with quite contrasting farm and soil conditions.

At Muston Gorse Farm, Redmile, Leics, Mr. Williamson manages 2,000 acres for Lord John Manners. Like Mr. Tatum he has succeeded his father who is now semi-retired. The land of Muston Gorse Farm lies in the Vale of Belvoir and is principally heavy lias clay, but with complications for soil management by being in some widely dispersed parcels and with considerable variations in quality of underdrainage. Cropping is mainly cereals and rape.

Mr. Mark *Tatam:* M; Mick *Williamson*

Discussing his soil management approach Mr. Williamson told me he was "very much a convert to Silsoe ideas before he went on the course"—but, like others, he went because he wanted to broaden his knowledge.

LGP Trailers

An obvious indication of Mr. Williamson's "conversion" is the way he has constructed special low ground pressure trailers for grain collection from the combine. The conventional grain trailer had been identified as a major cause of soil compaction on the wet clay soil. Now, two special trailers with Terratires pulled by tractors on Trelleborg LP's can follow the combine to unload on the move with little risk of soil compaction damage and minimum combine down-time.

These Terratires, in fact, get virtually round year usage for, after harvest, they are fitted to other power units for cultivating, drilling and spraying. Mr. Williamson would like to fit LGP tyres on his combines ➡

The special grain trailer on *LGP Terratires* constructed *by Mr. Williamson* at *Muston* Gorse Farm.

Improved performance from floating mole ploughs

Dick Godwin outlines the special features of the new Silsoe College design

The current designs of scrubbing long beam mole ploughs suffer **from** several problems. **These** problems are:

- high horse power tractors required to pull them.
- localised channel backfall produced when negotiating surface undulations
- tendency to block when moling in trashy conditions
- inability to produce an inclined mole channel when the soil surface is horizontal.

Recent work at Silsoe College aimed at overcoming these problems has resulted in a unique design where the mole plough beam floats completely clear of the soil surface and is indirectly connected to the tractor through a smoothing device, **Fig.1.**

Floating beam—saves power, frees trash

As a result of allowing the beam to float the draught force can be up to 40% less than the conventional scrubbing plough. Beam flotation also allows free trash flow around the leg and permits a more manageable field operation when attempting to mole prior to straw incorporation or disposal.

Hitching the mole plough beam midway along the smoothing device, rather than directly to the tractor drawbar reduces the vertical movement of the hitch point by a factor of 3. This in conjunction with the stabilizing effect of the mole plough foot significantly reduces any channel grade variation when negotiating undulations in the field surface, see Fig. **2.** This is of major benefit when moling across the path of recently installed field drains, zones of extensive rutting and local depressions.

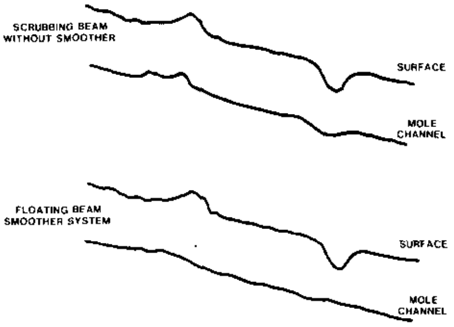


***Fig. 2** Effect of Floating Beam Smoother on reduction in channel grade variation (exaggerated vertical scale)*

The combined action of the floating beam and reduced hitch point variation.

- significantly improves the control over mole plough working depth when operating in soils with variable strength.
- prevents the backrrades in the channel produced by a scrubbing beam plough when moling directly from open ditches, as a result of the raised soil level on the bank edge.
- produces much less soil disturbance when drawing the mole plough out of work.

Simple grading from tractor seat.

Hydraulic control of the hitch position on the smoother allows adjustments to be made to the working depth from the tractor cab, the purpose of which is to produce rises or falls in the mole channel in flat fields. This is achieved by lowering and raising the hitchpoint as one drives to and from the field drain respectively, see Fig. **3.**

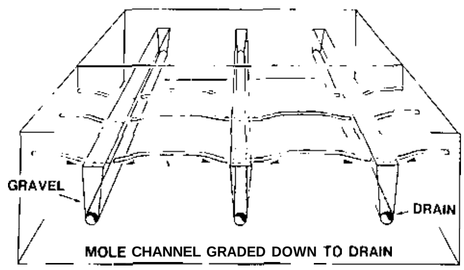


***Fig. 3** Rises andfalls in mole channel grade for flat fields.*

This design of mole plough, currently offered by J. Mastenbroek & Co., can operate over a depth range of 0.35m to 0.75m with a wide range of field conditions.

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too (a three inch deep rut is clear indication of their heavy loading) but, at present, he is having to make-do with the manufacturer's largest approved option.

Mr. Williamson referred to a particular message of this year's Silsoe Course—to "think twice before subsoiling". Following up this advice he had come to the conclusion that subsoiling to 16" every year was unnecessary. As a result, this Spring, a 6m. 11 tine "flat-lift" type cultivation has been constructed in the farm workshop. This implement is designed to achieve soil loosening to a depth of 8" to 10"; the likely extent of any compaction now that low ground pressure tyres are extensively used throughout the season.

Mr. Williamson commented that, compared with working to 16", considerable savings in terms of fuel and, more importantly, time, are made at this shallower depth. Now the intended practice is to subsoil to 16" every 3 or 4 years with soil loosening to a maximum depth of 10" in the intermediate years.

To be well informed

Like Mr. Tatam, Mr. Williamson is also a man of ideas. From my conversations with them it is easy to see why they, and the others went on the Siisoe Management Course. They have ideas—they want to do things—so they are making sure they are as well informed as possible.

A Standard Soil

Dr. Steven Nortcliff* invites your views

The standards established by the British Standards Institution provide a benchmark of the quality or safety of a particular product. There are few items in common use where it is not possible to refer to an appropriate British Standard, be it the desk lighting you read with or the brakes that stop your car. You know that compliance with that standard means that certain criteria have been adhered to, for example, with regard to safety or size.

In contrast, when we are dealing with soil, there is a wide range of expectations as to what constitutes the soil, how it should be defined. and what mieht be involved in defining a standard soil. These expectations vary with the needs and aims of the potential user.

The civil engineer often takes a broad scale view considering soil as the unconsolidated layers at the earth's surface which may be metres thick. His concern is with such qualities of soil as load bearing. In contrast the horticulturalist may often focus his attention on the first few centimetres of the soil, the topsoil, and in particular the requirements for the provision of good crop growing medium.

To date, within the British Standards Institution there are standards which have been established and are appropriate to these two situations.

BS 1377. Methods of test for soils for civil engineering as necessary.
BS 3882 Recommendations and Classification for top soil (currently under revision by BSI)

In addition to these two standards there are a number of others which include sections on soil standardization either in the form of definitions or in the form of analytical procedures. Among these are the following:

BS 3969 Recommendations for turf for general landscape purposes.
BS 3975 Glossary for landscape work
BS 4156 Specification for peat
BS 3998 Recommendations for tree work
BS 4428 Recommendations for general landscape operations (excluding hard surfaces)
BS 5837 Code of practice for trees in relation to construction.
BS 5930 Code of practice for site investigations (formerly CP2001)
BS 6031 Code of practice for earthworks

A Standard for soil quality

Those few standards provide a wealth and diversity of information illustrating the multi-purpose nature of soil and soil use. They highlight the complexity of the task facing the recently established BSI Technical Committee on Soil Quality (EPC/48). This technical committee was established following initiatives from the International Organization (ISO) to formulate international standards on Soil Quality.

With the growing national, European Communitywide, and international concern for environmental protection it is important that there be national and international standards on environmental quality. National and international committees have already been working for some time in the areas of air and water quality and in the United Kingdom EPC/47, Land Quality, is developing a code of practice for the identification of contaminated land, for which there is likely to be a draft published in the near future.

Soil quality deliberations still only at very early stage.

To date the technical committee on soil quality (EPC/48) has met twice. (before and after the first meeting of the ISO technical committee held in Holland in June, 1986). At the second meeting of the EPC/48, a provisional structure was established for a series of technical sub-committees. The five broad areas of interest for these five sub-committees are:

- Evaluation of criteria, terminology and codification.
- Sampling
- Chemical methods and soil characteristics
- Biological methods
- Physical methods

Scope for representation and involvement

Membership of these sub-committees and the main technical sub-committee is by wav of nominations from interested organizations, with a maximum of one nomination per committee and sub-committee from each organization. The deliberations on these topics are at a very early stage, but it is clear that the subject matter will be of interest to many members of SaWMA. At present SaWMA has no direct involvement with either the Technical Committee or the Sub-committees.

Comments welcome

The writer's involvement arises from a nomination by the British Society of Soil Science (to both the Committee on Soil Quality and the committee responsible for revising the standard on top-soil BS3882). We shall he pleased to receive comments on both the general field of soil quality and also the more specific revision of the standard on top soil. Comments should be sent to:
Dr. S. Nortcliff, Department of Soil Science, University of Reading, Reading RG1 5AQ

Anyone seeking further information on the wide range of topics covered by British Standards can obtain details from most large public libraries, or from: Enquiries Section BSI Milton Keynes MK14 6EL Tel: (0908) 320066

*Department of Soil Science, University of Reading and Chairman of the ISO Technical Committee on Soil Quality.

BOOKS

Drip/Trickle Irrigation in Action

Proceedings of the Third International Drip/Trickle Congress, Fresno, California, November 1985.

Elsevier, Amsterdam, 1986. 931 pages in 2 volumes D Fl 230.00

Many conference proceedings treat the reader to a wide range of papers. Some are very practical, others are highly theoretical; some are useful and have immediate application whilst others have little immediate relevance. The proceedings of the Third Drip/Trickle congress at Fresno was no exception with 160 papers presented by delegates from across the world on a wide range of issues surrounding the use of this relatively new and quite specialised method of water application. It should he pointed out that most people do not see any difference between drip and trickle irrigation, and so the Americans compromise by calling it 'Drip/Trickle'.

Within the two volumes there are papers to interest everyone: from the grower to the manufacturer and distributor and the research worker and teacher. Volume 1 examines the experiences of using trickle irrigation not only in the USA (from where many of the papers originate) hut also in many other parts of the world. Topics include the responses of crops to trickle irrigation, field system evaluation, water treatment and the application of fertilizers in the irrigation water.

For the really serious trickle user the reference material provided in these two volumes is a must on the book shelf. However, for many of us an occasional dip into them in a technical library I am sure will suffice.

M. G. KAY

Note: In US/Canada also available from Elsevier Science Publishing Co Inc. P.O. Box 1663, Grand Central Station, New Yorks, NY 10163.

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Land Drainage

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JANUARY **1987**

5-8* Soil Management Short Course, Silsoe College

5-8 Field Management for Effective **Drainage** – **Short** Course, Silsoe College

FEBRUARY **1987**

3 **Investing** in Woodland – Conference – NAC, Kenilworth, Warwicks

5* **Tillage – What** now and what **next?** – SaWMA, ADAS, ICI Plant Protection – One day Conference – Rothamsted Experimental Station, Harpenden, Herts.

MARCH **1987**

3 Organic **Farming – putting** it into practice – Conference – NAC, Kenilworth

10-11 **Farm** Woodland Workshop – NAC, Kenilworth.

APRIL/MAY 1987

date to be* announced SaWMA Field Meeting – Gantry Systems – Mr. David Dowler's Stamford Hall Farm, Warwicks

date to be* announced **SaWMA** Field **Meeting** - Restoration of derelict land – Thamesgro Land Management Ltd. Berkshire

*denotes event at which SaWMA is participating

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Thursday 5th February 1987 – Rothamsted Experimental Station

TILLAGE – WHAT NOW AND WHAT NEXT?

Chairman: The Earl of Selborne

Programme:

10.30am	Registration and coffee	
11.00	Introduction by the Chairman	
11.10	Session 1	The past 20 years – Ideas and developments, successes and failures Speaker: Dr. Bryan Davies, ADAS
11.40		Individual experience – ideas in practice Speakers: Mr. Richard Dawson – farmer, Essex Mr. Anthony Forsyth – farmer, Warwicks Mr. Peter Thorogood – farmer, Bucks
12.45		Discussion
1.00pm		Lunch
2.15	Session 2	Ideas for the future – What now? – the needs for current research Speaker: Mr. John Hawkins – Consultant Agricultural Engineer
2.40		The economics of tillage – the scope for cost savings Speaker: Professor John Nix, Wye College
3.05		Potential for the future – ideas and developments around the world Speaker: Mr. John Matthews, Director, AFRC Engineering
3.35	Session 3	Discussion
3.55	Summing up by the Chairman	
4.05	Tea and disperse	

Conference fee: inclusive of coffee, lunch and tea –
SAWMA members: £12.00 plus VAT Guests and non-members: £13.50 plus VAT.

For further details and registration forms write to:
Geoff Baldwin, 22 Edgerton Grove Road, Huddersfield, West Yorkshire HD1 5QX