The Agricultural Engineer

Incorporating Soil and water

Volume 49 Number 3 Autumn 1994

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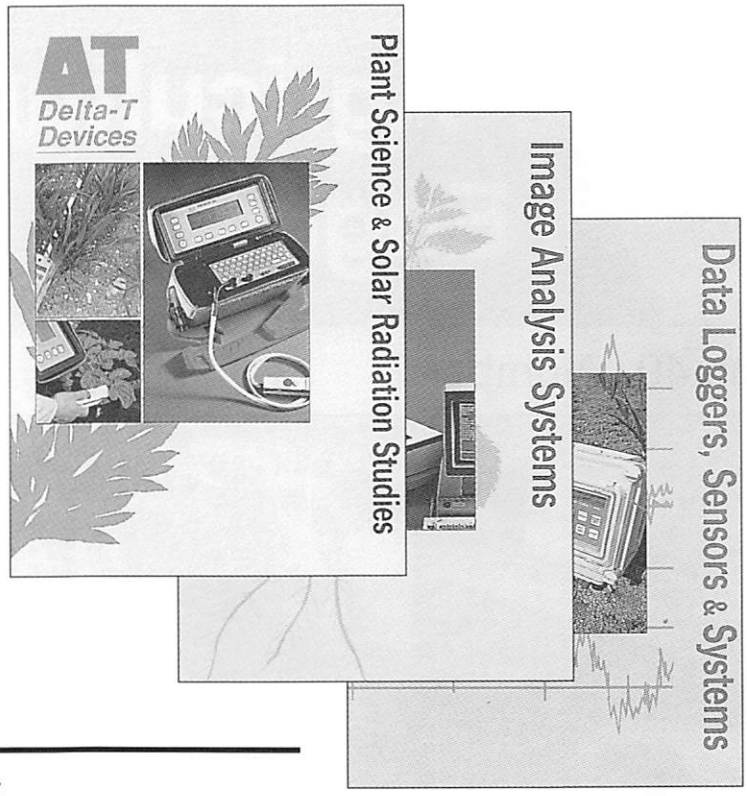

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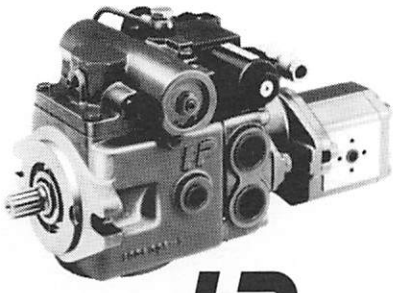

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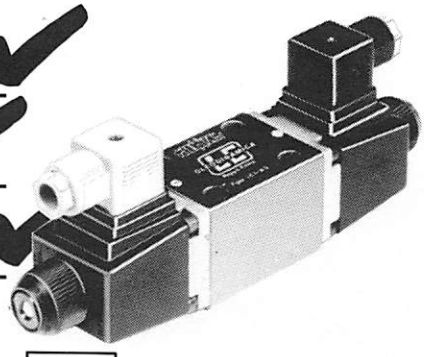

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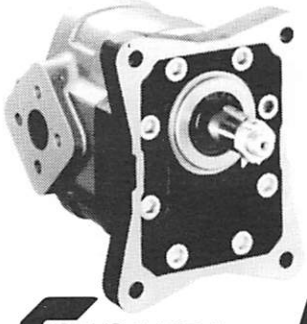

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The Agricultural Engineer

Incorporating Soil and water

Journal and Proceedings

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Front cover: Topics, events, people – the 1994 Annual Convention in pictures. See pages 70-78 for reports.

Regular Features

CONTENTS

COMMENT

And it's goodbye to him ... **Geoff Baldwin's** association with the production of *'The Agricultural Engineer'* began with the Spring 1989 issue when he took on the post of Advertisement Manager. By the following issue, he was promoted to the dizzy height of Production Editor (including Advertising!).

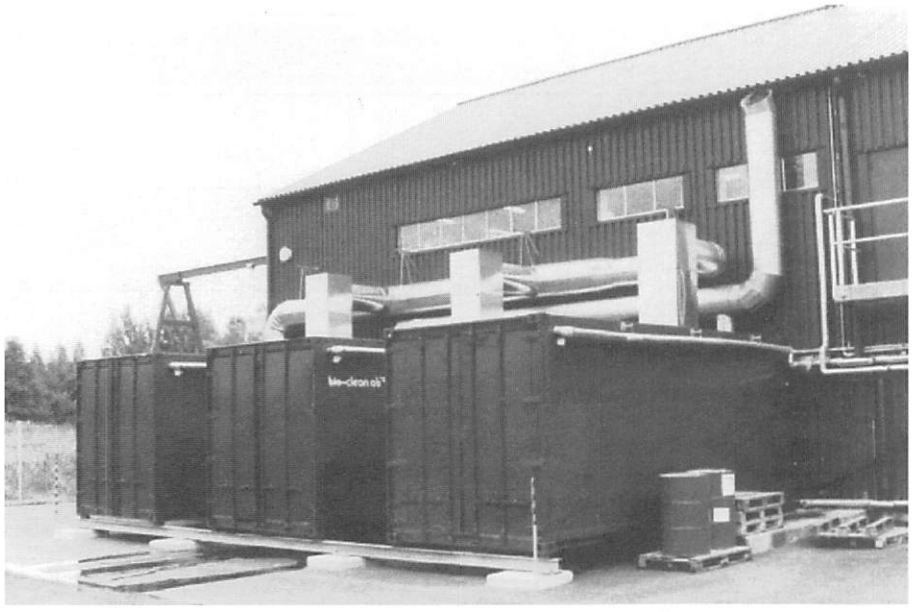
The most striking visual difference which accompanied Geoff's start with *'The Agricultural Engineer'* was the use of colour on the front page. This was, however, only a minor aspect of the improvements he effected on the journal. His innovative skill and expertise, accrued while editing the SAWMA Journal, enhanced readability by adjusting text layout and character size resulting in a user-friendly publication. Now Geoff has decided to hang up his keyboard and opt for a more leisurely lifestyle. Personally, it has been my good fortune to have had Geoff on the production side of the Journal. 'Production Editor' in Geoff's case included secretary, prompt, part-time editor, cajoler, adviser, caterer – the list goes on. His tolerance and unflappability were much appreciated attributes. We wish Geoff and Dorothy a long and happy extra retirement.

... and it's hello to him ... **Eoin Martyn,** as from the next issue, will be combining the duties of Editor and Production Editor. Eoin hails from Inverness but was removed to the deep south at an early age – both his and Scotland's loss, surely? His editorial talents were honed during his stint with *'Farm Buildings and Engineering'*, the joint journal of the FRBC and FBA. The success of any publication depends largely on securing novel and regular copy. It is in the interests of all members of the Institution that Eoin's task is helped by each of us providing him with suggestions, articles and possible authors to promote a healthy and informative journal. Good luck to Eoin in his new role.

Allan Langley
(Hon. Editor)

ISSN 0308-5732

Cleaner air from Sweden



A modular biofilter installation at the Kabi Pharmacia plant in Sweden.

Worcestershire-based Managed Pollution Systems has become the sole UK agent for Bio-clean, the Swedish manufacturer of biological air filters - or bio-filters. Biofilters are used for the purification of emission gases containing volatile organic compounds and for the elimination of odours from slaughterhouses, food processing, waste handling and water purification plant.

In a bio-filter, the polluted gas flows through a bed of common micro-organisms, which digest gaseous organic pollutants and leave carbon dioxide and water as end-products.

Stockholm-based Bio-clean ab has several installations in operation in situations such as a car spray-paint plant and a pharmaceutical company.

The bio-filters are designed as standard 6m long modular container units which can be combined as necessary to satisfy a range of air flow rates and emission gas concentrations.

Managed Pollution Systems Ltd, Sherwood Road, Aston Fields Ind Est, Bromsgrove, Worcs B60 3DR (Tel: 0527 570540; Fax: 0527 570534).

ROPS Testing – expansion at TEL

Manufacturers of agricultural and forestry tractors are now able to benefit from a new testing service for cabs provided by Taywood Engineering Ltd. (TEL), the design and technology arm of Taylor Woodrow Group. The service is a logical extension of TEL's existing expertise to test protection structures for earth moving-machinery in the construction industry.

The company has been awarded agency status by the VCA (Vehicle Certification Agency) for the Department of Transport for the roll over testing of tractor cabs. This allows it to conduct ROPS testing as required by current EC directives leading to the issue of type approval certification by VCA.

The test programme is tailored according to the mass and type of tractor and whether the protection structure is front or rear mounted. TEL can also provide specialist testing for other standards, such as ISO (International Standards Organisation) or SAE (Society of Automotive Engineers).

British All Terrain Vehicle Association (BATVA) formed

The five major importers of All Terrain Vehicles (ATVs), after working together informally for five years have formed the British All Terrain Vehicle Association (BATVA). The association will offer an industry voice to Government departments and training authorities.

Queries on ATVs should be directed to: Mr Ron Saunders, AEA, Tel No: 0733 371381.

Patent pursuit made easy

A juke box is not the sort of thing you'd expect to find in the British Library but its principle is the basis of a new service offered by that organisation. Known as Patent Express, the system enables very rapid access to over a million patents (with more coming on line all the time) by storing the information on over 100 CD ROMs. Account clients simply request the specific patent/s and a copy is on their desk within 48 hours.

Plans are also afoot to permit clients to access the information directly and receive it on their screens within minutes. Copies of patents are available from as little as £5.

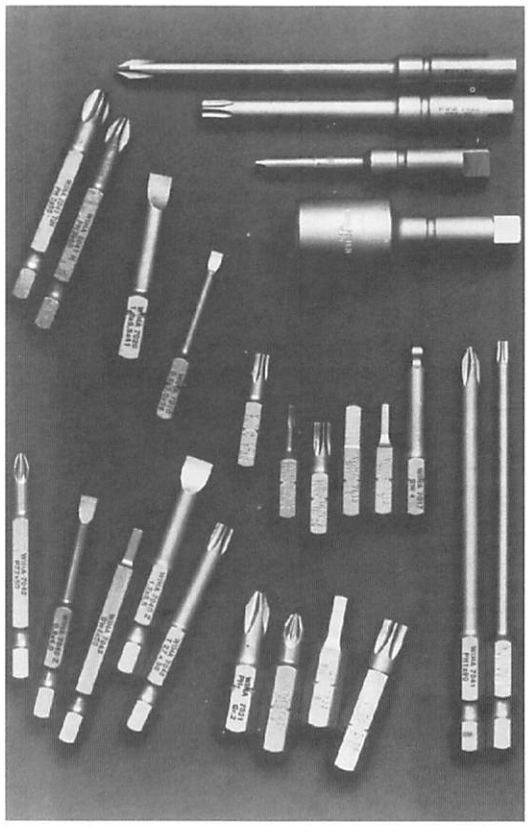
Patent Express is just a small part of the British Library's Science Reference and Information Service. Just about every patent ever filed is stored, whatever the country of origin – 33 million and still counting.

If a search for similar patents to your innovation is the requirement, then Patents Online is the service available; if an English language translation of a foreign patent is required then Transcript is the definitive service; and if you want to keep up to date with the latest technical developments, Currentscan will forward regular copies. All this at very reasonable prices. Start with Patent Enquiry Desk on 071 323 7919.

Screwdrivers

As part of a sustained development programme, Wiha, Germany's leading manufacturer of professional quality screwdrivers, has now focused on the volume production of screwdriver bits.

"Having recently moved into new premises with much larger warehousing facilities, Wiha Tools Ltd will be well placed to support the increasing demand for Wiha screwdriver bits – and large volume orders in particular," commented Tom Doneghan, Managing Director, Wiha Tools Ltd, 12A Harris Industrial Park, Stoke Prior, Bromsgrove, Worcs B60 4AD (Tel: 0527 575758).



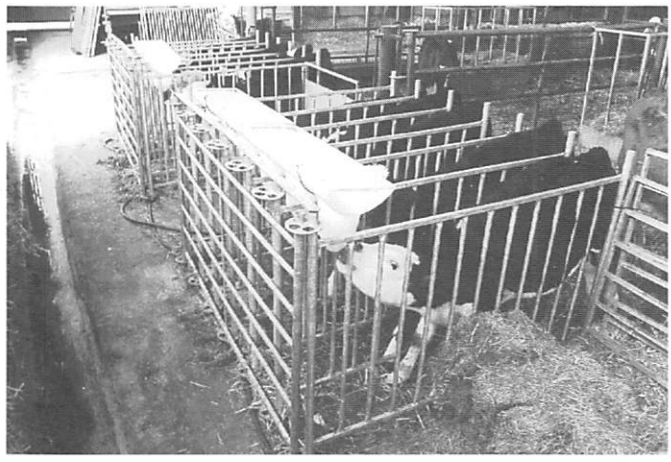
Environment protection at Shuttleworth College

Shuttleworth College in Bedfordshire has installed a 35,000 litre Klargester dirty water holding tank to ensure no further risk of pollution from run-off from its calf buildings and sheep handling area to the local watercourse and the nearby 'Bath Pond'.

The Livestock Centre at the College has been established for some 10 years and plays an important role in students' education by enabling on-site practical work with livestock, as well as being a centre for an ever-increasing programme of research and trials work. "As an Agricultural College, we take protection of the environment very seriously," said Bob Emmett, Head of Livestock. A detailed study was commissioned from ADAS and it was agreed that bunding and gullies would be installed around all cattle and sheep handling areas. The covered cattle area, bedded-down with straw, meant that the only effluent there was from a six-weekly pressure-hose wash-down. The sheep handling area, situated outside, also washed down regularly, is additionally subject to run-off from rainfall. An underground network of drains feeds to the Klargester dirty water holding tank.

Prior to entering the tank, the effluent is fed into a two-chamber solids and sediment settlement tank. The Klargester tank is fitted with an alarm to alert the maintenance team when the tank needs emptying. The liquid is then pumped to a low-volume irrigation system in fields some distance away.

The College contracts to rear around 300 calves each year for dealers and farmers. Entry to the Centre is at one week of age and they remain there until about twelve weeks old. They are then moved onto local farms for finishing on a number of different systems. This arrangement enables detailed recording and analysis of trial results to be made for various sponsoring UK companies and interested farmers. Current trials include the assessment of different concentrate feeds and of new milk powder formulations.



Run-off from the cattle and sheep handling areas at the Livestock Centre, Shuttleworth College is led to a 35,000 litre Klargester tank. All Klargester one-piece tanks are manufactured in glassfibre reinforced polyester (GRP) and are leak and rot proof – with proven durability of well oer 25 years underground.

'Green' light for biodegradable hydraulic fluids

Sauer-Sundstrand UK Ltd has announced the successful completion of an intensive testing programme which clears the way for its standard range of gear pumps to operate on Shell biodegradable fluids.

The company confirms that its pumps can now be operated at up to, and including, normal maximum rated pressures and speed limits using Shell Naturelle vegetable oil (HF 32) and synthetic ester (HF - E46).

Other 'green' fluids will be approved shortly.

In the meanwhile, a specialist team of engineers is available to advise on specific applications and operating conditions.

Sauer-Sundstrand Ltd, Cheney Manor, Swindon, Wiltshire SN2 2PZ (Tel: 0793 530101).

New cattle head gate

Cattle head gate

A new cattle headgate unlike any other on the market has been designed for Poldenvale Ltd by John Sparkes, retired founder of the company.

The headgate, although easily portable, is claimed to be strong enough to catch and hold the wildest of cattle.

Operation is smooth and almost completely silent to avoid upsetting nervous animals and there is an instant choice of widths making it suitable to use with cattle of almost any age.

Vertical yoke bars move smoothly and silently in a horizontal plane on 4 sealed bearings with complete control over the speed of operation being maintained.

The gate can be supplied as a separate unit or as part of a Poldenvale crush.

Poldenvale Ltd, Cornish Way, Galmington Trading Est, Taunton (Tel: 0823 322733).

Moisture meters for grain and bales

– Grainmaster models 900 and 900E

Protimeter models 900 and 900E represent a new generation of grain moisture meters and incorporate the latest technology. Improved grinding and compression facilities offer easier use and ensure accuracy even when the moisture is not uniformly distributed throughout the kernel.

Dual LCD displays are provided which show both % crop moisture content and the crop selected together with other instrument status information including cell temperature.

Crop selection is by means of a membrane key-pad sealed against dust. Calibrations for ten crops are 'built-in'. New calibrations may be added via a PC by the user, by the local dealer or by the Protimeter service centre.

The Grainmaster 900E incorporates extra facilities including an RS232 compatible output for serial printer interface and averaging of the last nine results.

Both models provide temperature correction automatically and will accept an extendible Protimeter temperature probe with a range of -50C to +50C.

Above: Grainmaster for moisture in grain; Left: Balemaster for moisture in hay and straw bales.

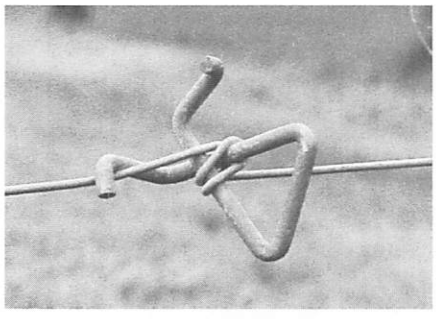
– Balemaster

Protimeter has also introduced the Balemaster meter for measuring moisture in hay and straw bales. The unit has a strong 600mm stainless steel probe and weighs only 600g.

A light emitting diode (LED) display gives a clear, accurate indication of the moisture levels from 10% to 70% moisture content.

Protimeter plc, Marlow, Bucks (Tel: 0628 472722; Fax: 0628 474312).

A stitch in the wire saves time



The Rappatite is a simple, quick and cheap method of tensioning and retensioning new and existing wire fences. When placed on the slack wire and turned with a specially designed handle, it winds in the slack to give the exact amount of tension required. When the desired tension has been set, hooks on the Rappatite stop the wire unwinding and keep up the tension. More tension can be applied at later stages as required by simply making more turns.

Rappatites are effective for tensioning plain or barbed wire, multi-strand electric fencing wire and sheep or pig netting.

Rappa Fencing Ltd, Steepleton Hill, Stockbridge, Hampshire SO20 6JE (Tel: 0264 810665; Fax: 0264 810079).

Hunting wins Tanzania National Resource Survey

A major contract which will result in the production of the first coloured land use maps covering the whole of Tanzania will be undertaken by Hunting Technical Services (HTS), the international firm of natural resource development consultants.

The contract, which is valued at £1.2 million, has been awarded to Hunting by the Tanzanian Government. The project is being funded by a loan from the World Bank.

During the period 1994/95 the Hunting project team will be using satellite imagery, primarily Landsat Thematic Mapper data, to prepare a national series of 1 ; 250,000 scale maps showing forestry and other land use units. The interpretation will be compiled on enhanced hard copy imagery and then checked by an extensive programme of field data collection.

The completed compilation will then be digitised by Hunting to enable area calculations to be made. The data will also be fully compatible with existing resource inventories, while the new national inventory will be used as a base for future planning studies within the country. Hunting will also be training local staff who will be involved in the project and the final product will be a set of land use maps reproduced in colour and printed in Tanzania.

Other recent successes for the Hunting Plc subsidiary include such GIS work as environmental sensitivity mapping in the Black Sea, forestry plantation preparation in Ghana and land information systems in Swaziland; the last two projects also being funded by the ODA. Projects are also in hand in the UK and other Western European countries.

Perkins alliance with Iseki of Japan – strengthens engine range and increases sales outlets

Perkins and Japanese manufacturer Iseki have formed an alliance to develop and produce a new range of low emission engines. The new range is being developed to meet new worldwide off-highway emission standards. Perkins will establish a dedicated production facility at its Peterborough headquarters to make the four cylinder, three litre engines.

In a separate agreement, Iseki will become the Perkins distributor for Japan. Using its 43-strong dealer network it will boost Perkins already significant presence in the country.

Ireland win; England fourth in 41st World Ploughing Championship

Irishman Martin Kehoe won the 41st World Ploughing Contest in New Zealand. Cornishman Adrian Brewer,sponsored by Firestone was placed fourth overall.

Against a stiff international field of nearly 50 competitors from 27 countries, Brewer shot into fourth in the conventional ploughing section, after tackling the stubble. The grass proved more of a match however, and he was beaten into eighth place the following day, despite an excellent result. The overall score of 350.50 left him 21 tantalising points away from the podium.

Sands Agricultural Machinery wins Burke Machinery Trophy

Continued investment in product development coupled with excellent customer service have won family owned Sands Agricultural Machinery (S.A.M. Ltd) the prestigious RASE Sir Roland Burke Perpetual Challenge Machinery Trophy for 1994.

Set up in 1976, the Norfolk-based company was singled out by a panel of judges for its continuous development of chemical application technology, in particular its significant contribution to the self-propelled sprayer market.

S.A.M. was the first company to develop high ground clearance crop sprayers. The company went on to launch one of the first British built hydrostatic sprayers.

Automated milking system
Alfa Laval chooses SRI

Silsoe Research Institute has won a £1.02 million contract to develop a fully automated milking system for Alfa Laval Agri, based on the prototype developed at Wrest Park (see Vol. 48 No.1 – Spring 1993). The author of that reference, Mike Street, will lead the project in the UK.

The British company, Norgren Martonair, will provide the key pneumatic components for the largely air- operated mechanisms and the British Technology Group Ltd will manage the patents to protect it.

Automic milking not only releases labour in a dairy unit but also improves cow welfare and increases milk yields.

Fertiliser revolution 'on the cards'

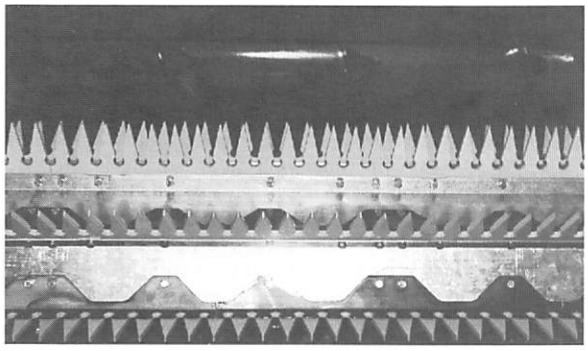
For the first time, a satellite guided tractor and spreader capable of adjusting fertiliser rates automatically on-the-move will be used on a commerial farm. It will target fertiliser rates to optimumise yield potential of different parts of a field. This marks the latest stage in the development of a new farming system of 'spatially variable' crop treatments based on the unique yield mapping abilities of Massey Ferguson combines.

A field at Shuttleworth College has been yield mapped by MF combines for the last two years, showing variations in yield across the field of more than 100 per cent despite the usual fertiliser applications being evenly spread across the field as a whole. Now data derived from the yield maps will be used by the spreader to target this year's fertiliser use more closely to the growing ability of individual parts of the field. The results will be evaluated at harvest when another yield map will quantify the cost-effectiveness of the treatment.

The spreader has been jointly tested by MF and Danish manufacturer Bogballe for the last three years. It will be operated with a 120 hp MF 3120 Datatronic tractor fitted with the same differential GPS (Global Positioning System) satellite positioning information equipment as used on the combine, to track the spreader as it works backwards and forwards across the field.

Fertiliser application will be targeted to yield potential with this combination of MF 3120 tractor and spreader controlled by the MF 'Global Positioning System.

Polymer material for the stripping elements of Shelbourne Reynolds harvester



A polymer material, Ceram 'P', specially developed by Poly Hi Solidur for highly abrasive processes in the paper making industry is finding a successful application in the Shelbourne Reynolds stripper header.

The patented harvesting system of the Shelbourne Reynolds harvester originally incorporated cast polyurethane stripping elements. These had an average life of 600 to 800 acres. The Ceram 'P' elements have an average life of 1500 to 2500 acres – sufficient to last for a full season's harvesting.

Since September 1993, all stripping elements have been manufactured from Ceram 'P', report Poly Hi Solidor.

The Shelboune Reynolds harvester incorporates eight rows of Ceram 'P' stripping fingers mounted on the octagonal steel stripping rotor. These fingers are manufactured by Poly Hi Solidu in lengths of 600mm (making it relatively inexpensive to change a section should one become damaged.) Ceram 'P' is claimed to be the ideal material for the arduous task of grain stripping, especially where abrasive crops, such as rice, are being harvested.

Besides the important abrasion resistance, Poly Hi Solidur list the properties of Ceram 'P' as:- high bending strength; impact resistance; chemical resistance; low coefficient of friction and; durability. Furthermore, Ceram 'P' will not absorb moisture and it operates effectively across a broad temperature range.

The rotor of the Shelbourne Reynolds harvester revolves at between 400rpm and 1000rpm depending on the crop and conditions.

The blend of Ceram 'P' properties is now being used to solve sticking and wear problems in other engineering applications. Poly Hi Solidur also foresees tremendous potential for the material in general agricultural use.

Poly Hi Solidur Ltd are at Halifax Road, Todmorden, Lancs OL14 5QQ (Tel: 0706 812457; Fax: 0706 817571).

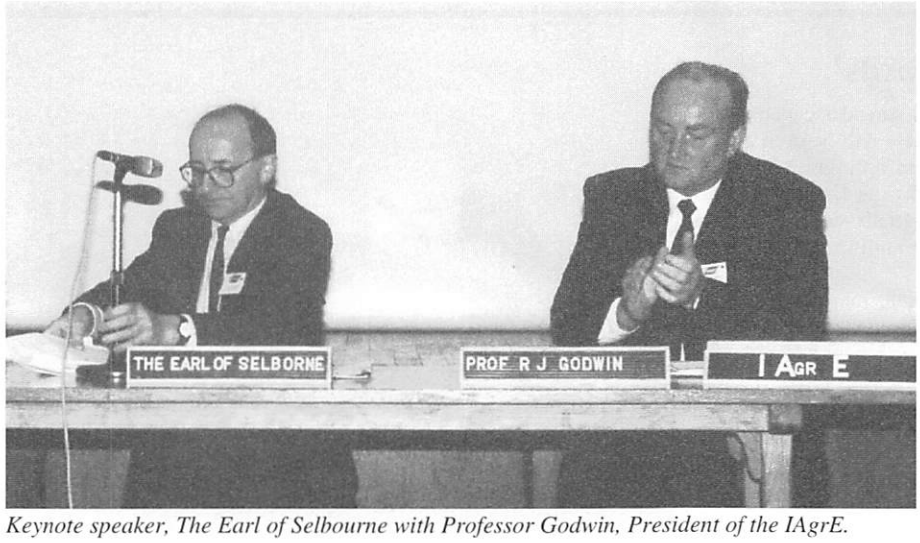
Environment and Amenity

The 1994 Annual Convention

The 1994 Annual Convention of the Institution of Agricultural Engineers was held at Harper Adams Agricultural College on 17 May 1994. Over 200 delegates attended. The theme was Environment and Amenity and we are pleased to present here abstracts and summaries of speakers' papers.

The keynote address was presented by The Earl of Selbourne, Chairman of the Joint National Conservation Committee.

In addressing his theme, Lord Selbourne acknowledged that there is now widespread recognition in the United Kingdom of the need to "green" agricultural policy within Europe. He cited a number of pilot schemes — the ESAs, Country Stewardship Scheme and the EC Agro-Environmental Measures. Such schemes have demonstrated that successful initiatives can be put in place which are attractive to farmers and which deliver desirable environmental benefits. However, it is still the case that by far the largest proportion of the cost of the CAP is devoted to measure aimed at supply control – measures which have no environmental content. Economic pressures on agriculture have been increased by the GATT and Blair House Agreements.



Keynote speaker, The Earl of Selbourne with Professor Godwin, President of the IAgrE.

Aim to reconcile competitive production with environmental concern

Looking into the future, Lord Selbourne stressed that the agricultural industry will therefore be seeking to develop policies which reconcile competitive production with systems which are perceived to be environmentally benign. There is a need for more research on the potential for new technology to provide cleaner farming systems with better targeting of inputs.

Lord Selbourne concluded his address with a warning that environmental concerns must not generate legislation which puts Europe in an uncompetitive situation and which does not adequately take into account the contribution that can be made by science and engineering.

Cecil Currin, State Conservationist from New Jersey, USA introduced the plenary session with his paper:

'A Productive Nation in Harmony with a Quality Environment'.

Bordered by the Atlantic and Pacific Oceans and stretching from Canada to Mexico, the coterminous states offer a wide variety of resources. From near tropical conditions in Texas and Florida to desert conditions in Utah, from the flat Mississippi delta to mountains that rise to 14,500 feet above sea level, natural resources sustain and challenge us. From the South Pacific Islands of Hawaii to the permanent frost in Alaska, we are challenged to manage a tropical paradise and a semi-frozen wilderness.

Role of the Soil Conservation Service

The Soil Conservation Service has as its agency vision, 'A Productive Nation in Harmony with a Quality Environment'. Its mission is to provide leadership and administer programs to help people conserve, improve and sustain the natural resources and environment.

The mission is carried out as part of the United States Department of Agriculture with a multi-disciplinary corps of 13,000 employees. These employees are scattered throughout the 50 states plus the Pacific basin and Caribbean Island areas.

Projects and problems

Natural resource projects and problems are as varied as the countryside.

The Soil Conservation Service works with farmers and other land users on erosion control and water management. Erosion control is necessary due to sensitive soils and intense rainfall which has been measured up to 43 inches in a 24 hour period.

Preventing damage to the land base also is a main line of defence against water course damage and water quality degradation.

Demand for water for irrigation and municipal use continues to increase, and even in water rich areas, supply is short of demand.

The Soil Conservation Service works directly with farmers to install conservation practices to prevent erosion, avoid water contamination, and maximise irrigation efficiency. This assistance is free of charge to the land user.

In addition, cost sharing for certain practices is available from USDA and many states. Cost sharing is generally 50 to 75 percent, but can range up to 100 percent in targeted areas.

As the year 2000 approaches, the agency is moving toward more field level assistance and toward targeting assistance to specific watershed based problems.

After lunch, delegates were able to select sessions of their interest from a range of specialist group offerings. Visits to Lilleshall National Sports Centre and Leigh Environmental Waste Disposal Site were also available.

Within the Electronics and Computing Specialist Group Session, **Colin Watt** of Silsoe College presented his paper:

'Expert Systems for Environmental Applications'

Information technology can be used to apply the knowledge of experts to the problems that threaten the environment.

In every subject area there are specialists who have expert knowledge but are not always available. Decisions have to be made by people who do not have a complete understanding of the situation and do not have the appropriate knowledge to analyse the problem and select a suitable solution.

This lack of expert knowlede can result in damage to the environment, for example, on a local scale where soil compaction damages the soil, or on a global scale in which large areas of land and scarce resources are affected.

The speaker evidently arousing some mirth among the delegates at the convention.

Experts for everybody

In his paper, Colin drew on his experience with expert systems at Silsoe College over the past five years.

He explained that an *Expert System* is computer software that encapsulates an expert's knowledge and make it available to the decision makers, be they farmers, land use planners or manufacturers.

The software replaces the expert and the user consults the expert system instead of consulting the expert.

The expert system behaves in a similar way to the expert. It asks questions, comprehends the answers and uses its knowledge of the subject to advise the user.

Expert systems are necessary, basically because experts are rare. They take years to train and build up experience. Non-experts are plentiful but they are the people with the problems to solve, the choices to make and the faults to identify.

Applications for Expert Systems

The main areas of application for Expert Systems are presented in the panel below:

Applications for Expert Systems

- *Land use planning* There are various methods used to match the crops to the land. An expert system could be based on a fairly crude system to give a rough guide to how the land might be used or it could use a detailed analysis of the site and hold detailed descriptions of all the crops. The simpler expert systems are based on knowledge expressed as rules whereas the more detailed ones are more akin to databases. There is no accepted standardised methodology for presenting detailed descriptions of crop/environment relations so the knowledge engineer has to select the most appropriate method.

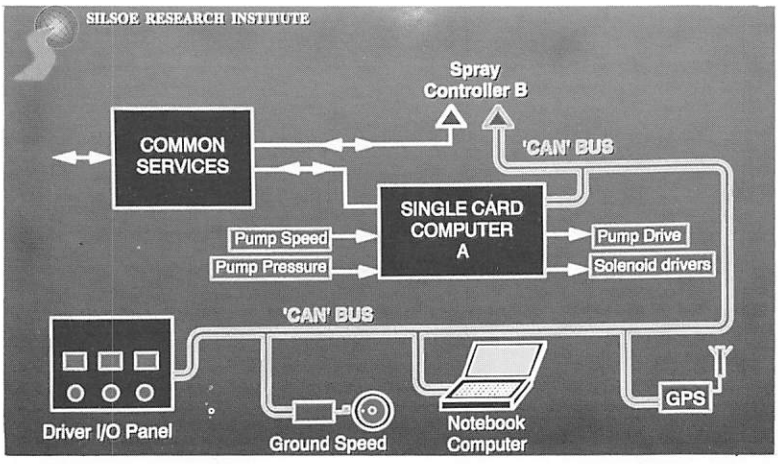
  An expert system designed for a restricted farming area is far easier to produce than one which tries to cover all farming situations.
- *Tillage* A tillage expert system could be a stand-alone package to be used by a farmer or an extension officer but it would require the user to input historical data about the fields and crops grown. *Arable farm software* could be enhanced by the addition of an expert system module. It would work in conjunction with the records of past operations and crop conditions. The farmer would supply details of proposed future cropping patterns and the expert system would advise on suitable cultivation operations.
- *Irrigation* The choice of a suitable irrigation system is, ideally, the job of an expert. The design of an expert system to replace the expert is a trade-off between generality and usefulness. There are many different situations where an irrigation system may be applied and these must be capable of being handled by the expert system.

  The selection of flow measuring devices for open channel irrigation is another area where experience is required. An expert system for irrigation engineers, who are not fluid mechanics experts, allows them to select the most appropriate device for their purposes.
- *Drainage.*
- *Dairy herds* Disease could be identified based on weight changes, fall in milk yield, fever or poor appetite.
- *Soil erosion* (Gully erosion Control).
- *Waste management* A Waste Management Expert System (WEES) for use by ADAS Regional Mechanisation Advisors has been developed to give detailed information on the control of pollution of ground and surface water by pig waste.
- *Identification of soil texture* A module has been designed to be incorporated into other expert systems in situations where the correct identification of the soil texture is required.

John V Stafford of Silsoe Research Institute continued the Electronics and Computing presentation with his paper:

'Sensing and Monitoring the Farm Environment'

The pressures on modern agriculture in terms of reducing input costs, maximising output quality and minimising adverse environmental impact dictate the need for sensors to control and monitor farming processes.



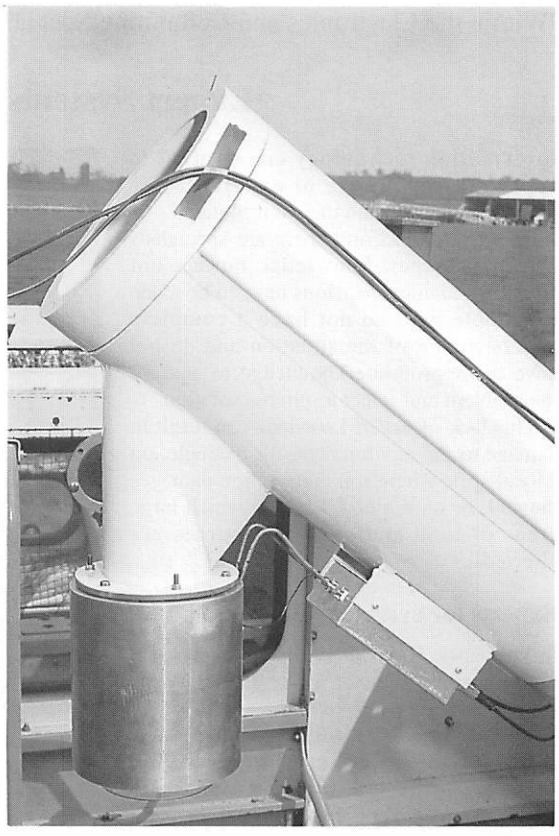
Sensors, however, have proved to be the hurdle to implementation of electronic control and data handling systems in agricultural applications.

Tight specification for agriculture

Part of the problem lies in the cost of development and in the relatively small agricultural market. A significant barrier is, however, the tight specification in terms of robustness and reliability required of sensors for agriculture; it has been said that the specification for sensors for agriculture is higher than that for military devices!

Nevertheless, there is an increasing uptake of sensors in both stationary and mobile equipment and for monitoring the below- and above-ground environments. The general requirements for agricultural sensors and the sensing techniques available which range from optical to biological activity, from electro-chemical to ultra-sound were outlined.

The environmental specifications for sensors in terms of the latest British Standard were discussed as were standard data transfer protocols, developed to rationalise the increasing quantities of data being generated by sensors and 'consumed' by controls and actuators in the farm environment.



Above: *The controller area network (CAN) data bus implemented on the SRI patch spraying system.*
Right: *Grain flow sensor on a combine tank unloading auger for the Silsoe Yield Mapping System (SYMS).*

Sensors for environment monitoring and for quality assessment

Whilst sensors are in commercial use for environmental monitoring in protected cropping and, to a lesser extent, in animal housing, there is a lack of suitable devices available for environmental monitoring in arable and rowcrop production and for quality assessment of produce.

As a case study, consideration was given to soil and crop sensing requirements in the rapidly emerging area of precision arable crop production where inputs are targeted according to locally determined requirement.

Bob I Harvey, Area Environmental Quality Manager of the National Rivers Authority, presented the first paper of the Soil and Water Management Group session.

'Water Pollution and Farming'

Today's intensive agricultural practices can sometimes come into conflict with the needs of the environment. Modern farms use pesticides and fertilisers, and produce large volumes of organic waste. All these are potential pollutants, and all can have a disastrous effect on water quality and aquatic life.

Organic materials alter biological balance

The most frequent source of pollution from farming is organic waste. In 1992, 83% of all farm pollution incidents investigated by the NRA were caused by either slurry or silage effluent. While pollution from farms accounted for 12% of all incidents, it was responsible for more than 17% of all 'major' incidents.

Organic wastes; such as slurry, silage effluent and even milk, can have a serious impact on water quality and aquatic life.

While chemicals may have a directly toxic effect, organic materials alter the biological balance of the water.

Organic materials provide a rich source of food for bacteria which rapidly consume oxygen in the water, depleting the supply more quickly than it can be replenished.

The effect on fish and other aquatic life can be disastrous; without oxygen, they simply cannot survive.

In addition, organic waste may contain nutrients that promote dense plant growth and algal 'blooms' that prevent light penetrating water, as well as increasing micro-organisms populations which, being harmful to stock and humans, render water unfit for drinking.

Leakage from stores

Most slurry pollution incidents result from leakage from stores. Good standards of design and construction and regular maintenance can prevent such incidents occurring. Wherever possible, clean water should not be allowed to mix with dirty washings or slurry.

Good management is also required in the handling or disposing of slurry, particularly when spreading it onto land, as slurry run-off may pollute watercourses.

Silage effluent is one of the most potent pollutants produced on the farm. In 1992, it accounted for 8% of all farm pollution incidents in England and Wales. Silage effluent removes oxygen from water, damaging or destroying fish and other aquatic life. It can also make water unfit for other purposes such as a drinking water supply.

Poor design, construction and maintenance of silos and associated effluent collection facilities are the main causes of pollution incidents from silage effluent. Highly corrosive, it can attack concrete and steel, escaping through cracked, porous or deteriorating silo floors, collection channels or holding tanks.

Legislation and other initiatives to control pollution

It is obvious that Parliament regards very seriously the subject of pollution as the maximum penalty on conviction in a Magistrates Court is now £20,000 and/or a term of imprisonment not exceeding three months.

Additionally, the Government has introduced regulations designed to prevent certain types of pollution by improving standards of design and construction for silage, slurry and agricultural fuel oil installations.

However, tough legislation is not the only action being taken to control pollution.

Other initiatives such as MAFF's Farm and Conservation Grant Scheme, the Code of Good Agricultural Practice for the Protection of Water, the CIRIA document on Farm Waste Storage and the NRA's development of Farm Waste Management Planning are all contributing towards the recent reduction in pollution incidents from farms.

The Soil and Water Management Session continued with **Cecil Currin** presenting his second paper:

'Conservation in Populated Areas'

Most of the 248 million Americans live within 75 miles of the coast.

This 70-75% of the population live, work and play near the oceans and the Great Lakes and create a strain on natural resources. Housing developments, commercial developments, industrial parks and road systems destroy natural vegetation, increase runoff, create erosive conditions and deliver increased sediment loads to the stream systems.

Erosion on construction sites may be sixty times that prior to the disturbance.

Sediment and erosion control laws

In order to protect natural systems and reduce off-site damages, many of the densely populated states have passed Sediment and Erosion Control Laws. These regulations usually require that a developer design and seek approval for a water management and erosion control plan prior to surface disturbance.

In New Jersey, the Soil Conservation Districts have regulatory authority for any area of disturbance greater than 5,000 ft^2. This fee-based system of control is self-supporting and has caused the installation of soil and water conservation strategies on hundreds of thousands of acres.

Installed practices include detention basins, lined channels, temporary and permanent seeding, wildlife plantings, diversions, waterways, sediment barriers, sediment basins, pipelines and drainage systems.

Plans are developed, reviewed and approved prior to construction and are fully implemented prior to the issuance of a Certificate of Occupancy.

At the Convention dinner. Immediate Past-President, Brian Finney with our new President, Dick Godwin. Doug Walker (facing camera), President 1990 – 1992, applauds.

In the Forestry Engineering Specialist Group session, **John Anstey** and **Rob Soutar** of the Forestry Commission presented a paper:

'The Prevention of Environmental Damage as a Result of Timber Extraction'

Clear felling of timber and the construction of unsurfaced forest roads both have the potential to cause environmental damage - in particular the pollution of water courses. When the two operations come together the potential for problems is maximised and, because different agencies may be involved, so is the difficulty of prevention.

Forester and Road Engineer need close liaison

The paper looked at the potential causes of environmental damage at the harvesting/road interface and presented a number of solutions, stressing the importance of close liaison between the forester and the road engineer from earliest design through to completion of the harvesting operation.

The visit to the Leigh Environmental Waste Disposal Site.

The Machinery Management Specialist Group session began with a paper by A C Knight, Silsoe Research Institute:

'The Opportunities for Eliminating Silage Effluent through Rapid Wilting'

The principal objectives of any grass harvesting system should be to minimise losses, to prevent pollution by silage effluent and to achieve these targets at minimal capital and operational costs.

Importance of wilting

– losses if too prolonged

Nutritional losses occur during prolonged wilting periods in poor weather by leaching and general degradation of potential feed value. Repeated field treatments, such as excessive tedding, and poor harvester pickup can result in inefficient collection through smaller crop particles being lost in the stubble.

Effluent production, and consequently the pollution risk, is directly related to the dry matter content at harvest and therefore any increases in dry matter content, ie losses of moisture, which can be achieved by field drying will reduce the potential effluent loading.

Over a decade ago, improved crop conditioning mechanisms became available and these had the potential to improve wilting rate by 25%, albeit only a few percentage points of dry matter over a 24 hour drying period.

– trend to wide swaths, less wilting

Current harvesting practices of reduced wilting periods and in some cases the combination of very wide cutting widths leaving narrow and dense, but easily harvested, swaths have severely restricted opportunities for field drying.

For economic reasons, many farmers have opted to employ contract services for their grass harvesting operations using large, high work rate equipment which inherently requires exceptionally high operational management to ensure that silage quality and environmental considerations are not suppressed by the goal of completing the harvest operation in the shortest possible time.

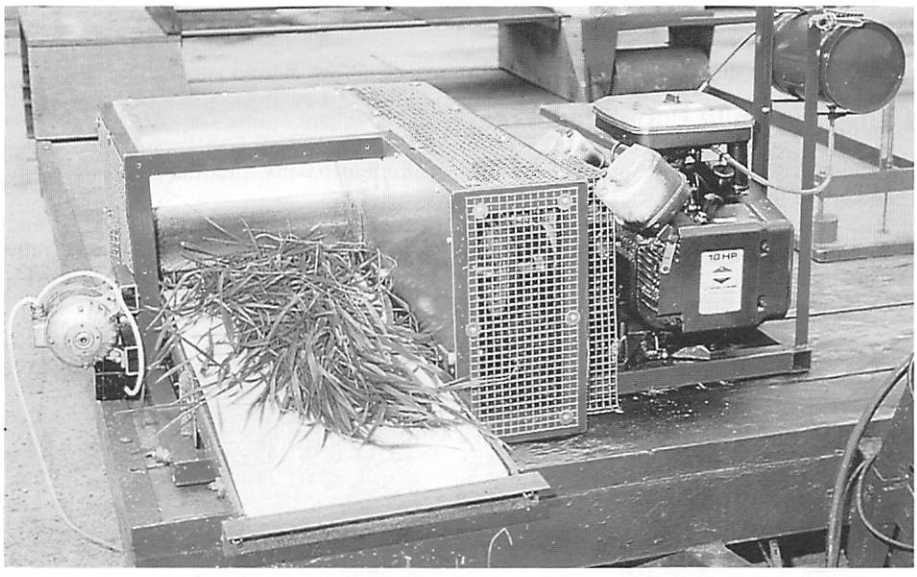


Fig 1. Apparatus for making small mats of forage for laboratory and field trials.

Rate of moisture loss

Two factors limit the rate of moisture loss from crops in swaths irrespective of ambient weather conditions. In the first instance the transfer of water from within the plant tissue is limited by the impervious epidermal layer, and thereafter movement from the crop surfaces to the atmosphere outside the swath is affected by the size and structure of the swath itself.

– more aggressive conditioning

To improve the rate of transfer of water from within the plant tissue, even more aggressive conditioning will be required but, with current systems, this could increase the risk of losses from crop fragmentation and weaken the swath structure so that it becomes more dense, thereby adversely affecting drying rate.

– maximising effect of sun

Alternatively, or in addition to more severe conditioning, the opportunity exists to maximise the effects of solar radiation by increasing the field cover with wide swaths or complete spreading.

Mat making for rapid field drying

Research in North America and Europe has investigated the opportunities for achieving very rapid field drying through "mat making".

The technique (see Fig 1) consists of severe maceration of the grass at mowing followed by continuous pressing into a mat of 5-10mm thickness which is placed back onto the stubble.

In general, the North American results showed that drying rates of mats are much faster than conventional swaths, field losses are reduced (especially with lucerne) and the fodder (hay in this case), had a higher fibre digestibility than non-macerated material.

Recent commercial developments to achieve rapid wilting involve the introduction of spreading, tedding and windrowing equipment which is suitable for use in high yielding wet grass conditions at high operational work rates.

Silsoe trials with different treatments

A series of experiments, under MAFF funding, was conducted at Silsoe Research Institute during 1993 to establish the feasibility of all these techniques in typical UK grass harvest conditions.

Different grass treatments, to include the effects of yield, severity of conditioning and degree of pressing, were evaluated under various ambient conditions ranging from dull and overcast to bright sunlight.

The treated grass was placed in wire mesh trays above water baths to simulate the effects of wet soil, and the rates of drying were monitored by hourly weighings for a four hour drying period (Fig 2). Ambient weather conditions of solar radiation and wind speed were continuously recorded together with temperature and relative humidity above and below the crop trays.

– 'drying potential' measured by pan evaporation

The 'drying potential' of grass under the different weather conditions can be represented by the meteorological parameter of pan evaporation (ie the change in depth of

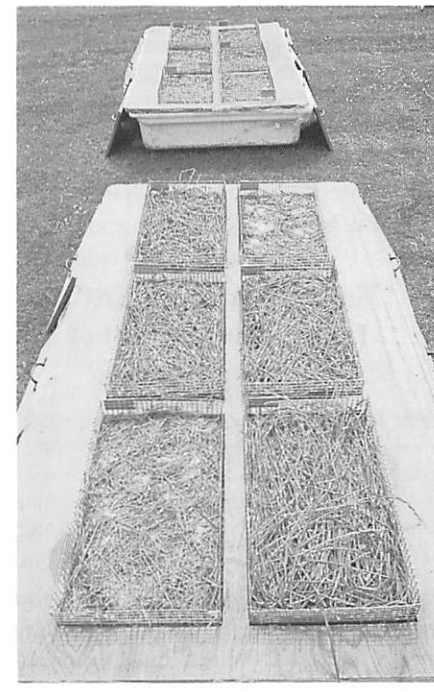


Fig 2. Forage in trays during the Silsoe trials. Water under the trays simulates damp soil conditions.

water in a standard pan exposed to the same ambient conditions as the grass). Typical values for the 4 hour experimental period were between 0.5mm on a dull, overcast day and 3.4mm on the brightest day; the value for a typical day at Silsoe was 2mm.

– results for unconditioned material

The experimental results indicated that for a yield of 5t DM/ha under good drying conditions, as experienced on the brightest day, unconditioned ryegrass required 3.2mm of pan evaporation when left to dry from 15% to 30% dry matter content in swaths covering 50% of the field area.

Spreading to 100% ground cover reduced this to 2.6mm but under more average weather conditions these were 3.5 and 2.8mm respectively.

As would be expected, under average weather conditions, both treatments required slightly more pan evaporation – in other words – longer drying periods, which was due to restricted evaporation from within the swath.

– benefits of conditioning and pressing

As stated above, previous results from conditioning trials would indicate that a 25% improvement in drying could have been achieved by conventional conditioning.

Macerated and pressed grass at 50% ground cover required between 2.5 and 2.6mm of evaporation in both weather conditions, but at 100% cover it was reduced to 1.0mm on the good day and 1.4mm under the average conditions.

However, macerated but unpressed grass (ie simply severely conditioned grass) dried at the same rate in average conditions and also at 100% ground cover in the good conditions. Furthermore, at 50% ground cover in the good weather, the macerated but not pressed treatment required only 1.8mm of pan evaporation.

Severe conditioning the best — but with management challenge

In conclusion, these results indicate the advantage of conditioning and spreading grass to achieve quicker drying.

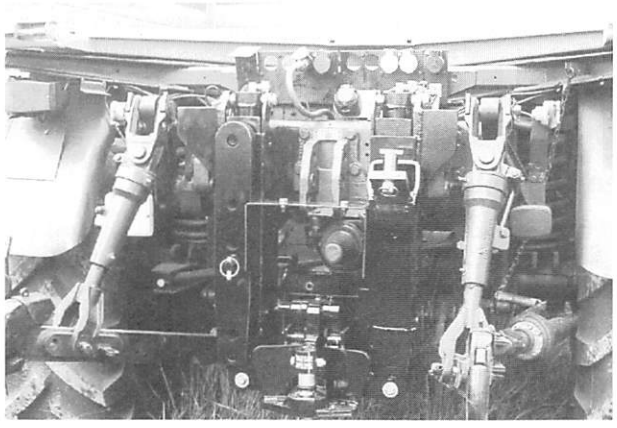
However, much greater improvements can be achieved through very severe conditioning, such that drying from 15% to 30% dry matter content can be achieved with only 1.0 to 1.5mm of pan evaporation, an amount of 'drying potential' very often available on individual days in typical livestock areas of the UK.

The challenge of introducing such systems, requiring a start/stop approach to avoid bad weather, remains.

The second paper of this session was presented by **Richard Robinson** of Autoglide Equipment

The application of agricultural engineering to the amenity market

Engineering for agriculture has much in common with amenity products, but significant differences also exist, particularly in areas of longevity and resistance to operator abuse. Richard's paper identified a number of areas of design divergence and illustrated some details.



Autoguide pick-up hitch for Unimog.

Move from agriculture to amenity

Over many years there has been a continual reduction in the number of agricultural machinery manufacturers in the UK. Whilst our tractor balance of trade is in excellent shape, the situation on machines is in continuous decline.

A number of machinery manufacturers has moved from agriculture to amenity, either in part, through acquisition, or as a clearly stated objective, disposing of traditional agricultural engineering on the way.

Richard's own company was intended to be 100% agriculture (it was named Intermec Farm Machines Ltd!), but after 17 years it is now approximately 15% agricultural and most of its growth is in amenity and utility products. This change in emphasis came about with the introduction of a new range of Ford Compact tractors and the wish to provide a coordinated range of products to go with it.

Designing for British conditions

Unfortunately, the mistake was made of relying on imported products and it was discovered once again that British conditions are the most challenging in the world!

Using the company's agricultural engineering experience, a programme of designing and building a coherent product range of grass care equipment was commenced. The design and development of a mower was detailed in this presentation.

The objective was to produce a machine which produces an acceptable quality of work whilst maintaining standards of durability which match an annual work load of 1500 hours. The original design had some parts whose actual life could be measured in minutes under particular combinations of conditions.

Front mounting for amenity users

The case of front mounted implements illustrates the divergence in engineering standards between agricultural and amenity.

About 20 years ago, the Alpha Accord front linkage, designed by Cyril Copperwheat, was introduced. Many thought it would be easy to fit equipment to the front. How wrong they were!!

The impact loads sustained on front mounted machines totally destroyed well-earned reputations for reliability and only recently have agricultural implements worked really well.

Amenity users, however, expect to push their mowers and ramming a manhole

Rotary deck designed for Iseki SF 300.

cover or concrete post is a regular occurrence which should result in no down-time.

To make existing designs work, the wide variation in mountings, PTO size, type, speed and rotation must be accommodated. Machines must be designed within strict weight criteria and special steels are often used to achieve this.

AUTOCAD for fast, careful design

AUTOCAD has been used for the last nine years and contributes to the fast design service offered. Three-dimension imaging and a rendering package to produce parts lists are used – the main problem now is finding operators who can work quickly and accurately to meet the customers' standards.

More work could be done with the system but a balance must be maintained between development costs and revenue.

At present, some 10% of turnover funds in-house product designs and another 8% sub-contract work. Projects are now handed over as a small book of drawings plus a few discs, ready to load onto clients' own computer systems.

Many areas of amenity equipment design neglect or forget basic agricultural rules.

A striking example is the use of hydraulic drives.

On agricultural machines, hydraulic motors are rare (except on large SP units), whereas many amenity machines have multiple units.

The reliability of hydraulic systems is largely a matter of careful design and meticulous cleanliness – but relative efficiencies are at levels usually unacceptable in agricultural machines. That a 30kW mower runs at about 40% efficiency matters little; that a 200kW forage harvester runs at less than 80% is a matter for grave concern.

This philosophy has spawned a very few specialist hydraulic equipment suppliers to the amenity engineering industry and this means that there are openings for the supply of higher efficiency amenity products.

Provided that maintenance is no more onerous, Richard expected there would be a 'drive' to double efficiency with consequent savings in installation costs.

Adaptations to amenity use

Traditionally, America has led the way in supplying simple straight-forward but remarkably effective equipment and has left Europe to develop more sophisticated products. The relative price of fuel and tough British conditions must account for these differences.

As an example of an agricultural product now adapted to amenity use, the fence post vibrator known for obvious reasons as 'Thumper 11' was highlighted. This machine can drive posts of up to 250mm diameter to a depth of 1.2m in 1-2 minutes. The posts can be up to 200mm shorter than other driven or bored hole posts, with savings around 80p per post on material alone.

Coupled with higher work rates – up to 400/day – and precision 10mm in all directions, it is an example of an agricultural concept adapted to amenity use with greater technical success.

Two papers were presented within the Vehicle Specialist Group session.

The first paper, by **J William Hargreaves**, Joint Managing Director, Sisis Equipment was titled:

'Vehicle Development for Amenity Applications'

William Hargreaves has been involved with product design at Sisis for 26 years, the company having started in 1932, producing horse-drawn power units. The development of vehicles has been the basis of the company from the start.

As a young company with few resources, it was necessary to utilise what was available in the market and adapt it for turf management. As the company grew it was possible to develop a power unit more suited. This became more urgent as competition was looming. The features, particularly manoeuvrability, were vital and the means to achieve this were continuously developed.

The development of machines was outlined with the use of photographs and showed the work and surfaces on which they were required to operate. The overseas market sales provided the means to finance much of this work, and for the range of products.

Some details of these implements were outlined with their various special features, many of which have been successfully patented.

With a view to the future, the Hydromain present and future development was considered which will ensure Sisis survives for the next sixty years.

Above: *The Hydromain with Sisis single unit Veemo.*
Right: *Sisis Technocore on HTV25.*

The second paper, by **G D Vermeulen** of IMAG-DLO, Wageningen, Netherlands considered:

'Over-Compaction and Damage'

Only a few years ago, when the effects on the environment were considered to be of secondary interest, maximised crop yields and farm profiles were often used as the target of sound agricultural practise.

At present, it is essential to weigh other effects too, such as:

- crop quality,
- losses of nutrients to the aquatic environment,
- losses of habitat quality for macro-fauna, micro-fauna,
- crop plants and non-crop plants,
- quantities of fossil fuels used,
- quantities of emitted gases such as CO2, CH4, NH3 and
- engine exhaust gases and particles.

New targets are therefore developing for sound agricultural practice.

Damage to environment

There is sufficient evidence that current farming systems do indeed damage the environment.

Within the farming system, compaction of the soil by agricultural traffic is known to affect the functionality of the soil in terms of reduced permeabilities for water, reduced aeration and increased mechanical resistance for penetrating or migrating members of the ecosystem and for tillage tools.

As a result there is development of such problems as:

- run-off,
- perching of water,
- reduced uptake of nutrients by plant roots,
- denitrification and other undesired chemical processes under anaerobic conditions and
- plant disease may increase.

Aim to minimise compaction

In the absence of specific targets for soil physical parameters, avoiding excessive topsoil compaction and preventing any further increase in compactness of satisfactory subsoil layers seem to be the two most sensible approaches.

One of the engineering options for year-round avoidance of soil compaction is the application of low ground pressure running gear on all vehicles entering agricultural sites.

The concept of the application of low ground pressure was discussed at the level of an uniaxial compression test, a single wheel, a vehicle and a traffic system.

Benefits of low ground pressure system

Generally, reduction of the pressure on the soil leads to lower compaction levels. This principle is easily demonstrated in the laboratory. However, in a low ground pressure farming system, many factors other than the average ground contact pressure of tyre equipment determine the compaction levels obtained throughout the year.

Nevertheless, traffic system experiments on a field scale generally show positive responses of the topsoil condition and the yield of most crops by substituting a low ground pressure traffic system for a conventional traffic system.

Other benefits of low ground pressure traffic systems and opportunities for application were briefly discussed.

The Overseas Development Specialist Group session included two papers.

T F Shaxson, a Land Husbandry Consultant, presented his paper:

'Soil Erosion – Cause or Consequence ? - Altering Emphases'

The disappointing achievements of past 'soil conservation projects' are often related to lack of attention to what farmers themselves perceive and feel about their particular situations. This has often resulted in apathy or antagonism not only to proposed 'solutions' but also to any other types of agricultural advice.

Erosion – a consequence of poor husbandry

From a technical viewpoint, lack of attention to cover and soil structure has meant that key factors governing the onset and severity of erosion have not been addressed effectively.

Crossing some watersheds in conservation thinking allows us to see the problems from different viewpoints.

Seeing erosion as a consequence of poor husbandry, rather than a prime cause of damage in itself, the way has become open to re-interpret the mass of technical data already available and to highlight key features, hitherto under-rated.

This approach allows one to begin integrating conservation into farming systems, and to achieve conservation through improved production processes, rather than merely 'do' physical conservation as an add-on activity for specialists and with little perceptible economic benefit.

The approach now developing across the tropical and subtropical world is one of improving the conservation effectiveness of production systems via improvements in the husbandry of land.

The use of specialist physical measures may well be important as backstopping devices against uncommon and severe climatic events.

The second paper in this session was presented by **Henry Gunston**, MIAgrE, ODA Programme Coordinator, Institute of Hydrology, Wallingford

'Putting Numbers into the Arguments'

Since 1968, when the Institute of Hydrology (IH) took on its present title, the programme of research and development funded by the Overseas Development Administration (ODA) has ranged widely in technical content, and involved a broad spread of host countries – from Botswana to Brazil and Nepal to Niger.

However, a common theme has run through much of the work. As water is a vital natural resource, its management often generates arguments which, although strongly emotive, are poorly based numerically.

Measurement and analysis – a frequent role for IH

A frequent role for IH, in cooperation with colleagues in host countries, has therefore been firstly to take necessary field measurements, then by analysis to provide sound, numerically-based conclusions on which water resources planning decisions can be made.

Following this common theme, the work of a number of IH overseas projects funded by ODA were presented.

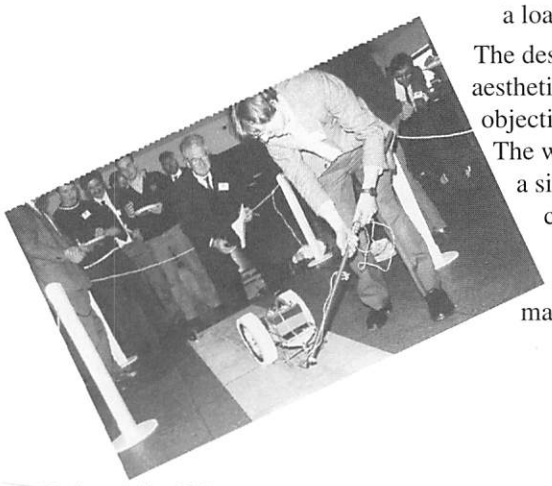
Topics included conversion of natural forest to tea and pine plantations in Kenya, developing irrigated village gardens using groundwater in Zimbabwe and the water use of eucalypts in southern India.

It is hoped to have a fuller version of Henry Gunston's paper in the next issue of the 'Agricultural Engineer' – Ed.

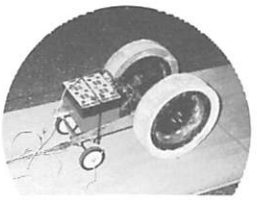
The Student Competition

The final of the Student Competition was held during the Conference Lunch.
John Kilgour (Silsoe College) and **Geoff Wakeham** (Harper Adams) had devised a set of rules for the competition in which a model tractor of restricted size and power was required to produce a maximum power to weight ratio while pulling a loaded sledge over a set distance.

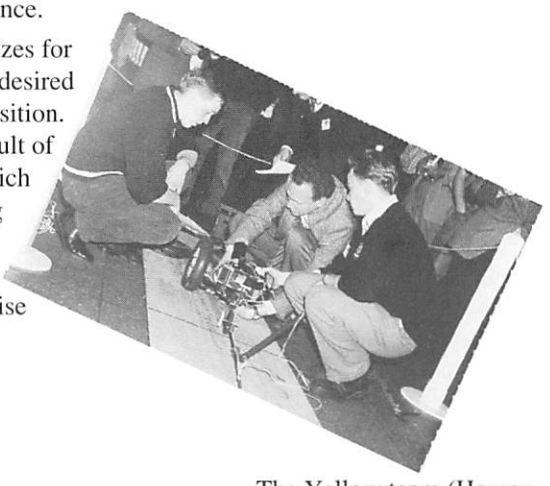
The design would not win any prizes for aesthetic beauty but achieved the desired objective of decimating the opposition. The winning design was the result of a single-minded approach which concentrated on the driving wheels which were constructed from 'home made' latex rubber to maximise traction.



Judge, John Kilgour, watches closely as Edwin puts his tractor through its paces.



The winning model



The Yellow team (Harper Adams II), checking the settings before releasing their model.

Edwin Ratcliffe, a post-graduate student at Harper Adams, was declared the winner and was presented with a model tractor donated by Massey Ferguson.

The Blue team (S A C) tractor getting a bit of stick.

Under starter's orders for the Red team (Silsoe College).

The Johnson New Holland Award

The Johnson New Holland Award for the best student project was won this year by a team from Harper Adams.

The classic line up! The winning Harper Adams team pictured together with Bob Friedlander, Commercial Operations Director, New Holland Ford Limited.

Membership matters....

THE NEWSLETTER OF THE INSTITUTION OF AGRICULTURAL ENGINEERS

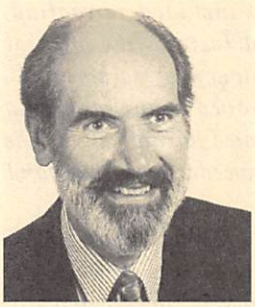
CPD should become mandatory

In his Presidential Address entitled 'Education and Survival' at the 1994 Annual Conference of the Institution of Plant Engineers at Southport, newly installed President Barry Hartley stated that, in his view, taking part in a Continuing Professional Development scheme (CPD) should as soon as possible become a mandatory requirement for the retention of registration at Chartered Engineer, Incorporated Engineer and Engineering Technician level.

Mr Hartley said that a strengthening of the engineering profession would be achieved by granting these three grades statutory status, hence conferring a "right to practice" upon all registrant engineers. This, he said, would enable the word "engineer" to be removed from job titles unworthy of its status and promote all registrant engineers to a level enjoyed by the profession in Europe and in many other countries of the world. "It is a well known fact", he added, "that the title 'engineer' is held in the highest esteem along with other senior professions in most other countries except Great Britain."

Signing off ...

I said I would only do it for a couple of years, and that was six years ago! That sentence will have a familiar ring to it for many members. I have to thank John Matthews for his initial approach, but notice that the word 'thank' has no inverted commas – I really have enjoyed my time as your Newsletter Hon. Ed., though occasionally that enjoyment has bordered on the masochistic. But the benefits have outweighed the drawbacks many, many fold.



Ian Gedye
The new Hon. Ed.

Thanks, too, to all who have helped in the compilation of every edition. To Panel Members and contributors, past and present, to the Secretariat for their support, to Edwina Holden for her typing and layout skills, but most of all to you, the members, for your kind words of encouragement and positive support.

Taking over my role is Ian Gedye, indeed Ian has helped me compile this edition. The Newsletter is in capable hands and no-one is more relieved than me. I trust you will give him the support you afforded to me, I'm sure you will. Ian can be contacted through the Secretariat, or direct at 68 Forton Road, Newport, Shropshire TF10 8BT (Tel: 0952 811484).

Denis Cartmel
retires after six years as
Newsletter Hon. Ed.

Denis Cartmel

Gaelic Mystery Solved

You'll recall the plea for a translation of the Gaelic greetings card received by the Secretariat and reported in the Spring issue – the endeavours of one member have, it seems unravelled the mystery. Niall Pigott, ably assisted by his mother, Mrs Doreen Pigott, identified the script as Irish Gaelic and reports it as follows:

The card celebrates "Ten years of the learning of Irish."

The greetings read: "The blessings of Christmas and a Good New Year to you all from everyone at the Great Barn."

The poem by Mark Macpharlain reads:

Great Barn of Uist

Take down to us the golden candelabrum,
And around us the bright wax candles,
Light them up in a room of sorrow,
And come with old songs of Irish,
And this in spite of the strength of their enemies,
But they are lasting, alive, singing, new and strong.
Come to us, come with us 'for always' (or 'to the west'),
And the family of us there, Singers of Fianna,
Come to us, come with us 'for always' (or 'to the west'),
And the family of us there, Singers of Irish.

Mrs Pigott seems to suspect some inclusion of Scots Gaelic in the prose and invites, nay, challenges any scholar of Scots Gaelic to improve on her work! Obviously the verse loses some of the romanticism in the translation – poems penned with patriotism in another language usually do – but the message of peace, goodwill and enchantment is clear to all.

Sincere thanks to Niall for his iniative and to Mrs Pigott for her translatory skills. Niall has recently finished a short-term appointment with the RASE analysing their user reports and putting together their 1994 Machinery Award Scheme. If anyone knows of a vacancy which might be appropriate for a man with obvious initiative and a desire to solve problems he can be contacted through the Institution's offices.

Just one mystery remains. What is the Great Barn ...?!

Andrew Landers, *who is now Head of Agricultural Engineering at Harper Adams Agricultural College (as reported in the summer issue), informs me that the department comprises 120 Agricultural Engineering students studying HND, BEng and BSc Rural Technology together with 21 academic staff. There are also 1300 Agricultural students studying mechanisation as part of their course.*

G K Anornu *has moved to Belarus to further his studies and to completer his doctorate.He speaks highly of the Institution as a means of meeting people and exchanging ideas. I wish him success and am glad to hear of his appreciation of the Institution. I look forward to hearing more from him as his career develops.*

Transferable skills

Karl-Ludwig Weiner *completed his three-year PhD at Silsoe College in 1993 where he was supervised by Dr Steve Parkin MIAgrE. He tells me that his research work, which was sponsored by Silsoe Research Institute and was a joint programme between SRI and the College, was related to Agrochemical Application Techniques, with particular reference to the effect of turbulentair flow on air-assisted crop sprayers.*

Karl is now a Project Engineer for Flomerics Limited, a software company in London. His duties involve thermal and fluidmechanical analysis of mechanical and electronic components which are cooled by natural or forced air-flows to obtain data for the development of improved designs. The common ground with his PhD research work is the use of Computational Fluid Dynamics techniques to simulate heat and mass transfer problems.

Karl is also secretary for a European R&D project concerned with an integrated mechanical design environment where he is resonsible for technical davelopment and co-ordination of the project as well as dissemination of information to customers. This work sounds interesting, although not at present directly related to agricultural engineering!

Tropical tree-work wanted!

Ian O'Neil Roe *was made redundant from his job as Managing Director of Anglo-Eastern Plantations in Medan, Sumatra, which was sold to a Chinese company. He is, therefore, at present looking for short or long term projects or consultancy work. Ian is a multi-tree crop specialist with over 30 years experience in the plantation industry in Malaysia and Indonesia. If any member can help, will they please contact Ian at Beacon Cottage, Ham Lane, Compton Dundon, Somerset TA11 6PQ (Tel: 0458 42415).*

I hope you will soon find some satisfactory employment, Ian.

Ivan S Barrowes *is now on a two-year contract with ST Environmental Services in Wakefield, Massachusetts, USA.*

Africa and Beyond

Peter Stewart Barton *informs me that he is now in Australia waiting for further career developments after serving for 16 months as Projwct Managerfor the rehabilitation of the Soroti Agricultural Implements and Machinery Manufacturing Company (SAIMMCO) in Uganda. (See The Agricultural Engineer, 48 2, Summer 1993).*

The Uganda project was funded by the United Nations Industial Development Organisation and the United Nations Capital Development Fund. The management was awarded to Hassell & Associates of Canberra, Australia who, in turn, employed Stewart as an independent Agricultural Engineering Consultant.

Hassell & Associates also took care of the design and supervision of the civil works by recruiting the assistance of a Ugandan company, Kagga & Partners. The Agrisystems organisation of England and Sweden also had an input, mainly by the provision of of personnel.

The rehabilitation of SAIMMCO included re-roofing, re-flooring and extending the original factory (the original building dates back to the 1960s), installing new machine tools, and training the workers in improved manufacturing technology. The products of the rehabilitated factory will include animal-drawn ploughs, seeders and weeders, ox carts and hammermills.

Stewart tells me that since becoming an independent Agricultural Engineering Consultant, he has worked in over 20 countries both on long and short-term projects. The geographical locations have extended from Turkey to Korea.

I have further news of **A G Chadborn** *(see The Agricultural Engineer 48 3, Autumn 1993) who, incidentally, was the only other Institution member Stewart Barton met whilst in Uganda.*

A G Chadborn and his wife are now settled in a homestead of thatched mud-block huts in a rural area. They are involved in encouraging local rural industry in projects such as beekeeping, and the manufacture of hardware for making ox carts, improved cooking stoves and kitchen equipment, also toolmaking for carpenters and blacksmiths. They are also concerned with AIDS awareness training and with advice on loans and grants for small businesses.

It is good to know that you are both settled and I wish you continued success with our ambitious and worthwhile projects!

Write to Tony with your news ! His address is:
32 Beverley Crescent, Bedford MK40 4BY. *Ed*

Canadian opportunities for Incorporated Engineers

A major advance has been made towards worldwide workforce mobility by the signing of a reciprocal agreement between the Institution of Mechanical Engineers (IMechE) and the Institution of Electronics and Electrical Incorporated Engineers (IEEIE) with the Canadian Council of Technicians and Technologists (CCTT), a federation of ten professional associations which represent the interests of engineering and applied science technologists and technicians in Canada.

The agreement mutually recognises the criteria for membership of the British and Canadian bodies and will enable reciprocal membership on both sides of the Atlantic.

For further information contact Bill Abraham on 071 799 1808.

John Deere on Video – Two Cylinder Tractors, Volumes I and II Farming Press Books and Videos, Ipswich IP1 4LG.
£14.95 each volume

These two videos tell the story of the John Deere two cylinder tractors from their beginnings, just over 100 years ago to the present day.

The story starts with the Froelich tractor of 1892 which was the earliest ancestor of all John Deere tractors. The Waterloo Boy is featured with some superb examples from America, Canada and Britain. Each model throughout the range is mentioned and there are some excellent collections presented. The full set of stationary engines is also featured and the video finishes with the two latest models, JD7800 and JD8970, outside the Waterloo works.

The presenter, Michael Williams, author of ten books on tractor history, encourages the owners to explain the interesting features and detailed history of their tractors.

If you are a John Deere enthusiast, then these videos are a must. If you are just an ordinary tractor enthusiast, you will be fascinated. JK

European Engineering Year book 1994 Cambridge Market Intellence Ltd, London House, Park Gate Rd, London SW11 4NQ.
£10.95

This yearbook is the result of a new initiative by FEANI, the European Federation of National Engineering Associations. It is designd to provide a yearly review of developments and issues in European engineering as well as to promote the opportunities for training and career development across Europe.

This first edition of the yearbook contains articles by engineers from almost 20 European countries and focuses on key issues facing the profession and the latest developments in engineering, education and training.

Primary cereal processing by B Godon and C Wilm (Eds) –ISBN 1-56081-609-0 – Pub: VCH, New York. 544 p; 263 figs; 119 tables.
£96

This book synthesises scientific, technical and economic data on primary cereal transformation and presents a comprehensive account of the milling and post-milling processing industry. Coverage explores unitary operations and equipment, milling and post-milling techniques, dust explosion hazard reduction and recent developments in computers and automation.

New British Standard for Hand Torque Tools BSI Consumer Services, Lynford Wood, Milton Keynes MK14 6LE.
£30.50 (£15.25 to BSI subscribing members)

BSI announce BS EN 26789: 1994, assembly tools for screws and nuts – Hand Torque Tools – requirements and test methods.

Environment Encyclopedia and Directory European Publications Ltd, 18 Bedford Square, London WC1B 3JN.
Price: £175

This publication reflects the awakening global awareness to ecological and environmental matters. Over 400 large format pages of the most current information is presented. This includes an A –Z glossary of key terms, a comprehen-sive directory, and an extensive biblio-graphy, detailed maps and a Who's Who.

Updated Guidance on Access to Effluent Stores on Farms HSE Information Centre, Broad Lane, Sheffield S3 7HQ

The HSE has issued a revised guidance on access to effluent stores on farms. Agriculture Information Sheet Number 19 – Preventing access to storage and similsar areas on farms. It provides advice on acceptable standards of child-resisting fences around effluent and other liquid storage areas on farms.

MAFF Research Strategy MAFF Publications, London SE99 7TP
£5 each (five publications)

MAFF has published five documents outlining development research needs through to 1996. They cover the environment, arable crops and horticulture, animal health and welfare and livestock products, fisheries and the aquatic environment and food. They serve as guides to prospective contractors wishing to submit research proposals to the Ministry.

Hydrological Data UK The 1988 – 1992 Drought by Marsh, Monkhouse, Arnell, Lees and Reynard, Institute of Hydrology,
£20 (inclusive of postage)

The drought of 1988 – 1992 has provided a sharp reminder of the conflicting demands on the water industry, and the continuing vulnerability of the English lowlands in particular to unusual climatic conditions. The drought has, however, helped to provide many useful insights into both the scale and scope of the water resources and environmental problems caused by long-term deficiencies and the strategies needed to combat them; these are expected to prove especially valuable in the search for viable sustainable development options against a backcloth of climatic instability.

European Pumps & Pumping' - A Pump Reference Book and Buyers' Guide CHW Roles & Assoc Ltd, PO Box 25, Sunbury-on-Thames, Middlesex TW16 5QB
£89 incl. postage and packing.

Formerly titled 'The British Pump Market', 'European Pumps & Pumping' is the unique and practical reference book and buyers' guide of European manufacturers and suppliers of pumps and auxiliary equipment. It includes for example, new ISO International Standards and EN European Standards and both rotodynamic and positive displacement pumps are covered in depth.

This book is an aid to everyone who uses pumps and wants to know how to select a pump and auxiliary equipment, such as packings, couplings, belt drives, gearboxes, motors, etc.

Although basic theory is comprehen-sively covered, this is a practical book and not simply another textbook on pumps. It is aimed at users of pumps and pumping equipment and covers the needs of process engineers and designers, pump operators, mechanics, works managers, maintenance engineers, purchasing managers and specifiers, as well as students and many others.

Membership

Admissions – A warm welcome to the following new members:

Associate Member: A Adu-Sarkodie (Middx); J F Favier (Tyne & Wear); S Gould (Derbys); J C Puddifoot (Nepal); E J Ratcliffe (Staffs); A Tzivanopoulos (Greece)

Student: L C Ashmore (Essex); L A Bamford (Cambs); J M Bellarby (London); A T Glazenbrook (Beds); E J Hughes (Beds); S J Ridley (Herts); L W Thomas (Wales); R J Todd (Cumbria)

Companion: E B H Martyn (Hampshire)

Associate: J Nemeth (Cumbria)

Transfers – congratulations on achieving a further phase of their professional development to:

...to **Member:** E A Hammad (Sudan); P Joyce (Cambs); V P Redfern (W Mids); G Tembo (Beds); G P Wardle (London)

...to **Associate Member:** G E Broughton (Kent); H G Thomas (Wales)

...to **Associate**: T A Ijir (Hants); S J Ridley (Herts)

...to **Student**: T E Horlock (Herts)

Re-instatements

M S Clarke (Shropshire)

Death – with great sadness we report the untimely death of: D W Balls (Essex).

Engineering Council registrations – congratulations to the following on inclusion on the register of professional engineers:

IEng J U Attah (Beds); C Heaney (Scotland)

EngTech G E Broughton (Kent)

Movements – members who have changed their address except where they remain in the same English county or, elsewhere, in the same country. We hope the move has proved beneficial.

H L Back (Norfolk to Uganda); P S Barton (Uganda to Australia); J F Browning (Devon to Philippines); H S G Cholmeley (Berkshire to Lincolnshire); H D Cooper (Essex to Belgium); C Dilley (Gloucs to Hants); R G Donald (Northumberland to Wiltshire); G N Foster (Tanzania to Lancashire); M A M Gatward (Northumberland to S Africa); D K Gbadamosi (Berkshire to London); N R Houseman (Stafford to Hereford); T A Ijir (Hampshire to Nigeria); B A Kendall (Wiltshire to Somerset); A H Knibb (Bucks to Ireland); R A Landen (Beds to Herts); C McKenzie (Saudi Arabia to W Mids); D J Mattey (Herts to Scotland); M T Payne (Tyne & Wear to Somerset); A J Sadler (Scotland to Yorks); A R Scott (N Ireland to Warwicks); B D Shead (Yorks to Wilts); M van der Matten (Surrey to Berkshire); J C L Welwood (Scotland to Albania).

French Honour for European achievements

To further prove our membership is not insular, **Brian Fraser-Smith** has been awarded a major French honour. He is now a Chevalier du L'ordre de Merite. He was presented with this award by the French Commissioner on 15 June. He receives it for his services to European Agriculture. This award is rarely made to non-Frenchmen, so it is an especially unusual honour.

Brian is a working President of the Trades Federation known as CIDE (Commission Intersyndicates de Dehydrators European). Representing some 95,000 Farmer Producers, 255 Co-operatives and 345 Drying Plants from 12 European countries, the work of the federation is partly political and partly technical, involved in environment, cropping, production, animal nutrition and marketing.

Brian Fraser-Smith of Aylescott Farms and Driers, Burrington, North Devon (350ha of permanent pasture) has been in intensive dairying with his father for many years. He started drying grass in 1968 and now produces annually some 4500 tonnes of dried grass and 7000 tonnes of specialised dairy and sheep feeds based on dried grass. Formerly President of BAGCD (the British grass driers association), Brian has, since 1989, been President of CIDE. He is a Companion of this Institution and Chairman of our SW Branch. He is also a Freeman of the City of London.

An innovator, Brian has received awards on energy conservation and he has been involved in the development of agricultural machinery, cattle housing and slurry management.

Our thanks to J P Dickson, General Manager of Aylescott Driers and Feeds, for this citation and our sincere congratulations to Brian on gaining this prestigious honour.

Obituary

Andrew Griffin MIAgrE

It is with sadness and regret that I write regarding the tragic death of Andrew Griffin whilst on holiday near Alicante in Spain with Louise Mitchell, his friend and colleague.

Andrew would have been 50 years of age in October. He had decided to take early retirement from ADAS in November of this year and had been working extremely hard recently to meet ADAS targets. He had well earned a holiday. (Alas it was not to be. He flew to Spain on Thursday, 9 June and had this tragic accident the following day).

I have known Andrew for 25 years. We attended Writtle College of Agriculture and Horticulture together in 1968/9 and we also met up at Silsoe College in the late 70s on different courses. I joined him later at the Taunton office of ADAS in 1987 and have worked in the same room with him for the last few years. We both joined the Institution of Agricultural Engineers at Writtle and we both received our 25 year Membership Certificates the week Andrew died.

Andrew Griffin was without doubt one of the best Soil and Water Engineers in ADAS, if not in the UK. He always had about a dozen jobs on at any one time but never let anyone down. (He was always dependable but of late he had become unsettled with the working environment and had decided to make a new life for himself. He even mentioned settling down to have a family).

I will miss him greatly, especially his dry sense of humour. I'm sure Brompton Ralph in Somerset will miss his involvement in village social events which he helped organise with his long-standing friend, Hazel Scott. He had many friends scattered all over Britain. He also had diverse interests – he had a collection of clarinets and a number of old antique engines, one of which is still on its working site near Taunton, Somerset.

Andrew was a 'one off' and did not deserve to go this way. His death will leave a yawning gap for any aspiring Soil and Water Engineer to fill (if it's at all possible to follow him, that is). If anyone wishes to contact myself or the Griffin family to pass on their condolences, however late, you can reach me at ADAS, Taunton (0823) 337922 Ext 3003. **Peter Hull**

CAD's a GAS !

Herts & Essex Branch

Richard Langley was at the February meeting of the Branch – though not without a little trepidation ! The meeting place was Writtle College's new Design Centre; the host for the evening was Graham Thompstone.

Richard's style is far better than mine so I'll let him tell the tale:

We ..... had little idea of what to expect, but our worst fears were soon confirmed when Graham asked us each to sit in front of a computer terminal. The next two hours were spent intensely experimenting with a few basic CAD techniques. (I'll leave out the bit about being shown how to use the kit by Ag Eng undergrads – that's just too humiliating for the proud members of the H & E Branch !)

Within a short time, Graham had us all moving buildings around an imaginary farmyard and attaching a loader and a plough to a tractor – there were some really strange ideas of where a plough should hitch onto ! The next phase was to produce our own drawings. This was a bit of serious engineering drawing – joining the dots – but someone had forgotten to number them !

Landscape design

Our final exercise was for the creative members in our midst — a landscape design project. Given a house, a driveway and a field, the objective was to supply plants, trees and a pond in whatever numbers we wished. Inevitably there was all sorts of abuse and licence — how one member managed to get all those juggernauts into his pond remains a mystery ! It was fascinating to view this landscape from different angles and perspectives, and to see what a mess we had made !

In conclusion, Graham demonstrated some extremely clever CAD programs, including an imaginary walk through a garden and a trip down Colchester High Street. This was a 'different' and most enjoyable evening's meeting.

Thinking at the beginning

Wrekin Branch

The introduction of a new product is fraught with problems, most of which are caused by the failure of the management to foresee those problems before they become reality.

Working together

No-one can see into the future but intelligence and experience can, if asked, assist anticipation. It was this latter point thatt Chris Jeffrey implored companies to adopt in a paper to the Branch entitled "Concurrent Engineering". Chris was formerly a director of F W McConnel and is now a Management Consultant.

The principle of Concurrent Engineering is multi-disciplinary team-work, breaking down the 'traditional' barriers that exist in many manufacturers premises and which so often result in late delivery, poor development and poor reception by the customer. Within the term are a number of initiatives which contribute to the whole and Chris outlined these in his paper.

The production team comprises representatives from design, marketing, finance, manufacturing, purchasing, even component suppliers and potential customers. It is headed by a Product Champion who reports directly to the Chief Executive. The key feature of this system is that development continues in parallel, not in a serial fashion as has been the case.

Ask the customer

Inherent in Concurrent Engineering is 'Quality Function Deployment', a technique for converting customer requirements into engineering specifications. Basically, it means 'ask the customer' – find out what the customers really value in that type of machine and invite them to assess the prototype.

Allied to QFD is DFMA –'Design for Manufacture and Assembly' – which demands the opinions of the people who will make, service and repair the product, again considered in parallel from an early stage.

Assessing effect of failure

But even the most carefully designed machine will suffer from failures at some time in its life, and estimating the likelihood of these is an essential part of the production process. Enter 'Failure Mode and Effect Analysis', a mathematical means of determining how a failure will affect the machine's performance.

A very interesting evening, one that comes highly recommended for a Branch meeting topic. You could, indeed you should, be busy, Chris, for our industry's sake! It begs the question, though, why wasn't this done 50 years ago?

Stopping the rot

Herts & Essex Branch (R L)

Corrosion was the topic, Clive Pearce the speaker. Clive works for the Anochrome Group in Wolverhampton who carry out functional, engineering, decorative and corrosion resistant coatings ('finishes') for many different industries. Around 50percent of their work is fasteners of one sort or another.

There are a number of reasons why finishes may be put on steel:–

- to enhance appearance;
- to inhibit corrosion;
- for identification;
- to improve mechanical performance;
- to make it non-conductive or, alternatively,
- to improve conductivity.

Clive reviewed the range of coatings available, starting with those for corrosion resistance.

Zinc plating – used since the early 19900s, a thin film of zinc is applied electrostatically, around 8 microns thick. The zinc is sacrificial – it is attacked in preference to the steel. *Yellow Chromate* is a better coating, it lasts longer but it does not conduct heat so well. *Cadmium* can be used to the same effect as zinc. Where electrolytic deposition is used, Clive warned that 'hydrogen embrittlement' can occur – the components become brittle. This is something that designers must bear in mind when specifying the process.

Other finishes mentioned in his paper were: *Barrier coatings* (eg. paints) – physical damage being the problem here; *Mechanical Plating* and *Mechanical Galvanising* – both sacrificial.

Testing corrosion resistance

Clive went on to describe the 'Salt Spray Test', a method used to accelerate the effects of corrosion. Typically, parts will last 120–240 hours before corrosion sets in.

Dacromet 500 is relatively new, it is a sprayed-on coating of zinc and aluminium with boundaries of chrome, oven dried to harden the coating. It is water-based, highly penetrative, it will withstand high temperatures and at least 4000h salt spray. *Xylan* is another "new" coating which gives good corrosion resistance (200 hours in a salt spray) with controlled lubricity – ideal for hinge-pins and studs. It is applied by spray or dip techniques.

Clive's review continued with such coatings as *Hard Chromium Plating* (good wear resistance, poor corrosion resistance); *Electroless Nickel* (expensive, but better than chromium plating) and *Phosphate* – a chemical conversion coating. Zinc phosphate is the norm but manganese phosphate gives a better 'torque-tension' relationship making it preferable for torque sensitive situations such as cylinder head bolts, and as a 'running in' compound on crankshafts and the like. Torque-tension is another factor that designers must take into account.

Safe waste disposal

In conclusion to this highly technical evening, Clive described the steps his company is taking to dispose of factory waste and he looked to the future – to the variety of zinc alloys that might replace straight zinc as a coating to stop the rot.

Paper chase

Wrekin Branch (D C)

What happens to Barclays Bank internal mail, or surplus Ford Sierra workshop manuals in Italian, or thousands of unused City & Guilds exam papers, or more mundanely – your 'daily' when the news is history? Chances are they're recycled into corrugated cardboard boxes, and chances are that the Wrekin Branch saw it happen! (well, fifteen of them did anyway).

The site was the factory of Smith, Stone & Knight in Birmingham; the event – the summer visit of that Branch, now a firm favourite in the calendar. In the middle of the July heat-wave (remember that ?) the assembled viewed the prospect of entering an even hotter and more humid factory with some trepidation but, once inside, all that was forgotten, inquisitiveness dulled the senses.

The company has been making paper for over 130 years, the last 50 of them devoted solely to recycled products – 480 different types of cardboard! Over 3000 tonnes of waste paper is pulped per week and fed onto one huge production line producing around 30t/h in 'large reel' form up to 0.75t each, with lengths often exceeding 8km, representing 16% of the UK market.

The speed of production was impressive, as was the computer monitoring and control installation developed specifically for the factory. Such is the automation that only 140 people work on site in three shifts.

Power for the factory is part bought-in, part generated in-house with an Allison gas turbine running on gas. Management is very much team-based with the customer featuring prominently in the production process. Water for the pulping function is drawn from an on-site bore-hole and it, too, is recycled via repeated filtration units where possible.

The series of summer visits to supplement the winter indoor programme has proved a resounding success for the Branch, this one no exception. Thanks to Alistair Taylor for setting it up and to our guides for the evening, Colin and Tony, for their informed and informative commentary.

UK farm incomes rise

"Farm Incomes in the United Kingdom 1992/1993", published by HMSO, contains results of surveys into the levels of farm incomes on different types of full time farms. The main changes recorded are as follows:

Dairy farms – In 1992/93 average net farm income rose by over 20 per cent in Scotland and Wales, 30 per cent in England and by nearly a half in Northern Ireland. Further increases, ranging from 10 per cent in Northern Ireland to over 40 per cent in Scotland, are expected in 1993/94.

Cattle and sheep farms (Less Favoured Areas) – Following large rises in 1991/92 (except Scotland), average net farm income rose in 1992/93 by amounts ranging from 22 per cent in Scotland to 57 per cent in Northern Ireland. These rises caused by the effects on prices and subsidy payments of the change in the value of sterling and the devaluation of the green pound. n 1993/94 average incomes are expected to rise significantly in Great Britain, but more modestly in Northern Ireland.

Cattle and sheep (lowland) farms – In England and Scotland average net farm income rose by 50 per cent and 60 per cent respectively. In Wales, where these farms are few, the increase was only 7 per cent. All three countries expect increases of over 40 per cent in 1993/94 mainly because of higher returns to sheep.

Cereal farms – Average net farm income rose by 34 per cent in England in 1992/93 because of higher prices and lower fertiliser costs. In Scotland average income was nearly three times higher following a poor year in 1991/92. Incomes are expected to fall in 1993/94 with the inclusion of a set-aside requirement under the Arable Area Payments scheme and lower crop yields in Scotland where the harvest in 1993 was notably poor.

General cropping farms – Despite a steep fall in potato prices compared with 1991/92, average net farm income increased by 7 per cent in England and by 47 per cent in Scotland (from a low base). Set-aside requirements and the poor harvest in Scotland in 1993 look likely to reduce incomes in 1993/94.

Pigs and poultry farms – For this group of intensive livestock producers taken as a whole, the higher prices for finished pigs more than offset the effects of lower egg prices and feed and other cost increases. This lead to a 12 per cent rise in average net farm income in 1992/93. The recent low pig prices have led to a significant fall in incomes in 1993/94 despite a more favourable start to the year.

Horticultural holdings – A 4 per cent drop in the value of output combined with a 5 per cent increase in input costs led to the average net farm income in England falling by 62 per cent in 1992/93.

We hear that ...

Chris Mussellwhite, late of Silo and Storage Systems Ltd., has teamed up with three colleagues to form BDC Systems Ltd. The aim is to provide grain and storage expertise and equipment to customer requirements. Chris will be providing sales, service and technical advice to northern and eastern parts of England so, if you need some help with a grain handling installation, contact can be made through BDC's head office at Prospect Farm, Monxton, Hants SP11 7DA (Tel: 0264 710900; Fax: 0264 710987).

It's the middle of summer (at least it was when this was written!) but one member's thoughts are no doubt firmly fixed on December. That member is **Bob Friedlander**, Commercial Operations Director of New Holland Ford for the UK and Ireland, who has taken on the Chairman's role for the 1994 Royal Smithfield Show. Bob's track record should ensure that this year's Smithfield should be the best ever!

Roger Hay is a CBE

Roger Hay CBE

Roger has been the driving force behind the Forestry Engineering Specialist group since its inception, and a fervent supporter of the Scottish Branch. We're proud to have him in our ranks.

GET-AWAY

Could you use an eight-week overseas study tour, studying those things that interest you, all expenses paid?

You could? Try the Winston Churchill Memorial Trust Travelling Fellowship for starters. Each year, opportunities are offered to British citizens to widen their experience, make contacts abroad and bring back knowledge to this country for the benefit of their work and/or the community.

The Travelling fellowships are available to applicants of any age and from all walks of life irrespective of academic or professional qualifications.

About 100 awards are made every year. If you would like to be considered for this coming year write for an application form to: The Winston Churchill Memorial Trust, 15 Queen's Gate Terrace, London SW7 5PR (enclosing a 220mm x 110mm s.a.e.).

The closing date for applications is 24 October, so don't delay.

Agra Europe launches Agrafood Asia Newsletter

A new monthly newsletter has been announced by Agra Europe (London) Ltd. It provides a comprehensive source of information about South-east Asian agriculture and food policy, production, trade, consumption and company news. The region's economies offer huge potential for development for food companies.

The newsletter covers China, Hong Kong, Japan, Indonesia, Taiwan, Thailand, Vietnam, Singapore, South Korea, Malaysia and the Philippines. Reports in the first issue show that, while rapid growth may be a common factor to all these countries except for Japan, in almost every other respect the economies are diverse. Gross Domestic Product per head, for example, ranges from US$30,000 in Japan down to less than $500 in China, Indonesia and Vietnam.

Further details: AGRA EUROPE LTD, 25 Frant Road, Tunbridge Wells, Kent TN2 5JT (Tel: 0892 533813)

Copier contracts chicanery

Many businesses have fallen foul of cost-per-copy photocopier contracts that have turned out to be extremely expensive in the long term and appear to offer no respite. These contracts were often secured by dubious sales techniques.

The Department of Trade and Industry, in conjunction with the Ofice of Fair Trading, has recently investigated the practices used and come up with a report which offers some help to those ensnared.

One company of consultants has taken up the fight against the 'copier rogues and is offering its services to businesses with such problems. If your company would like to get out of a seemingly water-tight photocopier contract it might be worth giving them a call. The person to speak to is Jackie Raven at F & M Consultants Ltd., their number is:- Tel: 071 404 4638; Fax: 071 831 6743.

Dowdeswell 6 metre power harrow

Dowdeswell Engineering Ltd has introduced a 6m wide power harrow with hydraulic folding to enable safe, convenient and speedy movement between fields and along public roads.

The new machine comprises two 3m standard units, each connected to an hydraulically-folded main beam by a pair of floating links. Folded width is 3m with a mechanical safety lock for transport.

Each harrow unit's 12 rotors are shaft

and gear driven from a central splitter gearbox. Several rotor speeds can be selected by interchanging gears within each power harrow's gearbox.

Maximum power input is 250hp with dry plate safety clutches providing protection for the machine and the tractor.

Dowdeswell Engineering Co Ltd, Blue Lias Works, Rugby, Warks CV23 8LD (Tel: 0926 817494).

Massey Ferguson take over

Massey Ferguson Group Limited announced in April that all of its shares are to be sold by its parent company, Varity Corporation of Buffalo, New York, USA, to AGCO, of Duluth, Georgia, USA.

The decision results from Varity Corporation's intention to concentrate its focus on its automotive and diesel engine OEM component and systems sectors.

All the Massey Ferguson business world-wide is to be transferred to AGCO debt-free. In previous transactions, AGCO acquired all Massey Ferguson's North American distribution business and the Agricredit Acceptance Corporation.

Agco is a holding company with a strong focus on agricultural machinery manufacture and marketing. AGCOs commitment is exclusively to the agricultural machinery sector with several established brands which include Hesston, Allis, Gleaner and White. The industrial and commercial elements of AGCO and Massey Ferguson are entirely complementary. Combining AGCO and Massey Ferguson creates a substantially more powerful global force.

New courses at Silsoe College

Three new MSc programmes and two BSc lines of study are being offered by Silsoe College from this September. The MSc's are in: Environmental Monitoring; Water Policy and Management; and Environment and Landscape Engineering. The undergrad courses are in: Environmental Management and in Business Management and the Environment. Contact Margaret Merredy at the college (Tel: 0525 860428, ext421) for details.

Gone Away!

R J Hirst's mail is being returned to the Secretariat. If anyone knows of his present whereabouts would they please inform the Secretariat. His last known address was:

164 North Park, Fakenham, Norfolk.

Portable band-sawmill brings economies and environmental bonus

A Wood-Mizer LT 40 HD portable band-sawmill annually cuts the best of 200 diseased elm – and some beech and Corsican pine – into planks, posts and re-saleable timber in Glasgow City Council's Pollok Country Park.

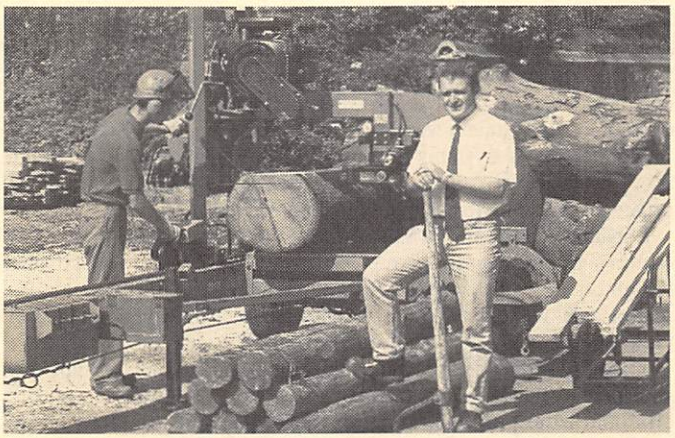
The elm logs are cut on the spot and they are subsequently used for fences, buildings (including a gazebo), bridges, etc in Pollok Country Park and in other council amenities. Previously the Parks and Recreations department burned or buried 90% of the wood.

Introduction of the Wood-Mizer LT 40 reduced cross-cutting and burning by 75%, offering significant money savings.

The 1.4t portable sawmill is simply towed behind a tractor out to felled trees, which are up to 20 feet long and weigh up to 2.5t each.

The mill's 1.00mm-thick cutting blades are claimed to yield 30% more wood than conventional saws, to produce 60% less sawdust and to require lower power with a consequent fuel saving.

Marlwood Ltd, PO Box 2, Edenbridge, Kent TN8 7JX. Tel: 0342 850874.



Compression-Injection moulding process from Oxford Plastic Systems

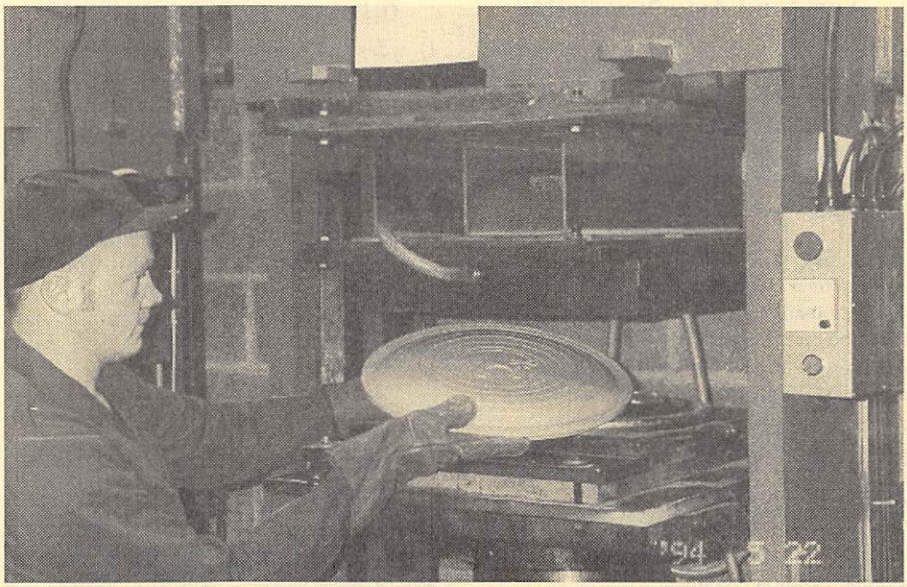
Oxford Plastic Systems has developed a Compression-Injection moulding process for Thermoplastic and Thermoplastic composite products. The cost of tooling is cheaper than for injection moulding allowing short production runs to be cost effective.

A further benefit is that the process can tolerate recycled materials from differing industries.

Oxford Plastic Systems offers a service in subcontract Compression-Injection Moulding to a wide range of industries. It undertakes development work for companies interested in the substitution of products at present manufactured in other materials such as metal, wood and rubber.

The twin process of Compression-Injection moulding and machining is also being developed, offering cost saving advantages against total machining.

Oxford Plastic Systems Ltd, Unit 2A, Enstone Airfield, Enstone, Oxon (Tel: 0608 678781; Fax: 0608 677029).



Manufacture of container lids by Oxford Plastics Systems using the compression-injection moulding technique.

Small wonders in microengineering

Have we any microengineers in our midst ? Before anyone admonishes me for referring to those disadvantaged in stature in this manner I hasten to add I am refering to the world of design, production and use of very small three-dimensional systems. It is this sphere of work that Professor Howard Dorey is involved in. Professor Dorey is the Chairman of the UK Microengineering Common Interest Group and would like to hear from any agricultural engineers who are working with these devices or who are interested in doing so. (Tel: 071 225 8532).

Festival of Food & Farming Event postponed

In January this year, the organisers of the Festival of Food & Farming announced that they were seeking a new sponsor for the 1995 event. A new sponsor has yet to be found and the event originally planned for May 1995 in Hyde Park is being rescheduled for May 1996.

Sustainable effort

Tucked away in the Thames Valley is a seven-acre smallholding devoted to training East Africans in the principles and practices of small scale organic mixed farming in a way that is relevant to the tropics.

This smallholding is run by the Kulika Trust, a charity working primarily in East Africa in the fields of community development, social development and education. in particular, the Trust devotes significant resources annually to the sponsorship of East African nationals in higher education both in Africa and the UK. Alhough the majority of the work at Warren Farm, the name of the smallholding, is concerned with training East Africans, day and short courses can be arranged for other groups.

Contact Andrew Jones, the Trust's Director at Warren Farm, Rectory Road, Streatly, Berks RG8 9QE for further details.

On the map

The Careers and Occupational Centre, part of the government's Employment Department Group, has published a series of booklets each focussing on specific areas of work. The are known as the 'Working in' Series and are aimed at school leavers and job hunters.

Working In No 92 deals with Agriculture and Horticulture and provides a dynamic image of these two broad industries and the career prospects. Agricultural engineering has its own section and, in the form of a 'case study', features the work of one of our members – Kate Cook IEng MIAgrE.

Kate is employed by Epping Forest District Council as a Field Engineer with a specialism in land drainage. The article describes some of Kate's duties and achievements, it is well written and should generate interest in our profession. It certainly puts us in a prominent position, something that has been sadly lacking in other general career literature.

Low light camera for CCTV systems

Mitsubishi Electric UK Ltd (Tel:0707 276100) announce a new, compact camera capable of providing high quality displays in poor lighting conditions down to 1lux is being introduced in response to customer requests for CCTV systems for use in adverse lighting conditions. The camera weighs 400g and measures 105x62x46mm.

Mobile CCTV systems eliminate the problems caused by blind spots at the front, rear or side of a wide range of vehicles, enabling drivers to manoeuvre accurately in complete safety.

Mitsubishi System CV-552 comprises a 1lux, wide angled, CCD camera and a monochrome monitor featuring contrast and brightness control for day or night time operation. Positioned on the rear or side of the vehicle, the camera provides an extensive field of view from directly below to 15m horizontally away.

The all-weather cameras are lightweight, rugged and completely shielded in airtight and waterproof cases. Solid state circuitry eliminates the problems of after image and burn-in from bright sunlight.

Optional equipment includes multi-camera switching, a washing system to clean the camera lens and an impact resistant, polycarbonate cover. C-Vision cameras can also be supplied with a motorised, protective shutter which is activated at switch-on.


Allan Langley


Denis Cartmel


Geoff Baldwin

Editorial changes in the journal


Eoin Martyn


Ian Gedye

The Institution depends heavily on the work and enthusiasm of those responsible for the production of the Journal and Newsletter and we would like to record our sincere thanks to three people in particular.

Allan Langley, who has long been associated with the Journal and service on the Editorial Panel, will complete his stint as Honorary Editor with the production of this issue. He has brought wisdom and good judgement to the job, continuing and raising the standards set by his predecessors.

Denis Cartmel is also standing down after seven years as Newsletter Editor and now 'Membership Matters' Editor within the Journal. As is appropriate for the part of the Journal that is largely concerned with the pleasure of belonging and knowing people within the Institution, he brought it all to life and stamped his own cheerful and energetic personality onto every issue. This responsibility is now being taken over by **Ian Gedye**, recently retired as Head of Agricultural Engineering at Harper Adams.

Finally, our Production Editor, **Geoff Baldwin**, will retire at the end of September. He came to us when SAWMA amalgamated with the Institution, and brought with him the high production standards that had been associated with the SAWMA Journal. Geoff is a Cambridge graduate in mechanical sciences, with long experience in the agricultural machinery manufacturing industry, and this background knowledge has been reflected in the quality production of our Journal.

The work of Editor and Production Editor is being taken over by **Eoin Martyn** from the winter issue, and he is keen to receive your paper for consideration for publication - preferably on disc, in almost any format, c/o the Institution Secretariat at Silsoe.

Brian Finney, Past President

Field meetings of the Soil and Water Management Specialist Group

Management of a landfill site

The landfill site at Compton Bassett near Colne is run on a commercial basis by Wiltshire County Council in conjunction with Aspinall & Co, Environment Management. This is the location of an experimental project exploring ways to reduce the cost of dealing with the leachate from the landfill material.

Mike Bart, the treatment scientist with Aspinall & Co, explained how the project has two main components.

Main treatment through aeration

The main component is a large lagoon designed to eliminate the bulk of the contaminates in the leachate. This operates on a batch system of 15 – 20 hours, in which time liquid leachate is aerated and digested by bacteria. After separation, the liquor is allowed to settle and the bacteria drop to the bottom along with any sediment, The top layers of liquor are then discharged to a public sewer (50m^3 per day licence).

Features of the system are that the COD and BOD of the liquor are in the order of 25–60,000 and 12,000 respectively.

This system reduces the oxygen demand by 95%, converting high ammonia content to nitrates. De-nitrification is an additional treatment which can be added to the treatment if required.

Jam by-products were used initially to get the bacteria started but are now no longer necessary.

We are indebted to David Russell for the details of these two meetings of the Soil and Water Management Specialist Group.

– outflow to sewage works for final treatment

The outflow from the main treatment lagoon, as described above still needs to be processed by the local sewage works before it can be discharged into any stream or water course.

The "water polishing" project

As a further development in the treatment system, a separate process, known as "water polishing" is being explored which gives an outflow pure enough to be discharged direct into the watercourse.

This secondary process uses a 10m^3 above-ground storage tank. Water flows by gravity at a controlled rate to be discharged via a stainless steel sprayer bar into a gravel bed. Reeds (*Phragmites australis*) line the bed and require no cutting or other maintenance. Liquor flows through the bed – which is contained and sealed) – to discharge directly into the watercourse.

The water polishing process takes 24 hours for each tank load to flow through the 100m^2 bed. Weed growth can be controlled by periodically flooding the bed from the discharge tank.

– temperature control essential

Temperature affects the level of bacterial activity in the lagoon. A drop of 10°C in temperature effectively drops bacterial activity by 50%. However, the landfill site discharges at some 8°C.

Magnetic flow gauges

Flow gauges are used on the water polishing plant – the magnetic types proving to be the most effective, although the most expensive. Elsewhere, the traditional type of flow gauges are installed to give the benefit of easy removal.

Less intensive farming

This LIFE (Less Intensive Farming and Environment) project is being conducted on a field scale at the RAC Harnshill Manor Farm, south-east of Cirencester.

Under the supervision of Long Ashton Institute of Arable Crops Research and jointly funded by MAFF and EC, the objective of the project is to evaluate, and to demonstrate to farmers and growers, a farming system demanding less inputs but with no reduction of overall gross margin.

Cropping and cultivations

Soil varies at the site from a Cotswold brash to a heavy clay loam. Two soil series have been identified by soil scientists. The crop rotation is : winter wheat, winter barley (they are thinking of moving into spring barley to control black grass), winter beans,winter wheat, set-aside and then oil seed rape.

Oats may also be included in the rotation. but where oats are grown, the straw is taken off as the volume is generally too great to be incorporated and causes problems with seed bed establishment.

For weed control, there is a single pass with a spring tine to get the seed germinated and this is followed with an application of Round-up (glyphosate).

The drilling of winter barley is delayed until mid-October to avoid problems with barley yellow dwarf virus. All other straw is chopped off the back of the combine.

Use of man-made fibre ropes for towing

Denis Welstead

Recently in Glasgow, a married man and father of three children was killed in an accident involving a man-made fibre tow rope. The polypropylene rope was attached to a tractor in order to pull out a log. The log pulled out of the ground and flew 40m through the air before striking him on the back of the head.

Stretching can be dangerous

'Snatch' towing of bogged down vehicles and pulling objects such as tree stumps using man-made fibre ropes is a dangerous operation and not recommended. When used for towing, this type of rope is liable to stretch by as much as 50%, particularly if the towing vehicle makes a 'snatch' start. This gives the moving vehicle extra energy to help move the machine or tree stump but the stretch rope acts like a large spring with a high recoil action and can become dangerous if the rope or another part of the tow line breaks or becomes detached.

When approaching breaking point, a man-made fibre rope gives no audible warning but the rope diameter noticeably decreases. On breaking, the violent recoil will be particularly dangerous if, for instance, a metal shackle or log is attached to it. Anyone in the path of the rope is in considerable danger and limbs have been severed by flying ropes in this type of accident.

D Welstead, Chairman of the Scottish Branch, is Senior Principal Inspector with the Health and Safety Executive.

The safety rules

- The safe working load of the rope should never be exceeded.
- Ropes attached to coupling points on machines should be provided with eyes fitted with thimbles.
- Everyone other than the driver of the towing vehicle should be kept well clear and never allowed to stand in the path of a rope under strain.
- The towing vehicle should be provided with suitable protection to prevent the driver being struck if the rope breaks.
- The rope should be securely attached to the towing vehicle and to the object being pulled.
- The rope should be attached to the towing vehicle as low as possible to reduce the risk of the towing vehicle overturning backwards – the cause of many deaths in the past.
- Ropes should be protected from unnecessary exposure to strong sunlight as this may weaken the fibres.
- Ropes should not be stored near boilers or heaters as fusing may occur.
- Joins in ropes should only be made by splicing and by an experienced person, as knotting can reduce the rope's strength by as much as 50%.
- Splices should be checked to ensure they are intact and can contain the number of tucks recommended by the rope manufacturer.
- Avoid contamination with battery acid, petrol, oil and hydrocarbon solvents.

Regular inspection essential

Man-made fibre ropes are popular because they do not rot and are much lighter and easier to handle than chain or wire rope. However, ropes of any material are liable to wear and suffer mechanical damage. Regular inspection, including turning to reveal all sides, throughout the length of the rope, is therefore essential to ensure the rope is still in good condition.

Observe safety rules

It is important that the proper safety rules are observed by both employers and user. These rules are set out in the panel.

Further guidance on the use of man-made fibre ropes can be obtained from the makers or from your local office of the Health and Safety Executive.

BOOK REVIEW

Avoiding Social and Ecological Disaster – The Politics of World Transformation
By Rudolf Baro
Gateway Books, Bath
£9.95 (paperback)

The title of this book indicates that it should be of interest to engineers and especially those concerned with agricultural and biological processes. Unfortunately, this is not so. The author, an ex-president of the German Green Party in the '80s, broke with his party and refused to compromise with electoral pressures. No wonder, as one of his concrete proposals seems to be to reduce world consumption to one tenth of its present level.

He considers our present civilization a 'Megamachine', founded on the logic of destruction which needs to be fundamentally changed if the world is to become a safe and happy place. I found it quite disturbing that the Green Party, once regarded as a serious political party with a considerable following in Germany and still aspiring to be so in many other countries, could, while not doubting the conviction and dedication of its believer, obtain the support of a great number of people for an ideology based in many cases on either unrealistic, obscure or unclear premises.

I do not believe that many agricultural engineers would find it worthwhile to read this book, which is both obscure and incomprehensible. In my view, while I fully accept that the world faces many daunting and potentially lethal problems, the only constructive way forward is pragmatic evolution rather than emotive revolution.

D S B

Factors influencing the mechanisation of UK agriculture since 1972

John Cracknell

The two decades since the UK joined the European Union have seen a major change in the nature and scale of national agricultural mechanisation. Discussions of agricultural mechanisation tend to centre on tractors, and should perhaps be more correctly termed as studies of 'tractorisation'. This concentration on tractors is inevitable given the importance of the tractor in UK agriculture – 75% of the UK agricultural machinery market is tractors. Whilst the number of tractors on farms in England & Wales has declined only slightly from the peak of 1983, annual registrations of new tractors have seen a marked decline from 1976 levels. At the same time, however, the total power on farms in England & Wales has almost doubled since the early 1970s. Average tractor power has increased from some 32kW to 53kW.

The adoption of larger, more powerful tractors has been seen as a process of substitution of mechanical power for labour as agricultural wage rates rise. This interpretation may not be strictly correct for the recent mechanisation of UK agriculture. There has certainly been a substitution of power for labour in UK agriculture, but this has been driven by the process of technological change altering the least cost combination of power and labour. This process is independent of the power/labour price ratio – UK agriculture would have increased mechanisation even if wage rates were static. Cropping patterns – in particular the increase of winter cropped land – have also influenced the man/machine balance in UK agriculture and encouraged further reductions in the labour force.

The early years of UK membership of the EU were a period of fundamental change in UK agriculture. The UK may now be entering another period of change due to redirection of the CAP, GATT, increasing environmental concerns and changing cropping patterns. In particular, agriculture is being moved away from the need to 'produce to be supported'. These changes may alter the level of mechanisation appropriate to agricultural production in the UK and pose new and difficult challenges for the agricultural engineering industry.

The process of mechanisation

The process of the mechanisation of agriculture in terms of tractors is well described by Witney (1988).

In the early stages of mechanisation, a fall in the labour force is accompanied by an increase in the number of tractors – one man and one tractor is replacing three men and three teams of horses.

As mechanisation progresses, there is a decline in the number of tractors, indicating that mechanisation is complete.

Tractor sales are now for replacement only, with larger, more powerful machines replacing older, smaller units.

Witney uses numbers of agricultural vehicles licensed to travel on public roads and average power of new tractors to trace the mechanisation of agriculture in the UK between 1945 and 1984. During the 1970s and early 1980s, Witney finds a declining number of tractors of all ages licensed, being partially offset by increasing average tractor power.

Tractor numbers and total power

An alternative, though not necessarily contradictory, view emerges from an analysis of the intermittent census of numbers of agricultural machines in the annual government publication, Agricultural Statistics, and of the number of new tractor registrations annually in *Business Monitor MM1*.

Surveys of tractor numbers in Agricultural Statistics are not perfect – it is left to the respondent to decide what constitutes a functioning agricultural tractor. Furthermore, the statistics are not collected every year and the figures for England & Wales, Scotland and Northern Ireland are collected separately.

Imperfect as these statistics are, the irregularities do not mask the overall picture. The data used in this discussion relate mainly to England and Wales, but give an indication for the UK as a whole (the last complete survey for the UK in 1980 showed 79% of the UK tractor fleet to be in England and Wales, 11.5% in Scotland and 9.5% in Northern Ireland).

Tractor numbers are presented by power class in the statistics (ie. 7-25kW, 25-40kW, 40-60kW and so on). This allows an estimate of the total tractor power in agriculture in England and Wales to be calculated.

Using the figure of 79% of UK tractors being in England & Wales, the total power

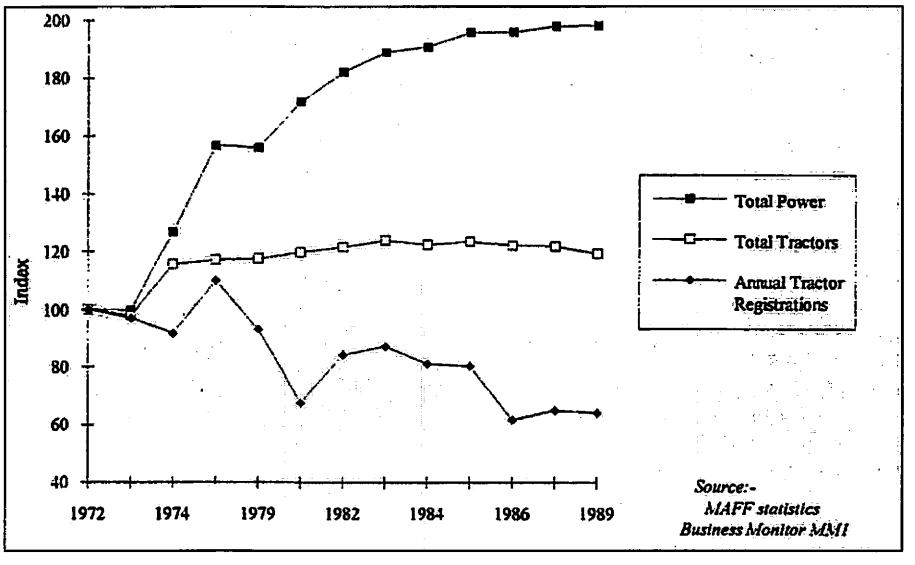


Fig 1. Tractor numbers, registrations and total power in England & Wales.

John Cracknell, 35 Meldon Avenue, Chase Park, Sherburn, Durham, DH6 1JY, is an independent consultant specialising in a wide range of topics including agricultural marketing, mechanisation and engineering, rural development and project management.

in UK agriculture can be estimated. Garden tractors under 7kW (9,040 in 1989) and tracklayers (8,480 in 1989) are excluded.

Total of UK tractors relatively static – but annual registrations show big fall

The results of this exercise are presented in Fig 1 in the form of indices (1972=100) for those years since 1972 when a machinery census was undertaken.

Data on tractor numbers in the early years are obviously suspect – 1974 shows a decline in registrations but an increase in total numbers. Nevertheless, the broad picture emerges.

Tractor numbers rise to a maximum of 412,000 in 1983, then fall away slightly to 396,000 by 1989. New tractor registrations peak in 1976 at 36,368, then fall to 19,348 by 1989.

This decline in tractor registrations has continued – less than 14,000 new machines were registered in 1992. However, the relatively static number of tractors in total and the falling annual registrations have been accompanied by an almost doubling of the total tractor power in agriculture in England & Wales from 10.5 million kW to 20.9 million kW (or, by extrapolation, some 26.5 million kW in the UK).

This is the trend, identified by Witney, towards larger more powerful machines. Average tractor power increased from 32kW to 53kW between 1972 and 1989.

Input substitution

Mechanisation has often been understood as a process of substitution of machinery for labour as wage rates rise. This process, dubbed input substitution by economists and illustrated in Fig 2, is discussed in most agricultural economics textbooks (Colman and Young 1989, Hill and Ray 1987, Ritson 1977).

In Fig 2, Q1Q2 is an *isoquant*, tracing the way in which mechanisation and labour can be combined to produce a given level of output Q.

If cultivations are considered, output Q would be measured in hectares worked/h (or/day/year or whatever).

In many developing countries, agriculture operates with very little machinery input but substantial labour input. This represents operating at or near to Q2 in Fig 2.

In developed countries, labour input to agriculture is much less, but many more machines are used. This represents operating at or near to Q1. Line ICIC in Fig 2 is an *isocost* line, showing the combinations of labour and mechanisation that can be purchased for a given fixed budget.

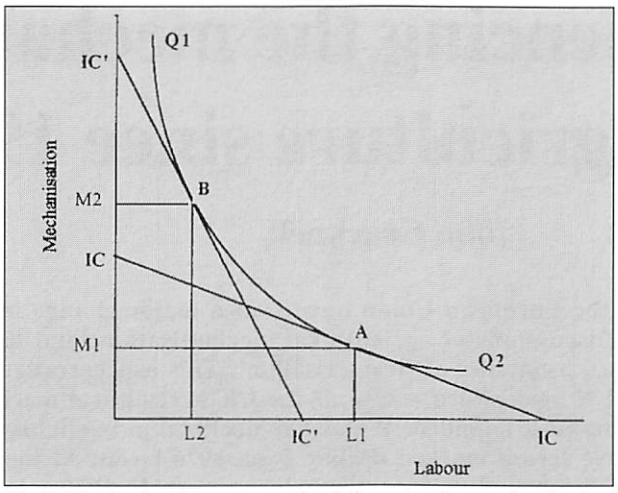


Fig 2. Mechanisation as a result of changing the mechanisation/ price ratio.

The slope of ICIC is the negative ratio of the price of labour to the price of mechanisation as follows:

Assume that the unit prices of labour and mechanisation are **Pl** and **Pm**, and the total budget for labour and mechanisation is **Bt**. If the entire budget is spent on mechanisation, **Bt÷Pm** mechanisation units can be bought. This is the intercept on the y-axis. If the entire budget is spent on labour, **Bt÷Pl** units can be bought. This is the x intercept. The slope of the isocost line is:

$$\frac{y\ intercept}{x\ intercept} = -\frac{\frac{Bt}{Pm}}{\frac{Bt}{Pl}} = -\frac{Bt}{Pm} \times \frac{Pl}{Bt} = -\frac{Pl}{Pm}$$

Least cost options determined by mechanisation/ labour price ratio

For any given labour/mechanisation price ratio, the least cost option is given by the point where the isocost line is tangential to the isoquant.

If labour is cheap relative to mechanisation, as indicated by ICIC, then the least cost combination is at point A, where a relatively large amount of labour is combined with a small amount of mechanisation.

A rise in the cost of labour(or a fall in the cost of mechanisation) rotates the isocost line to IC'IC', and moves the least cost combination of mechanisation and labour to B. Labour input is reduced and mechanisation input increased. Machinery has substituted for labour.

This machine/labour substitution arises as a result of an increase in the labour/machine price ratio – machinery is substituted for labour as rising wages cause labour to become more expensive

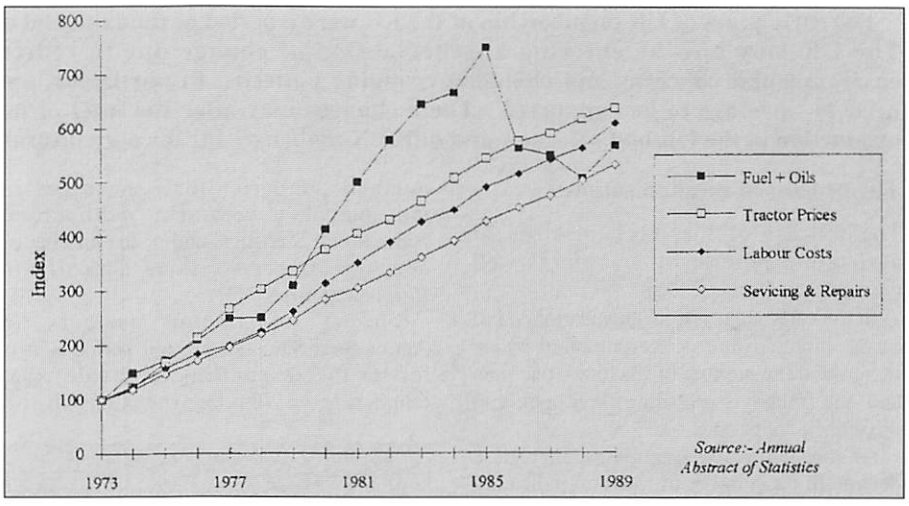


Fig 3. Tractor operating cost indices.

Table 1. Tractor and labour costs.

Year	*Tractor costs excluding labour £/h*				*Labour cost £/h*
	27 – 34kW	*35 – 47kW*	*48 – 66kW*	*67 – 90kW*	
1974	0.45	0.52	0.60	1.20	0.74
1976	0.94	1.09	1.26	1.97	1.13
1978	1.36	1.60	2.01	2.88	1.40
1982	2.21	2.63	3.28	5.16	2.42
1986	2.94	4.04	5.36	7.70	2.97
1988	3.23	4.25	5.55	7.93	3.34
1989	3.19	4.09	6.20	8.82	3.51

Source:– Nix, Farm Management Handbook.

relative to machines.

A much quoted example is that of increasing agricultural wages encouraging farmers to adopt fewer and larger tractors and associated mechanical equipment.

UK data available for the period 1972 - 1989 does not suggest that labour has become more expensive relative to tractors – if anything the reverse is the case.

Indices of purchase prices of the means of agricultural production and agricultural wage costs are calculated annually by MAFF and published in the Annual Abstract of Statistics. This allows indices to be developed for the labour and non-labour cost components of tractor operation. These indices are presented in Fig 3, with 1973 as 100.

From Fig 3, it can be seen that both tractor prices and fuel and lubricant costs have risen at a faster rate than labour costs. Nix calculates tractor operating costs excluding labour for varying sizes of tractor, and gives typical hourly agricultural labour costs as shown in Table 1.

Nix data allow labour costs as a percentage of total operating costs for varying tractor sizes to be calculated (Fig 4). For all tractor classes, the labour contribution to total operating costs has fallen since 1974. If tractor engine size is fixed, the labour/non-labour cost ratio of tractor operation has decreased since 1974 – labour is in fact cheaper relative to non-labour costs. This is partly a reflection of the increasing sophisticâtion of agricultural tractors over the last twenty years (eg. Q cabs, air conditioning, four wheel drive, improvements in transmissions etc. have all added to initial capital cost), and partly it is a reflection of the increased costs of fuel oils and lubricants in the 70s and early 80s.

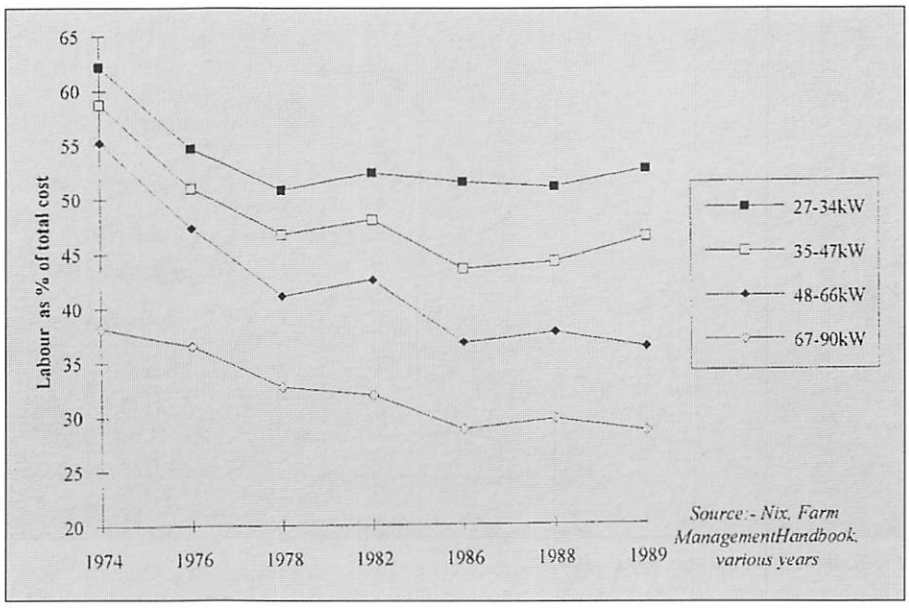


Fig 4. Labour as a percentage of total tractor operating cost by power class.

Technological change

Labour costs as a proportion of total operating costs do fall, of course, as engine size increases. This points to the more correct explanation for the adoption of larger tractors in UK agriculture, that of technological change.

A discussion of the process of technological change can be found in the agricultural economics textbooks cited above. Colman and Young identify the result of technological change as being:–

- more output can be produced with the same quantity of inputs (more land can be cultivated with the same level of mechanisation and labour input), or,
- the same output can be produced with a smaller quantity of inputs (the amount of mechanisation and/or labour required to cultivate a given area is reduced).

– neutral or biased change

Technological change may be *neutral* or *biased* (Colman and Young). This is illustrated in Fig 5. Initial isoquants and isocosts for a given level of output are QQ and ICIC respectively. Least cost operation is at A with L1 labour and M1 mechanisation.

Neutral technological change has the effect of moving the isoquant for the given level of output from QQ to Q'Q'. Least cost operation is now at B. Neutral technological change decreases the cost of producing a given output (B is closer to the origin than A) without changing the proportions in which inputs are used – the reduction in labour input from L1 to L2 is proportional to the reduction in the level of mechanisation from M1 to M2.

Practical examples of neutral technological change in agricultural mechanisation are difficult to identify. A possible example would be a system of one-pass cultivation based on a machine less complex than the standard plough/power cultivator combination. If both labour input and level of mechanisation to prepare a seedbed were reduced in equal proportions this could be seen as neutral technological change.

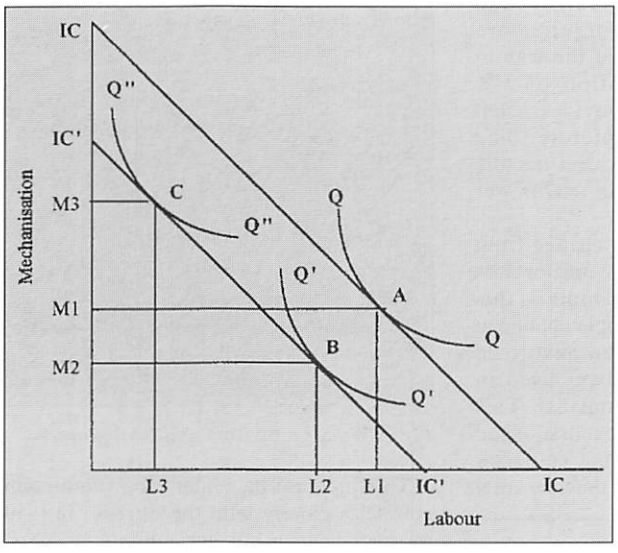


Fig 5. Mechanisation as a result of technological change.

The more normal case is that of *biased* technological change.

In Fig 5, biased technological change has the effect of moving the isoquant from QQ to Q''Q''. The least cost option to produce the required output is now at C, with level of mechanisation increased to M3 and labour reduced to L3. This is the case of the adoption of larger more powerful tractors.

If more powerful tractors and larger associated powered machinery are seen as a higher level of mechanisation, biased technological change alters the proportions in which labour and mechanisation are used – a higher level of mechanisation is associated with a lower labour input.

Larger, more sophisticated machines are reducing labour requirements. This process takes place even though the labour/mechanisation price ratio remains unchanged – the slope of IC'IC' is the same as ICIC. It would in fact be possible for the price of labour to fall relative to mechanisation (IC'IC' would become less steep) and cost savings still be possible through increasing the level of mechanisation and reducing labour input.

– theory into practice

So far, the rather obscure term 'level of mechanisation' has been used, instead of more specific machine numbers, tractor power, etc. as the alternative input to labour.

As with much economic theory, the move from theory to practice is difficult, and the substitution of actual machines for

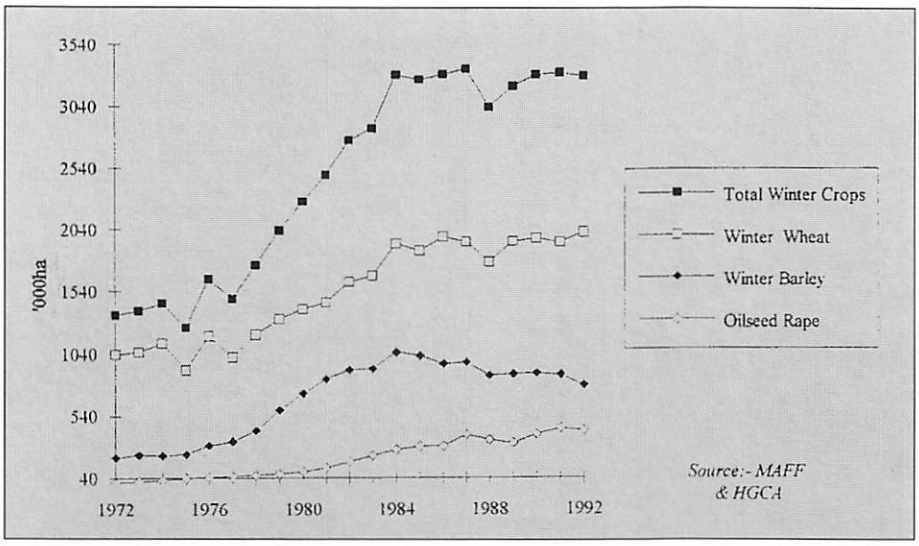


Fig 6. Winter crop area: 1972 - 1992.

'level of mechanisation' can cause problems.

For example, suppose that two 40kW tractors (and two drivers) are replaced with one 80kW machine, and one driver made redundant. In terms of machine and labour units this could be seen as neutral change – the man/machine ratio is 1/1 in both cases. In terms of power (in kW) to labour (in man units), the change is biased – the initial power/labour ratio of 40/1 changes to 80/1.

The value of the theory is less in its relevance to specific practical situations than in the illustration of the processes of technological change and in demonstrating that this change is independent of the labour/mechanisation price ratio.

Timeliness and cropping patterns

– labour saving

Labour-saving technological change through the adoption of larger, more powerful tractors goes part of the way to explaining the mechanisation of UK agriculture over the last twenty years, but this is not the complete picture. The adoption of fewer, more powerful tractors does not explain the growth in total power in UK agriculture.

In the example above, the change from two 40kW tractors to one 80kW tractor does not change the total power input – this remains at 80kW. If this example applied at national level the number of tractors would be halved, but the total power used in agriculture would remain constant. This has not been the case – as discussed previously – and MAFF statistics on tractor numbers and power suggest that the total power used in UK agriculture has nearly doubled since 1972.

– timeliness

A further influence on the adoption of larger, more powerful tractors has been recognised as the need to improve timeliness of operations (Witney, Culpin).

Timeliness has become increasingly important in UK agriculture because of changes in cropping patterns, in particular the increase in the cultivation of winter cereals and oilseed rape. The area of autumn seeded land in the UK has increased by 155% since 1971 (Fig 6).

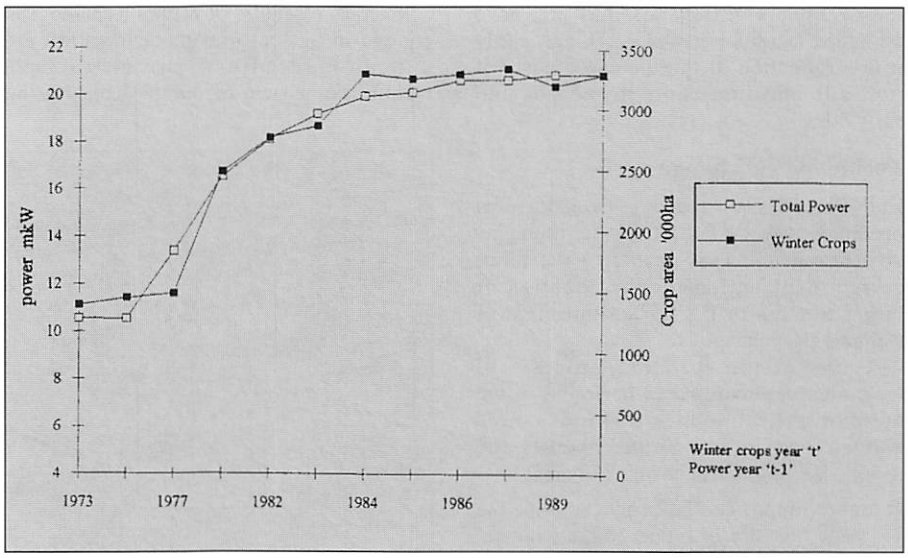


Fig 7. Winter crop area and total power.

This increase in winter crop production correlates closely with the increase in total tractor power in UK agriculture* [R=0.98, winter crops year$_t$ vs. power year$_{t-1}$] (Fig 7).

Winter crop production requires all cultivation and seeding to be undertaken in the immediate post-harvest period, in contrast to spring crop establishment, where autumn, winter and early spring are available for landwork. Winter cropping requires relatively large inputs of power for relatively short periods.

A central tenet of this study is that the adoption of larger tractors and the increase of power in UK agriculture since 1971 is a result more of the concentration of the major part of the landwork for the cereals and oilseed crops into a few weeks in late summer and early autumn, as a result of a desire to substitute power for labour.

– work planning

This concentration of cultivations and seeding into the immediate post-harvest period does, however, encourage further shedding of labour.

Assume that a farm is 100% autumn sown, and requires 100kW of power for cultivation and crop establishment. This 100kW can be in the shape of two 50kW tractors or one 100kW tractor. If the manager opts for the two 50kW machines, he is then faced with the problem of occupying two tractor drivers for the nine months of the year whent they are not involved in harvest or cultivations and seeding.

The option of one 100kW machine not only reduces the hourly cost of cultivations through technological change as discussed above, but allows annual savings through a reduction in the total farm labour force. This is nothing to do with rising agricultural wages – even if agricultural wage rates were static this process would take place.

This is obviously simplistic, but it serves to illustrate the influence of cropping patterns as well as technological change on power/labour substitution.

– cropping and livestock patterns

The situation is further compounded by the adoption of combinable break crops such as oilseed rape and field beans, rather than the more labour intensive traditional break, potatoes, and the absence of livestock from an increasing number of farms.

*It is recognised that a percentage of tractors, often older machines, are used only for light haulage and standby duties. Not all of the power in agriculture is used in cultivations. The correlation between increasing power in agriculture and winter cropping holds, however, regardless of whether the growth of power is from 10mkW to 20mkW, 5mkW to 15mkW or from zero to 10mkW. The pattern of change, rather than absolute levels, determines the degree of correlation.

This has made it possible for one individual to provide the necessary labour for a substantial area of land.

There are units where the farmer himself is the only permanent labour on the holding. A contractor is used for combining, and possibly some drilling, and one large high power tractor which the farmer operates himself does all cultivation, carting and seeding as appropriate.

A recent article in the farming press describes how one individual single-handedly farms 325 ha of winter cereals, winter beans, oilseed rape and linseed with one 140kW tractor (Faulkner).

This is not an attempt to argue that there have not been cost savings in agriculture through power/labour substitution, but increased mechanisation to save on labour costs is not the complete picture. Changing cropping patterns have had an important influence on the man-machine balance in UK agriculture.

Implications for tractor and machinery manufacture

The conclusion that cropping patterns have had a major effect on total power requirements of UK agriculture has important implications for the national tractor and machinery market.

– less pressure on timeliness factor

It is difficult to envisage a change in cropping patterns that will further decrease the time available for cultivations and seeding - if anything agriculture would appear to be moving in the opposite direction. Winter cereals are being developed that can be planted later, spring sown rapes are appearing and mandatory set-aside is now an integral part of EC agricultural policy. Set-aside effectively prevents farmers from seeding a percentage of their land with winter crops, removing the requirement for immediate post-harvest cultivation.

– practical limits to machine size

Farmers will continue to seek to substitute power for labour, but there are limits to the size of machines that can be operated on all but the largest of farms. There are also increasing environmental and safety concerns about the movement of very large agricultural machines on public roads.

– prospect of power surplus

UK agriculture may be entering a period of power surplus with the existing tractor fleet, particularly if cropping technology moves away to some extent from winter cropping and mandatory set-aside requirement increases.

At best, the market for new machines will be purely for replacement of existing stock (Witney). At worst, there may be some shedding of power as UK agriculture is increasingly moved by changes in the CAP and the GATT agreement away from the need to 'produce to be supported'.

– present 'boom' may be short-lived

The substantial upturn in the UK tractor market in 1993 (The Agricultural Engineer) may well be a result partly of the increase in farm incomes in 1993, and partly a result of the very low replacement rates in recent years.

A further important effect in 1993 will have been the reduction of first year tax allowance on new machines from 40% to 25% in the 1993 budget. This reduction was widely forecast, and it is has been suggested that tax allowances exert a psychological effect on farmers beyond their true financial value (Cooper).

If these factors have influenced the recent upturn in the market the boom may well be short lived.

There is no guarantee tha the higher farm incomes of 1993 will be maintained, and continued pressure on the CAP budget, GATT, and EC agricultural policy moves to reduce surpluses and control production do not augur for expanding markets for agricultural machinery. It is certainly very difficult to envisage a return to the heady days of the mid-1970s and early 80s.

– rationalise production

Machinery manufacturers will need to rationalise production facilities, range of models and distribution channels if their operations are to be profitable in this static market.

At the same time, however, there must be sufficient capacity to respond to short term upturns in the market such as that which has recently taken place.

This is the challenge for agricultural machinery manufacturing and marketing towards the year 2000.

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Advice for the aspiring

Sir,

More openings with Business Studies

I read with interest the letter in the Spring edition from my old personal tutor at Harper Adams, Geoffrey Wakeham. As an Agricultural Engineering graduate from 1993, currently pursuing a challenging career as an agency van driver, I would like to state from experience that his arguments against a Business Studies course do not hold water in today's jobs marketplace.

Mr Wakeham makes the reasonable assumption that in order to succeed as a leader in a certain trade, one has to know something of the workings of that trade. This may well have been true in the past – one cannot imagine Harry Ferguson conceiving his draft control system with a social science/politics background – but in recent years it appears quite acceptable to have hospitals, for instance, run by managers without so much as a first aid certificate.

This transfer of management responsibilities from technical to business graduates is also evident in the graduate recruitment publication, *Prospects Today*. Editions 17 and 18 contain a total of 146 vacancies, of which 24 require a Business Studies degree and 30 a specialist engineering degree. As there is limited transferability between the differing disciplines of engineering, the advantage clearly lies with Business Studies graduates. No Agricultural Engineering vacancies appeared in these editions, nor in any others that I have read, and while the Business Studies content of my course provided a welcome respite from the hard sums, it is insufficient to qualify me for vacancies requiring that subject alone.

Please be assured that I am not running down either the Agricultural Engineering profession or the first class education imparted by Mr Wakeham and his colleagues. However, I do not believe that a qualification in this subject is superior to Business Studies in actually obtaining a job for the bearer. I suspect that at least half of my past classmates would agree with me on this, because as far as I know, this proportion are still awaiting permanent, graduate level positions.

In short, I would state that Agricultural Engineering is best suited to those of an enquiring mind who are genuinely interested in the subject, but have no great desire to become a captain of what is left of our industry. While an Agricultural Engineer would be the ideal companion on a desert island, from a point of view of food and water procurement and boat building, there is little demand for him or her in corporate Britain of the 1990s.

Yours faithfully

C A Stark, AMIAgrE,
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Precision Farming: an overview

Simon Blackmore explains how Precision Farming allows the area of treatment to be reduced from a field to a few square metres. The outcome is better management, greater efficiency and economy with less environmental impact.

Precision farming is the term used to describe the goal of increased efficiency in the management of agriculture. It is a developing technology that modifies existing techniques and incorporates new ones to produce a new set of tools for the manager to use. Inevitably it integrates a significant amount of computing and electronics but higher levels of control require a more sophisticated system approach.

This paper sets out the framework for applying these principles to arable farming. It advocates the use of vehicle positioning systems, geographical information systems and decision support systems to allow better understanding of conditions within the fields and the heightened control of agricultural inputs.

Agricultural managers have always looked for better ways to grow crops. Sometimes, the aim has been to grow as much food as possible, such as in war-time. Now, we look for more efficient ways, both in an economic and environmental sense.

Invariably this search also leads to efficient use of resources, especially inputs such as seed, fertiliser, land, field operations and time.

Environment friendly systems

Nor can we ignore the influence our management practices have on the environment. No longer can managers freely apply nitrogen for maximum yield without considering possible pollution of the ground water.

This continued trend of increased efficiency has not only an economic push but also an environmental pull. If the environmental pull is not strong enough then legislation may take over and force the issue by capping the quantities applied to the fields or taxing them.

Since the introduction of the Environmental Protection Act in 1990, everyone has a responsibility under the law not to cause significant pollution.

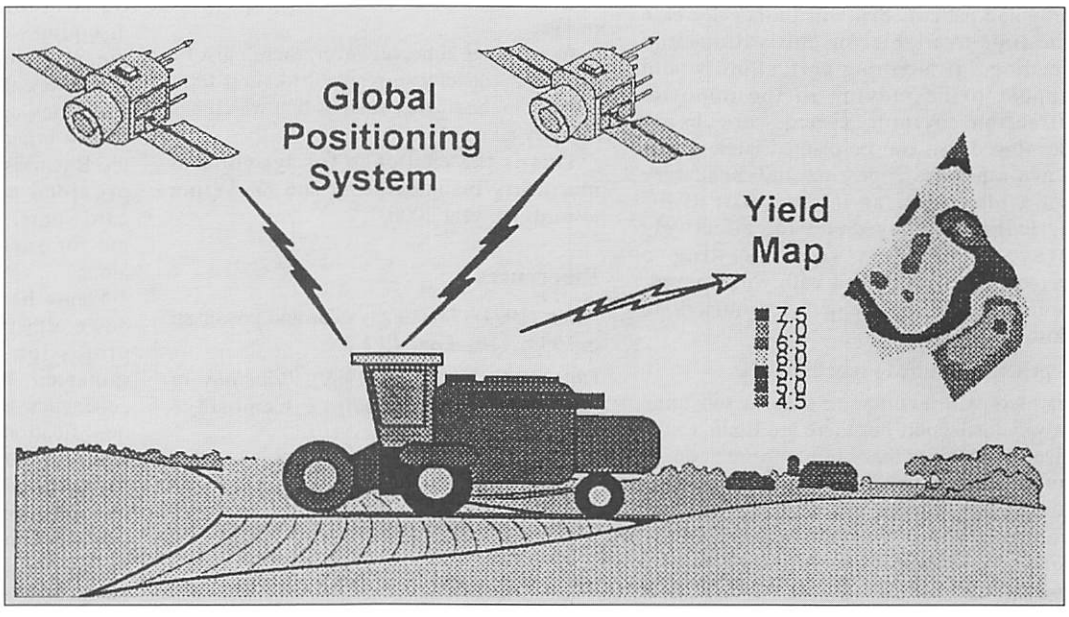

Fig 1. Yield mapping.

There are three aspects to Precision Farming:

1. Find out what is happening within the field,
2. Decide what to do about it,
3. Treat the areas according to the decisions made.

What has led to this opportunity for greater efficiency?

It is the development of on-board vehicle positioning.

Yield mapping

As the tractor or combine moves about the field the positioning system can record its precise position to within a few metres. This development has lead to the amalgamation of yield sensing monitors on combines and a Global Positioning System (GPS). The results allow the production of a yield map that not only gives the total yield but also shows how the yield varies across the field and displays it as a yield contour map (Fig 1).

This is the first part of the Precision Farming system. It allows us to record the yield variation within the field. whereas, traditionally, we have only recorded the total yield from the field. Now we can resolve it to a specific small area (at present this is about 10m by 10m).

Management Information System

How should the manager make sense of all this data?

What the yield map is showing is the spatial variability of the yield within the field. A Geographic Information System

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(GIS) is the best way to deal with this type of information. This is effectively a way of computerising a set of map overlays to look at the interaction between them.

The advantage that a GIS has over traditional maps is that the manager can combine maps to produce new maps that show the interactions between say, yield and pH. The farm manager can also then display a map of the farm on the computer and be able to recall both the field history (crop, treatment and application history), and the point, linear and geographical features (ponds, fences, gateways, old hedgerows, soil type, etc).

Soil surveys are often conducted to give the spatial variability of soil characteristics (N, P, K, pH, Mg, moisture, compaction, etc.). The decision-maker can then compare these field characteristics to the change in the yield profile to get a better understanding of why some areas of the field are more productive than others.

The decisions made will be based on information from the GIS as well as traditional sources such as experience, advisers, suppliers, other farm records, etc. A number of these sources can be incorporated into a wider Management Information System (MIS).

Continuing agronomic research will lead to a better understanding of the reasons for the variability.

Management strategies

Precision farming does not imply any particular management technique. What it does do is to allow the manager a better understanding and a greater control over the treatments to the fields.

Two management strategies have developed already:

Produce more from the same inputs

Produce the same from less inputs

Both strategies require increased efficiency that precision farming techniques allow.

– Treatment Maps

Once the yield information is in the system, the manager will then want to make decisions on how to treat those fields. Should there be a uniform treatment? Should the low yielding areas get more fertiliser or less?

The actual decision belongs to the individual manager but the precision farming system can offer some help in implementing the decision that is taken.

The resulting treatment map (Fig 2), shows the precise location and quantity of the treatment within the field. This could be in terms of seed, fertiliser or spray application or other field treatments such as cultivation.

Farm the soil : not the field

– Decision Support Systems

In combination with the GIS, a set of economic and agronomic software models can be combined to make up an integrated Decision Support System (DSS).

A DSS is a collection of software tools that present the manager with the specific information that is needed to make a particular decision.

Information is very personal: what is felt to be essential information for one manager may be seen as trivial to another. No doubt there will always be other information that must be taken into account, such as factors that are not within the information system, so there must always be the facility to create a treatment map manually.

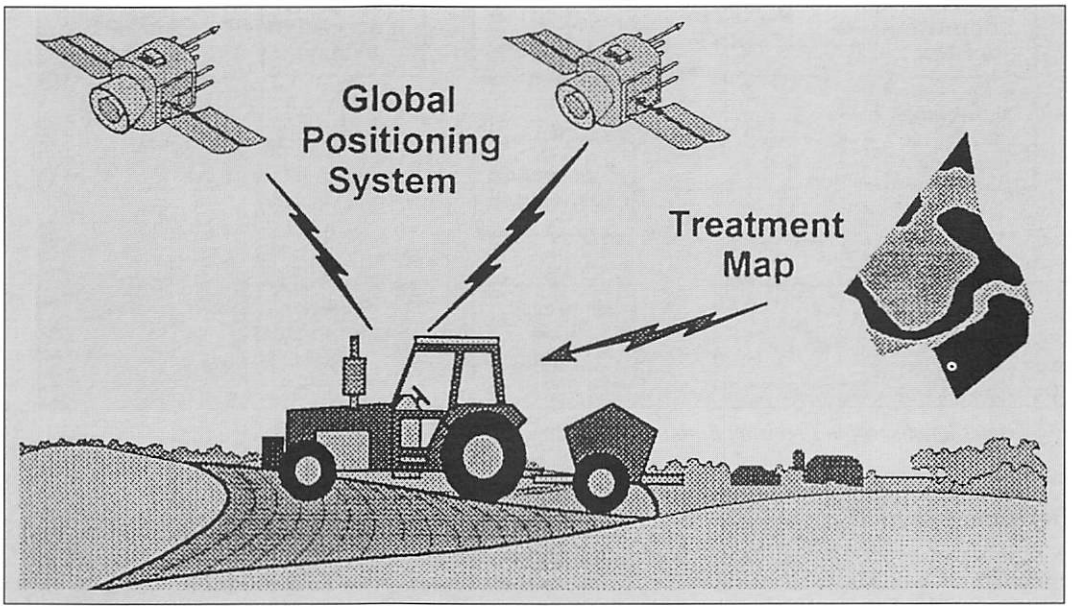


Fig 2. Using the treatment map.

Field treatment

After creation of the treatment map on the GIS, it is then down-loaded onto the tractor, with an *aide memoir* for the operator (a computer display of field, fertiliser type, desired application rate, etc).

The application of herbicide is a special case where a weed map can be produced beforehand and only those weed patches are then sprayed. This further enhances the effectiveness of new developments such as direct injection sprayers. The procedure will be that the operator loads the machine in the normal way then heads for the field. Initialising the control system will occur at a known set point, perhaps a gateway, and the driver will then cover the parts of the field that need the application or treatment.

With the GPS and a computer system mounted on the tractor, and the treatment map loaded, the correct amount decided by the manager in advance will be applied when the tractor reaches any particular point in the field.

Record of application

The on-board computer also keeps a record of what is actually applied as there are often discrepancies between what was intended and what really happens. This can then be uploaded onto the main computer in the office for future decisions, thus giving a much more accurate picture of the field treatments.

Economic and environmental justification

Any form of increased efficiency that allows reduced inputs without a reduction in yield really makes sense from both an economic as well as an environmental perspective.

There seems little point in buying fertiliser and spreading it on an area of soil for it then only to be washed away and pollute a nearby watercourse.

The Precision Farming ethos is to apply only *what is needed, when it is needed* so that it gets used with maximum effect and minimum wastage.

Precision farming in practice

Putting Precision Farming into practice requires a fairly integrated systems approach which combines hard technology and soft systems as is shown in Fig 3.

Simple calculations on investment can show a pay back period in the realms of three to four years depending on the size of the farm. The current estimated figure for initial investment in Precision Farming technology is between £10,000 and £15,000 depending on the level and sophistication of the equipment.

Most of the Precision Farming equipment is still new on the market but, as with most new technologies, it is expected that the prices will fall as more farmers adopt these practices.

– one year break-even

If all the inputs can be cut by 10% in this way, then the break-even period for a 200ha farm would be within one year. If fertiliser alone was targeted, then the break-even period is increased to five years.

Farm the soil : not the field

Massey Ferguson since 1991 and recorded yields have shown the variability to be a fairly consistent ±25%, with some cases being up to ±100%. If the field inputs are assumed to be uniform, then these variations represent the variability of the gross margin for that field.

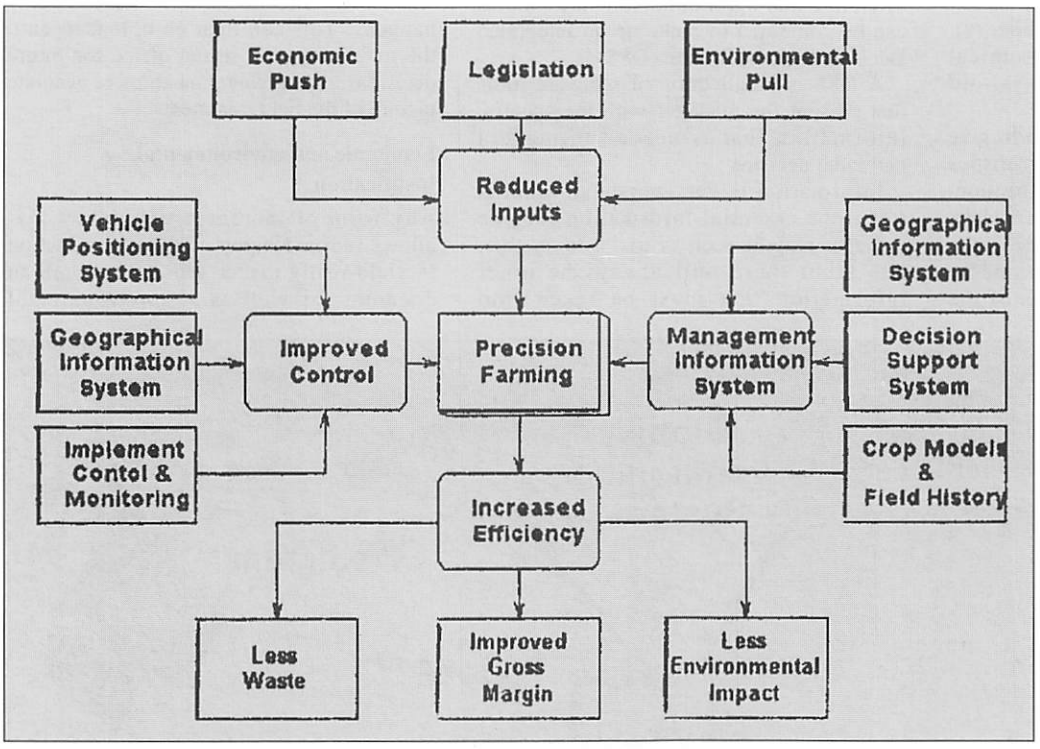


Fig 3. Interactions within Precision Farming.

Developments in UK

A number of research institutions and commercial companies in the UK are actively involved in developing the tools and techniques required to advance Precision Farming. Yield mapping combines have been available from

Other companies such as RDS Technology Ltd are actively developing the integrated electronic systems that are needed to gather the data and implement the managerial decisions in the field.

The next generation of software that supplies the MIS tools and gives the DSS structure is being developed by Optimix Computer Systems.

Overseas interest and developments

In other parts of Europe (Germany, Denmark and the Netherlands) there is particular interest and similar developments are under way.

In the USA, this work has been continuing for a number of years, so much so that a farmers' co-operative of more than 40 producers covering 10,500 acres has adopted the first stages of what it calls prescription farming and is expected to expand to 25,000 acres in the near future.

As with most emerging technologies, there are many names used to describe essentially the same thing. For example:– Computer Aided Farming (CAF), Spatially Variable Agricultural Production Systems (SVAPS), Soil Specific Crop Management (SSCM) and Site Specific Agriculture (SSA).

In another report of a 2,000 acre farm there was seen to be "an input saving of nearly $14 per acre in 1991" by the reduction of fertiliser and seed and accepting a lower overall yield. This was achieved without the aid of yield maps but did rely heavily on soil testing services.

Other reports quote the saving on fertiliser alone as being 30% without any decrease in yield and that "calculations on thousands of acres indicate in excess of $10/acre per year above the cost of the service".

Not only does this new technology seem to make sense but it is technologically feasible as well as being economically and environmentally justifiable.

This is a new approach to agricultural management whose time has come.

Approved Body appointment for Lloyd's Register

Lloyd's Register has been appointed an Approved Body for compliance with the EC Machinery Directive.

The appointment, made by the UK Secretrary of State for Trade and Industry and recognised by all EC member states, enables LR to help manufacturers worldwide comply with the Directive's requirements for a wide range of machinery items for industrial, commercial and consumer markets.

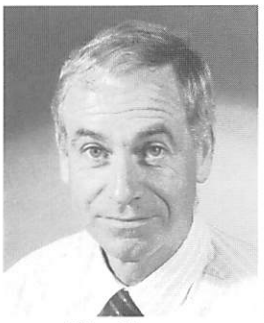
The EC Machinery Directive (89/392/EEC as amended) is one of the key measures concerned with the removal of technical barriers to trade to establish the Single European Market. All machinery covered by it must bear the CE mark from 1 January 1995, regardless of its place of manufacture, before it is placed on the market.

LR's services cover all attestation module routes laid down under the Machinery Directive. These include advice on the 'self certification' route, as well as advisory, approval and certification services for the Technical Construction File (TCF) and Type Examination routes, applicable where the construction or use requires a high level of safety.

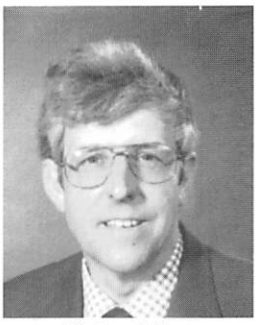
Vaughan Pomercy, head of LR's Engineering Services, explains; "LR's aim is to assist manufacturers worldwide to comply with the new EC requirements for machinery efficiently and cost effectively; We have more than 255 exclusive offices worldwide, covering all EC member countries and 70 other countries. This allows manufacturers to have any necessary testing done at a convenient location, cutting down both time and expense.

"At the same time, through LR's comprehensive services, allied to our wide knowledge of certification procedures and experience of type testing and machinery approval, our clients can have greater confidence that their products comply fully with the Directive"

The effect of straw incorporation on diesel fuel use and the emission of pollutants



Tim Chamen



Richard Cope

The banning of straw burning gives a social improvement but there is no equivalent environmental benefit say Tim Chamen and Richard Cope.

Using data from two trials, a desk-top study was made (funded by MAFF) to determine the effect on fuel energy use of more rigorous tillage practices resulting from a ban on the burning of cereal straw in the field.

Mouldboard ploughing to a depth of 200mm rather than tine/disc cultivation to 100mm depth increased diesel consumption by 15Ml/annum in England and Wales. This represents 734TJ/annum of fossil fuel energy and emissions of 807Mg NO_x-N, 139Mg of particulates and 41Gg of carbon dioxide.

Non-plough systems of straw incorporation could reduce this increase in fuel use by about 7%.

The introduction of a ban on the field burning of cereal straw in the UK was in response to the social nuisance caused during the burning process.

As far as reducing the amount of atmospheric pollution was concerned, it was anticipated that the need for farmers to introduce mouldboard ploughing to incorporate straw, would lead to a greater use of fossil fuel.

Desk-top study

To determine the level of increase in fuel usage, a desk-top study was made using results from two series of experiments on clay soils at Silsoe.

The study was confined to clay soils because it was more likely that the ban on burning would have changed cultivation practice on these soils rather than on sands and loams, where conventional ploughing was probably already being practised.

Sources of information

— fuel and energy requirements

Two primary sources of information were used. Chittey *et al* (1986a & b, 1988, 1989) provided data on a minimum tillage technique used in conjunction with straw burning, while Cope *et al* (1989, 1990, 1994) provided information relating to a plough-based technique for straw incorporation.

Straw incorporation – an alternative to straw burning.

Table 1 shows the range of fuel and energy requirements of a cultivator having a combination of tines and discs used to produce a tilth on a burnt wheat stubble. All operations up to but not including drilling were included.

Table 2 provides similar information for a system based on a mouldboard plough working on a clay soil covered with wheat straw which was chopped and spread during combine harvesting.

Further sources of information were needed to determine the energy content of diesel fuel and its polluting emissions.

— assessment of area involved

In addition to the information on fuel use, it was necessary to determine the area of land upon which cereals were being grown in England and Wales, the proportion of this area which was on clay soils (data for Scotland and Northern Ireland were not readily available) and similarly the proportion of the clay soils upon which minimum cultivation techniques were being practised.

Results of the study

— fuel and energy requirements

The area of cereals grown in England and Wales has declined slightly and has been variable in the last few years, but a figure of three million hectares annually represents an average based on the last three years (HMSO, 1992).

Tim Chamen and Richard Cope are members of the Soil Science Group at Silsoe Research Institute, Wrest Park, Silsoe, Bedford. MK45 4HS.

According to Davies (1988), approximately one third of the cereal area in Britain was being established with minimum tillage systems by the end of the 1970s. Davies also noted that these systems were particularly successful on clay soils. As a result of this information, it was estimated, for the purposes of this study, that 50% of clay soils were being cultivated with minimum tillage techniques prior to the ban on straw burning and before any increased legislation controlling the burning of straw was introduced.

Table 1. Fuel and energy requirements of a tine/disc cultivator system operating on burnt wheat stubble.

Year	*Depth (mm)*	*Fuel (l/ha)*	*Fuel energy*[1] *(MJ/ha)*
1983	80	17.2	188
1984	80	28.4	253
1985	100	28.9	313
1986	110	29.5	300
Mean	92	26.0	263

1:– Fuel energy derived from tractor engine power consumption

The proportion of the cereal growing area in England and Wales which is on soils containing more than 30% clay was taken from an unpublished report by Chamen (1977).

In this study, the Soil Map of England and Wales (1973) was used to determine, by area measurement with a planimeter, the proportion of the area of each county on clay soil. These data were then combined and resulted in an overall proportion of 0.314.

Thus the area of cereals which was considered to be minimally cultivated on clay soils was:

$$3 \times 10^6 \times 0.5 \times 0.314$$
$$= 471 \times 10^3 \text{ ha/annum.}$$

From the figures in Tables 1 and 2, it is seen that the difference in fuel use between the minimum cultivation and plough techniques is:

$$58.6 \quad 26.0 = 32.6 \text{ l/ha.}$$

Therefore the additional fuel used for straw incorporation using a mouldboard plough system in England and Wales would be:

$$471 \times 10^3 \times 32.6 = 15.355 \text{ Ml/annum.}$$

The total energy cost of diesel fuel (including its production cost) is 47.8MJ/l (Pimentel, 1992). Thus, the additional fuel used represents:

$$15.355 \times 10^6 \times 47.8 \times 10^6$$
$$= 734 \text{ TJ/annum of energy } (T = 10^{12}).$$

— emission of pollutants

In burning diesel fuel, 670g/l of carbon are released (Bertilsson, 1992) as well as emissions such as nitrogen oxides and a number of particulates. Present emissions from tractor engines are of the order of 1.1g NO_x-N/MJ and 0.19g/MJ of particulates (Moser, 1992; Bertilsson, 1992). Using these and the energy figure calculated above, the increased emissions would be as follows:

NO_x-N	807.4×10^3 kg/annum
Particulates	139.5×10^3 kg/annum
Carbon dioxide	41.2×10^6 kg/annum

The opinion is often expressed that no pollution occurs when straw is incorporated into the soil compared with when it is burnt. As far as the carbon content of the straw is concerned, this is not the case, since it is only a matter of a difference in the time scale for its release, mainly as carbon dioxide. When straw is burnt, this CO_2 release is immediate, whereas it may occur over a period of 12 months or more when the straw is left to decompose in the soil.

Discussion

— increased fuel use

To put the increased use of fuel energy in context with primary energy consumption in the UK, reference is made to a figure given by Smil (1992) based on an analysis by Leach (1975). This suggested that in 1972, 8685PJ ($P = 10^{15}$) of energy were used, of which agriculture used 4.7%, ie. 408PJ.

White in his paper of 1979 gives a similar figure for primary energy consumption in the UK (9,290PJ), but also indicates the proportion of this energy which is used by agriculture to the farm gate, namely 3.9%, or 362PJ.

Thus, the 734 TJ/annum increase in energy identified above represents a 0.2% increase in that used by agriculture to the farm gate in the UK. This would appear to be a conservative estimate, since White in his paper gives a figure of 1846MJ/ha required for the cultivation of winter wheat by a "conventional system", which almost certainly is one based on the mouldboard plough.

— the pollutants

As far as the pollutants are concerned, any increase in these at the current time is undesirable. If methods can be found to reduce crop establishment energy requirements, some redress of the increase as a result of straw incorporation would be possible.

Data from Cope *et al* (1994) suggest that mixing-in of straw residues with a disc cultivator, rather than a mouldboard plough, could reduce fuel consumption by about 7%.

Other novel systems which would allow direct seeding of the crop through the straw residue, perhaps on a rotational basis, might have potential if properly researched.

— validity of the findings

One major potential source of error in the comparison between systems in this study, is soil water content differences between the sets of seasons.

As no comparable water content data were available, rainfall in the four months prior to cultivation was compared. This showed that the soil conditions for the minimum cultivation trial (1982-1985) were likely to have been considerably drier than during the mouldboard plough experiments (139, 196, 209, 162mm compared with 256, 230, 156, 264mm June to September respectively).

Although this gives only some hint of the seasonal effect on soil strength, it provides an indication that soil strength was likely to have been higher in the earlier trial, and that the estimates of additional fuel use calculated are probably conservative.

Conclusions

On clay soils in England and Wales, the increase in diesel fuel use as a result of changing from minimum tillage to mouldboard ploughing for straw incorporation is about 15Ml/annum. This is equivalent to an energy use of 734TJ/annum with resultant increases in the emissions of nitrogen oxides, particulates and carbon dioxide. As a proportion of the energy use by, and emissions from, agricultural production to the farm gate, these increases are equivalent to about 0.2%.

The results indicate that the social improvement achieved by banning straw burning is not accompanied by an actual environmental benefit.

Table 2. Fuel and energy requirements of a mouldboard plough system operating on wheat stubble and chopped straw.

Year	*Depth (mm)*	*Fuel (l/ha)*	*Fuel energy*[1] *(MJ/ha)*
1987	163	66.1	693
1988	241	77.2	666
1990	210	47.5	489
1991	200	43.8	407
Mean	203	58.6	564

1:- Fuel energy derived from tractor engine power consumption.

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The Weir Prize and Shield

Presentation of the Weir Shield – which is awarded to the top Agricultural Engineering student in Scotland – toWayne Gordon, student at Aberdeen College. Photo: Courtesy of Aberdeen College.

At Oatridge College, West Lothian, on 28 May, 1994, the Scottish Branch held the Mechanics Skills Competition for the Weir Prize and Shield. The competition was also included as the Scottish heat of the UK Skills competition. The colleges of Aberdeen, Barony, Elmwood and Oatridge each entered two students.

The competition was divided into four disciplines:

i. Tractor hydraulics and electrics – these were tested with relevant equipment and reported on to the examiner (John Pedley of Evesham College),
ii. Engine valves and fuel systems – a valve was refaced and the seat lapped in, fuel filters replaced and the fuel system checked and bled, and the tractor started (examiner; Martin Nelson of John Kerr Equipment)
iii. Forage harvester and fabrication – competitors had to undertake certain service operations; check over the harvester; and fabricate a jump clip to the satisfaction of the examiner (William Hamilton of Hamilton Engineering)
iv. Combine harvester and crop sprayer – the drum and concave had to be adjusted together with a report on the condition of certain components of the two machines (examiner; Jeremy White of Kirkley Hall College).

The contest was close. Eventually, however, the Weir Prize, an engraved tankard, a cheque for £50 and a place in the final of the UK Skills Competition were awarded to Wayne Gordon, a student at Aberdeen College. Wayne also accepted the Weir Shield on behalf of his college. The runner-up was Andrew Samuels of Elmwood College who received a cheque for £30. Martin Little of Barony College, who was third, received a cheque for £20. John Kerr Equipment of Linlithgow donated a socket set for the winner of the combine harvester test and this was received by Wayne Gordon.

After awarding the prizes and congratulating all the competitors, Denis Welstead, Chairman of the Scottish Branch, thanked the examiners for so generously giving their services and time on behalf of the competition. He also thanked all the lecturers present from the colleges involved in the event, particularly Jim Petrie of Oatridge College who did most of the organisation and to Chris Nixon, Principal of Oatridge, for provision of the college facilities.

Chris Nixon concluded affairs with a short statement on the value of competitions, like the Weir Prize and Shield within the correct educational environment.

Jim Pascal.

Perkins Power on the Farm Award

The Perkins Power on the Farm Award is a prestigious recognition of endeavour run in conjunction with the Guild of Agricultural Journalists. This year's winner of the award is Michael Bird for an article in Crops magazine entitled "Use your Nozzle to Cut Drift" – an expose of the latest developments in field crop sprayer nozzle selection.
Michael is a freelance journalist and he is also the Hon. Press Officer of the Amenity & Ecological Engineering Specialist Group.

Silver Jubilee of Innovation Recognition

The annual award for the recognition of excellence in engineering, the Royal Academy of Engineering McRobert Award, celebrates its 25th anniversary this year. It is given for outstanding innovation of benefit to the community. The winning team stands to gain £50,000 this year.

Agricultural Engineering has featured in the roll of honour for this award – a team from Silsoe Research Institute shared the spoils in 1985 with Rolls-Royce. It is too late to enter this year's proceedings – but there is always next year! Contact Tim Walker at the Royal Academy for details of how to enter your brainchild on 071 222 2688.

It pays to keep title to your goods

The total number of business failures in England and Wales fell slightly in the first three months of this year, according to Government figures. Yet the fact that there were more than 4,500 company insolvencies during the period shows that there is still a high risk of customers getting into financial difficulties and going into receivership or liquidation.

One way of easing the blow when this happens, writes legal expert, Richard Baines, is to sell your goods under Retention of Title terms.

The recession may be officially over but the general climate is patchy and the upturn gradual. Corporate insolvencies continue at alarmingly high rates in spite of the good news about the economy.

Traditionally, businesses get into financial difficulties coming out of a recession. This is due partly to a tendency to overtrade which then exposes any weaknesses in their financial bases.It is important, therefore, that company directors and managers remain vigilant and keep their eyes on the ball, remembering the hard lessons learned over the last four years.

Retain title to goods supplied

Because so many firms have failed during the recession, an increasing number of companies are selling goods under Retention of Title terms in an effort to ensure that, so far as possible, the stock they supply continues to belong to them until they are paid.As the economy improves, suppliers should be careful not to relax over using such a safeguard. If the customer defaults, a supplier could take its goods back and thus reduce, or even eliminate the impact of a bad debt.A buyer's default frequently coincides with its financial collapse, resulting in its affairs being placed in the hands of a Licensed Insolvency Practitioner, acting as an Administrative Receiver, Administrator or Liquidator.By the Sale of Goods Act, title to goods passes to the buyer on delivery of the goods unless the contract otherwise provides.

Documentation required

The correct procedures will need to have been followed and it will be necessary to provide the relevant evidence, documents and information to establish ownership of the goods, despite delivery.

Individual cases require specific advice but, in general, it is not sufficient simply to put terms of trading on the invoice or on the back of the invoice because a contract is usually regarded as made either by the telephone order or by exchange of telexes, faxes or letters.

– agree terms of business in advance

The only really effective way to incorporate your standard terms of trading into contracts which you make with a customer is to write to the customer before the course of dealing begins (ie. before you accept any orders), enclosing a copy of your standard conditions of trading and asking your customer to sign and return it to you.Thus, if there is ever any dispute in the future as to whether your terms and conditions (including your Retention of Title clause) are incorporated, you will be able to produce to the receiver or liquidator of the customer a signed copy of the conditions of trading from you own file. If a customer sends you an order specifying its own terms of purchase, you could override that by replying with a copy of your own terms and conditions, asking it to be signed and returned.It does no harm to have your conditions printed on the reverse of despatch notes and invoices because if your terms become well-known to your customers over a period of time, they may be incorporated into the contract even if they were not specifically drawn to the attention of your customers, although it is not safe to rely on that alone.

– re-confirm terms when accept order

In my experience, it is sensible when accepting purchase orders to send an order acceptance form stating that the contract is on your standard terms and conditions, which will be printed on the reverse of the form.This should be done in addition to sending terms to the customer before any business is commenced because, that way, there can be no doubt that your own terms, including your Retention of Title clause, will apply to the contract.The inclusion in your terms of trading of a Retention of Title clause, known as an "all monies" clause, means, broadly, that if your customer owes you any money on any account whatsoever then any goods supplied by you in its possession will still belong to you.

Customer to maintain identity of goods

It is probably no longer possible, under English law, for a supplier to claim a right to the proceeds of sale of goods which it has supplied. However, a right to claim the proceeds of sale could be included which might improve the seller's bargaining position in the event of a problem. Unfortunately, once goods have been mixed with other goods in order to make a finished product, the supplier also loses any rights and cannot claim any rights in the finished product. However, ownership is not lost in the case of components which can be easily unbolted without causing damage to the goods to which they are attached. A clause can be inserted in your conditions of trading requiring the customer to store supplied goods in such a way as to be clearly identifiable as your property. Some suppliers are still using an out-of-date clause which only retains title to the specific property sold under a particular contract in question. The problem here is that with this type of clause, the goods supplied have to be identified to specific unpaid invoices. Often, it is difficult, if not impossible, for the supplier to match goods with particular invoices. This problem is avoided with the "all monies" clause previously mentioned, although any goods which are identifiable as having been supplied by you at the customer's premises at a time when the customer goes into liquidation or receivership will remain your property, and receivers and liquidators should permit you to collect them.

Tight credit control essential

It has to be said that Retention of Title clauses must be used in conjunction with tight credit control. Since you are unlikely to be able to claim the proceeds of sale of goods which you have supplied, it is essential not to permit excessive credit to build up over a period of time.It is also in your interests to take swift action to enforce your Retention of Title rights as soon as you learn of a customer's insolvency.

Richard Baines is a partner with leading commercial law firm, Osborne Clarke, which has offices in London, Bristol, Brussels, Copenhagen, Frankfurt, Paris and Lyon.

Sept	**27–30** Conference	**Off road vehicles in theory and practice** –Vienna, Austria *Austrian Society of Automotive Engineers (Tel: 010 43 1 58801 Ext:4917; Fax: 010 43 1 566294)*
Oct	**8 –9** Compet'n	**44th British National Ploughing Championships.** Easton Lodge, Wansford, Peterborough (by kind permission of Farmers Weekly and A Fuller Esq) *The Society of Ploughmen Ltd, Doncaster DN1 9DH (Tel: 0302 852469)*
Nov	**5–9** Exhibition	**EIMA 94 (Agricultural Machinery Exhibition)** – Bologna, Italy *Contact – Tel 01039 6 44231370; Fax: 01039 6:4402722*
	8 Seminar	**Thermal processing of biomass and small-scale power production –** Institution of Mechanical Engineers, Birdcage Walk, London. *Philip George, IMechE (Tel: 071 973 1312)*
	8–10 Exhibition	**IWEX 94 (International Water Treatment Exhibition)** – National Exhibition Centre, Birmingham *Turret Group Plc (Tel: 0923 228577; Fax: 0923 221346)*
	9–10 Conference	**Engineering for profit from waste –** Institution of Mechanical Engineers, Birdcage Walk, London. *IMechE (Tel: 071 973 1249 Fax:071 222 9881)*
	27–30 Exhibition	**Royal Smithfield Show** – Earls Court Exhibition Centre, London *Philbeach Events Ltd,Waewick Road, London SW5 9TA (Tel: 071 370 8226; Fax: 071 370 8142)*
Dec	**13–16** Conference	**ASAE International Winter Meeting –** Atlanta, Georgia, USA *ASAE Meetings Dept., 2950 Niles Road, St Joseph, Michigan 49085-9659, USA (Tel: 0101 616 429 0300; Fax:0101 616 429 3852)*

February	8–9	**Grain '95** – N A C, Stoneleigh, Warks
Feb 26 – March 2		**SIMA 95** – Paris-Nord Exhibition Centre, Paris
April	5–6	**Muck 95** – N A C, Stoneleigh, Warks

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Silsoe College

Postharvest Quality Assesment

The Fifth Silsoe College Postharvest Convention will take place at Silsoe College on

Wednesday, 22 March 1995

in association with

The Institution of Agricultural Engineers and **The Association of Applied Biologists**

The convention will include:

- Presentation of scientific papers
- Exhibition of technical equipment
- Display of posters on scientific and technological developments
- Information on training and careers

For further details, please contact:

Mrs Pam Cook, Postharvest Technology Department,Silsoe College, Silsoe, Bedford MK45 4DT.
Tel: 0525 860428; Fax: 0525 860597.

Institution of Mechanical Engineers

One day Seminar — Tuesday, 8 November 1994

Thermal Processing of Biomass and Small Scale Power Production

With increasing emphasis being placed on alternative energy supplies, biomass has been established as an important source of renewable energy and interest is likely to increase with a new government initiative to be announced later this year.

The IMechE is holding this one-day seminar at its headquarters in Birdcage Walk, London

Information will be presented on developments in production (eg new species, coppicing) and will also include recent technical advances of small gasifiers, thermal conversion and power production (Stirling and IC engines). Speakers will include representatives from the government, industry and research establishments.

For further information, contact Philip George at the IMechE on 071 973 1312.

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