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Institution of Agricultural Engineers

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The Journal for Professional Engineers in Agriculture, Forestry, Environment and Amenity

Editor
Eur Ing Prof Brian D Witney
PhD CEng FIMechE FIAgrE MemASAE

Advertising Manager
Prof Brian D Witney
LAND TECHNOLOGY LTD,
33 South Barnton Avenue,
Edinburgh, EH4 6AN
Tel/Fax: 0131 336 3129

Products Editor
William A Jeffrey BSc IEng MIAgrE
SAC, Bush Estate,
Penicuik, EH26 0PH
Tel: 0131 535 3036
Fax: 0131 535 3070

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President
Michael J Dwyer
BSc MSc PhD CEng FIMechE FIAgrE

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BSc MSc PhD CEng FIMechE FIAgrE

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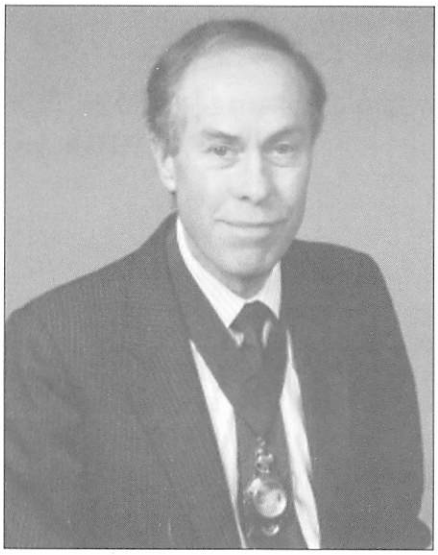

The future of the Institution in a changing world

Michael J Dwyer

Introduction

It is with great pride and not a little trepidation that I address you for the first time as your President. The pride obviously comes from being invited to join the list of my illustrious predecessors, who have contributed so much to the Institution over the years. My trepidation is born of the realisation that the pace of change in the world at large seems to accelerate from day to day and there will almost certainly be more, difficult decisions to make in the future. With this in mind, I wish to share with you some personal thoughts on where I think agriculture and the agricultural engineering industry are likely to develop in the future and how the Institution will have to respond.

Agriculture

In the UK, agriculture, in its narrowest sense, only contributes a tiny percentage to our Gross Domestic Product and only employs a tiny proportion of our national labour force, yet it is clear that its importance to the people of this country is very much greater than this would indicate. Agriculture hardly ever seems to be out of the news for long, even if it is more often than not for the wrong reasons. At the moment it is Bovine Spongiform Encephalopathy (BSE), not long ago it was live animal exports.

There are not many industries whose products are consumed three times a day by every man woman and child in the country. Clearly an adequate, safe and wholesome supply of food is a top priority and always will be; and the industry which supplies it is of supreme importance, irrespective of its economic status. However, there have been subtle changes in how this priority is expressed. In the developed world, the adequacy in the supply of agricultural raw materials is unlikely to come under threat. Productivity continues to rise as higher yields are produced from fewer farms, leading to the decline in the economic importance of primary agricultural production and the decline in the size of the agricultural labour force.

"the whole food supply chain is still very big business indeed"

If we look at the whole food supply chain, however, we get a very different picture. As the resources needed to supply the raw materials have been reduced, the food processing, distribution, and retail side of the industry has expanded enormously. If we include all these components, agriculture is still a very big business indeed and the resources in terms of manpower, human skill and ingenuity needed to ensure that food reaches the consumer, in a safe, nutritious and attractive condition, are every bit as vital as they were in the past, when the need was just to ensure that there was enough food to go round.

But what of the future? This must be heavily dependent on political decisions on the Common Agricultural Policy (CAP) and on the General Agreement on Tariffs and Trade (GATT). I cannot, personally, see the UK ever withdrawing from the EU. Therefore, the future of our agriculture will inevitably depend on the CAP. On the other hand, all the pressures seem to be pushing towards its total revision. If, as seems likely, the EU expands to take in most, if not all, the countries of Eastern and Central Europe, the present CAP will be unsupportable. Add to this pressures from Third Countries on GATT and disillusionment amongst the electorates of some countries at what they see as subsidising overproduction of unwanted food and the forces for change seem irresistible. So what sort of agricultural policy might we see in the EU in the future? If we move away from subsidising food production and let EU prices move towards world prices, the effect on the rural environment would not be what most people would wish to see.

And here we come to the second way in which agriculture has a vital and immediate effect on the people of this country. Despite being a densely populated country with most of us living in urban areas, if you travel by train on a long journey, the overall impression one has is not of passing through towns, but of travelling through open countryside, most of which is farmed. We tend to get

a false impression when travelling by car. Most of Britain is open countryside and 80% is farmed. The vast majority of the population want to keep it that way and would accept the continuation of subsidies being paid to farmers, if they could see that they were being used to encourage the development of agriculture in a way which would protect their enjoyment of the rural environment.

Closely tied up with this is the increasing demand for raw materials from renewable resources. Forestry clearly has an important role to play here, not only as a source of raw materials, but as a means of enhancing the environment and providing facilities for leisure and recreation. But arable crops may also be important, both by making better non-food use of by-products of existing food crops and growing specific non-food crops on land no longer needed for food production. There are exciting possibilities for production of fibres for textiles, paper and board, oils for a wide range of specialist applications, and starch for plastics.

While the developed world struggles to cope with the economic problems stemming from over-production of food, and worries about the environment, however, the other half of the world has not even reached the level of guaranteeing a stable supply and, when natural or man-made disasters occur, people starve. I have no experience of agriculture in developing countries and would not begin to suggest a solution to this problem: but a solution must surely be found and, whatever it is, I am sure that it will affect us all. The Pacific Rim countries are solving the problem for themselves by creating vibrant manufacturing industries which are taking away some of our markets for manufactured goods, but creating an increasing market for food products, which they cannot supply from their own resources. But what will happen in Africa and will global warming concentrate world food production still more into the Northern hemisphere? These must be major questions for the world to answer in the next decades.

Agricultural engineering industry

So what are the implications for the agricultural engineering industry of changes likely in agriculture over the next decade or so? In Europe, the accent must be on increased efficiency of production of raw materials, aiming to maintain profits at world prices. This must mean increasingly sophisticated equipment, applying cultivations and chemicals with increased precision, so as to minimise costs in terms of manpower, energy and chemical inputs. I cannot see any likelihood of change in the current trend towards larger and fewer field machines unless it is caused by the need to re-equip the farms of Eastern and Central Europe, if and when the capital for re-investment is made available. The big growth area in equipment for primary production of agricultural raw materials, both from crops and animals, must be in sensors, control systems, and computing hardware and software.

"the population wish to protect their enjoyment of the countryside"

I have recently been looking at the potential for remote sensing in agriculture. One application in the future will be in precision farming and decision support systems, to improve the efficiency of production of agricultural raw materials. A second application will be in monitoring the environment, by detecting changes in vegetation, identifying areas showing stress due to overgrazing, monitoring river flow and pollution and water levels in wetlands.

The increasing priority being given to the environment will provide more opportunities for the agricultural engineering industry to supply forestry and estate maintenance equipment. This is not restricted to traditional farming and forestry outlets, but finds increasing applications in country parks, urban parks and gardens, maintenance of roadside verges, and motorway central reservations, sports fields, golf courses and even private gardens.

Another opportunity is in the field of farm animal waste management. The public is becoming less tolerant of pollution from farm waste whether it be silage effluent and slurry running off into water courses, or malodours spoiling the enjoyment of being out in the fresh air. The problems are compounded by the increases in herd and flock sizes and the concentration into large, intensive units necessitated by economic pressures. These factors all point towards the need for more sophisticated waste management systems in the future.

The main growth area in the field of engineering applied to agriculture, however, will be in the food processing sector. The demand for prepacked, quality produce, convenience foods and ready-cooked meals looks set to continue its increase. Whilst interest in cooking at home is probably greater than it has ever been, it is becoming a leisure pursuit for special occasions, whereas the demand for ordinary everyday meals is more often for something which can be produced as quickly as possible with minimum effort. This must create increasing demand for equipment for sorting, grading, processing, cooking and packing.

The Institution

So what can we learn from all this about the future of the Institution?

When thinking about the Institution in preparation for this address, I re-read John Gowing's paper: "Biological Engineering: into a New Era for the Profession" - in last summer's edition of the Journal (Gowing, 1995). He made some very pertinent points in that paper which have not been adequately addressed since. However, the first inference which I should like to draw from his paper is not one which I think he would have wanted. He showed how membership of the Institution had varied since 1948 and pointed to the fall in membership since 1985. I have been only too well aware of the fall in membership in recent years, but I must admit to having been heartened to realise that membership of the Institution was no higher in the mid 1960's than it is today. Bearing in mind how much larger the industry was in the 1960's compared with today, it is immensely encouraging that membership has held up so well over that time.

Two important exercises have been carried out in recent years to try to map out a future path for the Institution. The first was the survey of members, the results of which were published in the spring 1994 edition of the Journal (Finney and Godwin, 1994), and the second was the Strategy Forum held at Silsoe last

summer.

The first thing which struck me when looking again at the results of the survey was the wide range of interests of our members. This exemplifies one of our problems. Agricultural engineering is not a branch of engineering in the same sense as are mechanical, electrical, or civil engineering. John Gowing made this point in his paper and asked the question: "Is agricultural engineering a discipline, or is it rather the specialised adaptation of other engineering disciplines to the problems of agriculture?" His answer was to propose the concept of biological engineering, suggesting that biological engineers would be to biology what chemical engineers are to chemistry and mechanical engineers are to mechanics. He then listed a range of applications which biological engineering would embrace - biomechanics, bioinstrumentation, biomaterials, bioprocessing, food engineering, aquaculture engineering, ecological engineering and bioremediation. I have much sympathy for his views, but consider that what he suggests could be accommodated without losing our traditional base, a compromise position which he himself suggested.

A disappointing result of the survey was that only about one-third of the respondents ever attended Branch meetings or Annual Conventions. I believe that this is particularly regrettable because members, especially younger ones, who do not attend meetings, are missing out on a valuable oppportunity to make contacts which will help them in developing their careers. I am sure that anyone who takes an active part in Institution affairs will agree with this but, unfortunately, those who have not experienced it will never know what they are missing.

We must continue to give careful thought to the ways in which we organise our meetings to obtain maximum benefit from the time and effort that goes into them. For Annual Conventions, I personally feel that we could use the ASAE model, even though we are only one-tenth of their size. By that I mean persuading as many as possible of the Specialist Groups to use the event for their main, or one of their main, conferences of the year, so that we have really lively parallel sessions going on thoughout the day and all delegates attend in the knowledge that they are going to have a full day of activities devoted to their own specialist interests.

The Specialist Groups represent one of the main hopes for increasing the strength of the Institution in the future. They can be the means of revitalising Branch meetings and Annual Conventions and of attracting new members by opening up new areas such as food, the environment, or aquaculture.

"early professional contacts span a career and last a lifetime"

However, we do not exist alone as an Institution. The Engineering Council has recently been reformed and it is my hope that under its new Director-General, Mr Mike Heath, it will bring much greater benefits to the engineering profession, in general, than its predecessor was ever able to achieve. We are, of course, a very small player indeed in this company with less than 0.5% of all Engineering Council registrants. Nevertheless, we have our part to play and have a good record of achievements despite our small size.

The pressure for small Institutions such as ours to let ourselves be swallowed up by larger ones or amalgamate to form larger ones has gone. There is now much more of a spirit of co-operation which I think suits us well, but we should use the opportunities which this situation offers. For example, the Institution of Mechanical Engineers has a Food Engineering Division. We should explore the possibilities for co-operation with them and other groups with similar interests to ours in other Institutions. This could be done both nationally and at Branch level. The limited resources available to us all are too valuable to waste in duplication.

There are two recent initiatives in which I believe we are playing valuable roles despite our small size. The first is the Engineering Council initiative Continuing Professional Development (CPD). As you know, we got off to a flying start with our CPD booklet and I hope this will prove to be an invaluable asset to members in their own Personal Career Development (PCD). This new focus for ways in which the Institution can help members to progress their careers was initiated by Brian May and confirmed by the Strategy Forum as one of the most effective ways for fulfilling the Institution's mission.

The second initiative which I should like to mention is the Year of Engineering Success (YES). This will take place in 1997 and will be a national effort supported by the Engineering Council and all the Institutions with the aim of raising awareness of the benefits of engineering and improving the image of engineers. We already have a Committee in place and are planning ways in which we can incorporate the successes of agricultural engineering into the overall picture. This will be the theme of our Annual Convention in 1997, when our keynote speaker will be the Director-General of YES, Dr Mary Harris.

Conclusions

In conclusion, I hope that these personal thoughts on where we are coming from and where we are going to will provoke some positive thoughts and action. I hope that they have conveyed my conviction that agricultural engineering, in the broadest sense, is a vital and vibrant industry which has a tremendous amount to contribute to the quality of life of people everywhere. I also believe that our Institution has an exciting future if we can grasp all the opportunities that are out there. I hope that, during my Presidency, we can at least make some progress together in turning some of these dreams into reality.

Footnote

The opinions expressed in this Address are those of the author, and do not necessarily represent the official policy of MAFF.

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Soil stabilisation for rural housing

Desiderio G Simango

In many rural areas in Malawi and in many other African countries, traditional resources used in the construction of farmers' dwellings are becoming increasingly scarce. The growing rural population is tending to over-exploit a limited resource of traditional building materials, such as grass and timber, at the same time as reducing that resource by extending cultivation into marginal land which is the traditional sources of such building materials. Also, labour-saving skills in traditional methods of construction are limited and expensive. These scarcities have forced the rural dwellers to look for alternative materials and construction methods, causing increases in construction costs.

1. Introduction

For a long time, the most common structure was dry clay on a framework of sticks. As the socio-economic situation improved and due to the influence of urban houses, the use of fired clay bricks has increased in the rural areas over the years *(Figure 1)*. With the depletion of trees, however, people have resorted into using unburnt air-dried bricks (adobe) for construction of walls. Owing to the labour involved in moulding bricks, the use of earth-rammed walls is the most widely used. The problem with earth (mud) as a building material, is its weaknesses which include low resistance to water penetration, ease of erosion by water, low compressive strength, cracking due to

high shrinkage/swelling ratio and low resistance to abrasion, requiring frequent maintenance and repair.

With the addition of stabilisers, the durability of earth as a building material can be improved, increasing strength and resistance to water penetration and erosion. Among the many indigenous materials that have been employed as stabilisers, the following are said to have been successful in varying degrees (Dietz, 1979; Bengtsson and Whitaker, 1986): oat straw, elephant grass, jute fibre, molasses, rice husk ash, various plant juices and cattle dung. Soil stabilisation with natural fibres such as sisal and straw is mainly for tensile reinforcement, but the fibres have also been used to reduce swelling and shrinkage of the soil. However, they have also been found to increase water absorption in dry soil blocks and reduce compressive strength of the soil (Stultz, 1983). Man-made materials such as bitumen, asphalt, Portland cement, unslaked lime and resins, have been used as stabilisers with the aim of increasing the soil's resistance to

Fig. 1 Typical village house (above) and improved house (below).

Dr D G Simango is Senior Lecturer at the Department of Agricultural Engineering, Bunda College of Agriculture, University of Malawi, P O Box 219, Lilongwe, Malawi.

Table 1 Effect of cow dung on compressive strength of adobe.

Dung:soil ratio	Mean compressive strength, N/mm²	
	Silty clay[1]	Sandy clay[2]
0:1	2.12 (+/- 0.58)	1.77 (+/- 0.33)
1:6	2.27 (+/- 0.98)	1.89 (+/- 0.41)
1:5	3.41 (+/- 0.69)	1.79(+/- 0.39)
1:4	3.94 (+/- 0.81)	2.17 (+/- 0.45)
1:3	3.92 (+/- 0.39)	2.17 (+/- 0.51)
1:2	4.52 (+/- 1.37)	2.41 (+/- 0.57)
1:1	4.40 (+/- 0.97)	2.85 (+/- 0.25)

Silty clay[1] : 26% sand, 35% clay, 39% silt.
Sandy clay[2] : 52.5% sand, 42.9% clay, 4.6% silt.

destructive weather conditions. However, the majority of the rural people cannot afford these stabilisers for house construction.

In Malawi, cow dung (an emulsion of cow dung plaster) has been used for rendering the walls of grain and groundnut stores, and for the rammed walls of dwelling houses. The treatment conceals cracks and protects the walls from rainfall erosion. Cow dung is sometimes used as a floor treatment to increase the soil's resistance to abrasion. A mixture of cow dung and clay or mud, straw and cow dung have been used for rendering in countries such as India, Ghana and Sudan, and the walls have lasted for years (Agarwal, 1981; Miles, 1976).

This paper reports the results from two studies to investigate the effect of cow dung as a soil stabiliser for air-dried bricks (adobe) for the construction of rural houses and in low-income urban areas made from two types of soils. The bricks were moulded during the months of June and July.

2. Methodology

Silty clay and sandy clay soils were used. These soils are suitable for earth wall construction but soils with too much clay have high shrinkage on drying, resulting in cracking (Sandness, 1977). However, opinions differ on the clay and sand content of the soil suitable for adobe. Ranges from 20% to 50% sand (as long as there is enough clay to provide good cheap cohesion to the dried brick) and 25% to 80% clay are acceptable (Dietz, 1979; Sandness, 1977).

Cow dung was mixed with the dry soils in various proportions by volume in the cow dung/soil ratios of 0:1, 1:6, 1:5, 1:4, 1:3, 1:2 and 1:1. A 240 x 120 x 90 mm mould was used to mould the bricks manually. The freshly made bricks were shaded with grass to encourage gradual drying and to prevent cracking and disintegration. Each treatment consisted of 48 bricks. Compressive strength tests were conducted by using 12 unsoaked bricks per set. The porosity of the adobe bricks was determined by measuring the depth of water percolation after they had been immersed in water for periods of 4 hours, at 0.5, 1, 2, and 4 hour intervals. Erosion was determined by exposing twelve adobe bricks from each treatment to the rains from December to April. The difference between the initial and final weights indicated the amount of admixture eroded.

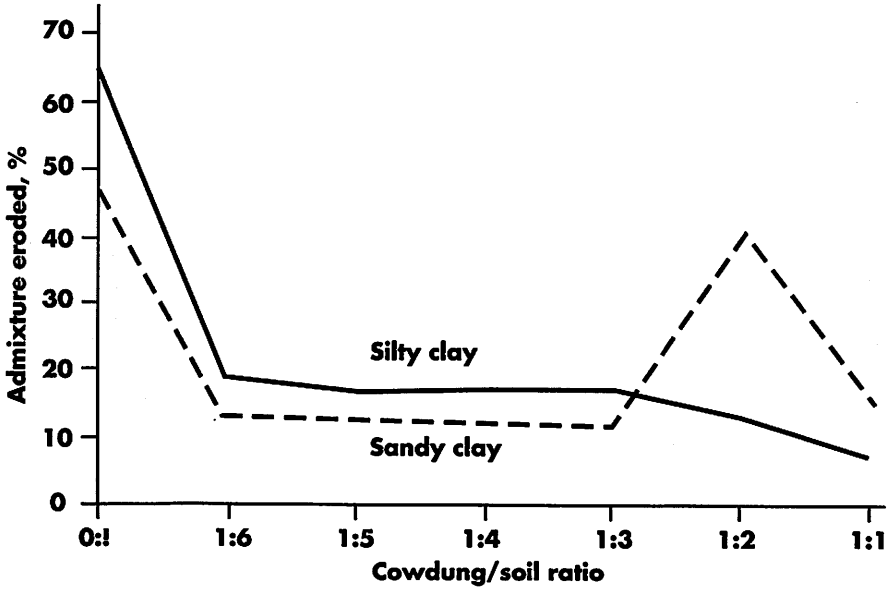

Fig. 2 Effect of cow dung on erosion of abode.

3. Results and discussion

3.1 Compressive strength

Table 1 shows the change in the compressive strength versus the amount of cow dung in the mix for the two soil types. The data indicates that addition of cow dung improved the compressive strength of the soil. A ratio of 1:2 showed the highest compressive strength in the silty clay and 1:1 in the sandy clay soil.

The results show that cow dung improved the compressive strength of the silty clay and sandy clay soils by 113% and 38% at the optimum mix ratios, respectively. The high values obtained in these investigations indicate that cow dung has cementing agents which improved the adhesion among the soil particles and this increased the compressive strength. The Ministry of Works' specification for fired bricks is a minimum of 3.45 N/mm² and an average of 5.52 N/mm². On the basis of compressive strength alone, the results compare favourably with the above specifications, especially with cow dung/soil ratios between 1:5 and 1:1.

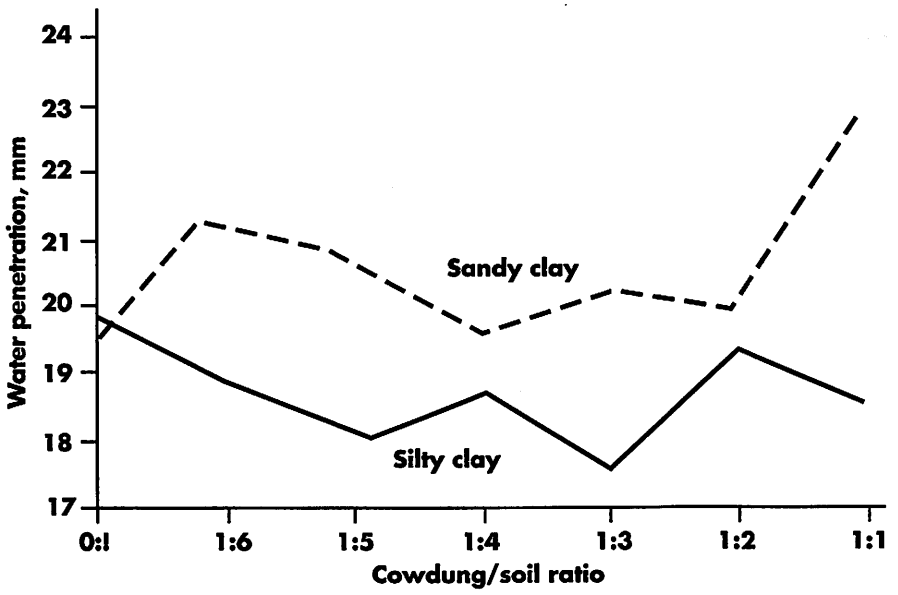

Fig. 3 Effect of cow dung on the porosity of adobe.

3.2 Erosion

The effect of cow dung on erosion of adobe is shown in *Figure 2*. Addition of cow dung increased the soils' resistance to erosion, as indicated by the small amount of admixture eroded in all the treatments when compared with the control. This means that the stabiliser acted as a binding agent which increased the cohesion and internal friction between the soil particles. The highest proportion of cow dung in silty clay and sandy clay soil increased the resistance to erosion by 78% and about 13% over the control, respectively. It was observed that the adobe made from the untreated soil had completely disintegrated and had formed a heap of 'crumbs', while those made from the treated soils retained their general shape.

3.3 Porosity

The test for porosity measured the resistance of the adobe to water penetration and the results show that this was achieved in the mixture with cow dung/soil ratio of 1:3 for silty clay. Addition of cow dung to sandy clay reduced the resistance to water penetration. This is shown in *Figure 3*.

4. Conclusions and recommendations

The results obtained from the above investigations have demonstrated that the durability of soil as a construction material can be greatly improved by proper treatment with cow dung as a stabiliser in a suitable amount. The objective of stabilisation is to increase the strength, impermeability, erosion resistance and durability of the soils used for the construction of adobe, wall elements, mortar and plaster used in masonry and earth buildings. No one stabiliser improved the durability of the soil in all aspects, but most of these conditions have been met in these investigations with varying degrees.

Cow dung is susceptible to termite attack, and therefore the 1:1 ratio cannot be recommended for construction of adobe buildings. Also, the light weight of the adobe of the above cow dung/soil ratio makes it unsuitable for permanent structures. In both investigations, therefore, the optimum proportion is 1:2 based on strength alone because the resistance to water absorption was hardly improved. Because of the lower resistance to water absorption and erosion of sandy clay, the abode from this soil will require greater protection against driving rains than that from silty clay soil. This can be achieved by proper building design and architecture.

The data presented here are for two soils only. Further research is needed on the stabilisation of other soils, eg clay loam, for the construction of low-cost housing using cow-dung which is a natural material. Other natural stabilisers need to be investigated for all types of soil. The development of low-cost materials for building construction from available, indigenous earth materials is urgently needed to help solve the housing problems in rural areas as well as in low-income urban areas. Improved soil characteristics will result in increased strength of adobe which may eliminate the need to rely on fired bricks for permanent structures, and will result in a great reduction in the energy demand of the rural people.

Acknowledgements

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Minimising nitrate loss from sewage sludge

Mark A Shepherd

Sewage sludge offers a useful source of N for crops, but applications must be such that nitrate leaching from agricultural soils is minimised to protect water sources. The principles of good sludge use are straightforward, but are perhaps not so easy to put into practice. They involve (a) ensuring that the supply of N from sludge (and any additional 'topping up' with inorganic fertiliser) does not exceed the crop's requirement and (b) avoiding the application of some sludge types in autumn. Sludges can be classed as having a high or low leaching risk by their composition. For example, liquid digested sludge, with about 60 % of its N in a 'readily available' form, could cause substantial N loss if applied in autumn; dewatered cakes, with most N in a recalcitrant organic form, offer less risk and there is no need to restrict application times.

This paper was presented at the IAgrE conference entitled: "Sewage sludge and water resources - present and future", organised by the Soil & Water Specialist Group and held at the ADAS Land Research Centre, Gleadthorpe on 29 November 1995.
Mark Shepherd is a Soil Scientist based at ADAS Land Research Centre, Gleadthorpe, Meden Vale, Mansfield NG20 9PF.

1. Introduction

Nitrate in water has been, is and will continue to be a contentious issue, but it is not the intention to debate it here. Agriculturists have to accept that:

- there is a limit of 50 mg/l nitrate in our drinking water (Anon., 1980), and this limit is unlikely to increase
- some drinking water sources are above this, and others are expected to exceed it in the future
- much of the nitrate derives from agriculture and steps must be taken to decrease leaching
- legislation (the Nitrate Directive; Anon., 1991a) requires agricultural practices to be modified to protect water sources at risk from nitrate pollution.

MAFF's Pilot Nitrate Sensitive Area (NSA) scheme (Anon., 1990) has shown that leaching can be decreased by modifications to agricultural practices, but the challenge ahead is a difficult one; if we assume that all nitrate leaving agricultural land finds its way into water (i.e. no denitrification in unsaturated zones), then the average loss from much of central England, with average annual drainage of only 180 mm, must not exceed 20 kg/ha, and losses from (drier) E Anglia must be less still. To put this in perspective, soils typically have 50-150 kg/ha N in the top 1 m in autumn.

The NSA scheme has identified that better use of organic manures (and sewage sludges) is crucial in decreasing nitrate leaching. With land application as a major route for sewage sludge (Chambers, 1996), it is important that these practices do not exacerbate nitrate leaching and this article reviews current advice on how to decrease losses.

2. Nitrogen in sewage sludge

Nitrogen (N) in sludge can be considered to consist of two main fractions, inorganic and organic *(Figure 1)*. The inorganic N is usually in the form of NH_4-N. Although compositions can vary, typical inorganic N contents (as a proportion of total N) are 50-60, 25-30, 10-15 per cent for liquid digested, liquid raw and dewatered cakes, respectively *(Figure 2)*.

On application to the soil, the NH_4-N is quickly converted to nitrate by microbial action *(Figure 1)*. The organically bound N is generally more resistant to breakdown, but some of it will be less recalcitrant and after application will be mineralised (converted to NH_4-N) and then nitrified. The inorganic and easily mineralisable fractions are the 'readily

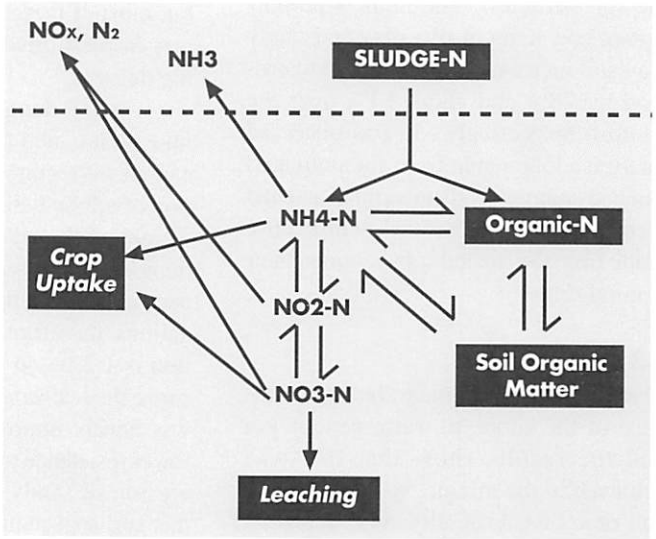

Fig. 1 The nitrogen cycle for sludge-N applied to the soil.

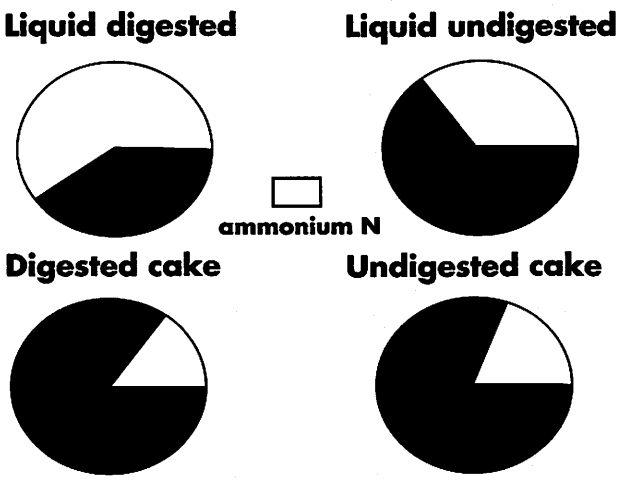

Fig. 2 The average composition of sewage sludges, inorganic N as a proportion of total N (from Anon., 1994).

available' N. The residual organic N contributes to the soil's organic pool and is only slowly mineralised over the following years. Sludge composition is a major factor in determining nitrate leaching risk and therefore influences its use on agricultural land. Sludges with a high proportion of readily available N (liquid digested sludge, for example) are considered a high risk and, as shown below, particular care must be taken with timing their application to land. Sludges such as dewatered cakes (with most N in organic form) are obviously less susceptible to leaching, and can be handled accordingly.

3. Nitrate leaching from sludge

3.1 Sources of advice

MAFF's Codes of Good Agricultural Practice for the Protection of Air (Anon., 1992), Soil (Anon., 1993) and Water (Anon., 1991b) provide advice on avoiding pollution. The code for water is particularly relevant to nitrate leaching. The advice is not mandatory, whereas farmers who join the NSA scheme must follow specific regulations. Under the Nitrate Directive, farmers within the designated Nitrate Vulnerable Zones (NVZs) must also adhere to specific practices. Although there are some differences in the detail between guidelines, the main restrictions placed on manures and sludges are time and rates of application *(Table 1)*, for reasons outlined below.

3.2 'Direct' and 'Indirect' leaching losses

Two main agronomic (mis)practices result in increased nitrate leaching from sludge applications:

• *overfertilising the crop in spring* so that a large amount of nitrate remains in the soil at harvest, which is available for

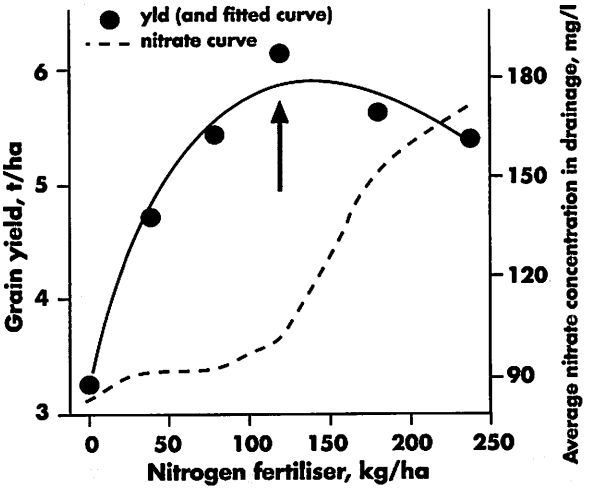

Fig. 3 The effect of nitrogen fertiliser rate on cereal yield and nitrate leaching during the winter after harvest, Gleadthorpe Research Centre.

Table 1 A summary of the current advice or mandatory restrictions relating to rates and times of applications of sewage sludges.

	Source of advice or restrictions			
	Water Code	*Nitrate Sensitive Area Scheme*		*Nitrate Vulnerable Zones (under the Nitrate Directive)*
		Pilot Scheme	*New Scheme*	
Comments	MAFF code	Pilot (1989) superseded by new (1994) scheme		Details still to be finalised
Status	Not mandatory: guidelines only	Compulsory for those who sign to the schemes: compensation paid		Compulsory for all in designated areas. No compensation
Max. annual application rates (all sludges)	250 kg/ha total N	175 kg/ha total N	No sludge allowed	250 kg/ha total N for grass 210 kg/ha total N for arable (arable likely to be reduced subsequently to 170 kg/ha)
Timing restrictions	Avoid autumn/early winter applications of liquid sludges; no restrictions on cakes	No liquid sludges between: 31 Aug & 1 Nov (grass) 30 Jun & 1 Nov (arable) No restrictions on cakes	No sludge allowed	No liquid digested sludge between- 1 Sep - 1 Nov (grass), 1 Aug - 1 Nov (arable). No restrictions on cakes or raw liquid sludge

Table 2 Fertiliser allowances made by farmers, after applications of organic manure (from Chalmers et al., 1992).

Crop	Area receiving manure, % of crop	Fertiliser allowances, kg/ha	
		Nitrogen (N)	Phosphate (P_2O_5)
Winter wheat	11	20	0
Oilseed rape	9	28	13
Potatoes	37	9	36
Sugar beet	27	7	20
Silage grass	65	1	5

leaching during the winter after harvest ('indirect' loss);

• *mis-timed autumn applications of sludge* (and farm wastes) with a large available N content which is readily nitrified and leached during the winter of application ('direct' loss).

3.3 'Indirect' losses - fertilising the crop

Sludge can be an important N source for crops. The difficulty is ensuring that full account of the applied N is taken when deciding what additional 'bag' fertiliser to apply. *Figure 3* shows the consequence of overfertilising a crop - once the optimum N rate is exceeded, extra N gives large increases in post-harvest leaching.

However, it is common for farmers to underestimate the N available to a crop from an application of organic manure or sewage sludge *(Table 2)*. This is perhaps not surprising because many factors affect N availability to the crop, including application rate, time and method, manure composition, soil type and subsequent weather. Another difficulty is the variable composition of many organic wastes. Here, sludge has an advantage over most animal manures because the farmer is provided with an analysis and the application rates of liquid sludges are metered. If the sludge analysis includes both total and ammonium N this is a good starting point to calculate a fertiliser recommendation. However, there is further research required to develop a robust, field specific fertiliser recommendation system following sludge applications, which takes account of all the factors involved.

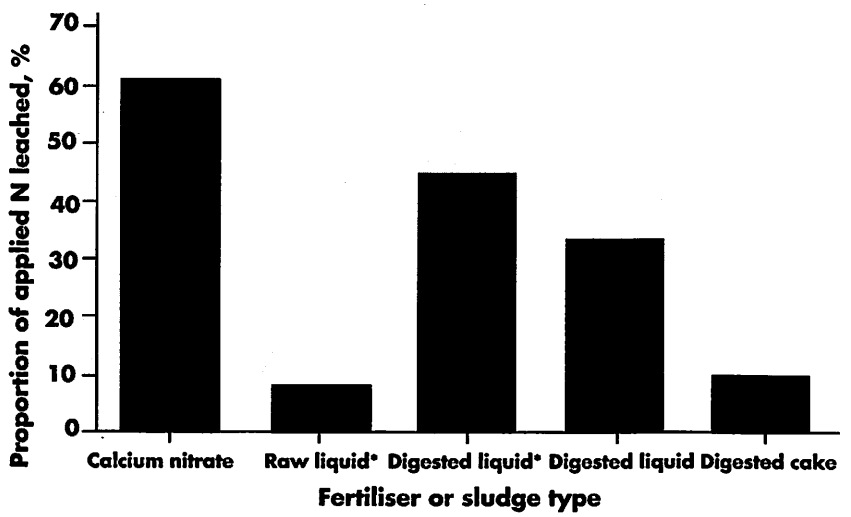

Fig. 4 Nitrate leaching from applications of sewage sludge to winter barley. Gleadthorpe Research Centre, winter 1991/92. All surface applied, except '*', which were injected.

3.4 'Direct' losses - autumn sludge applications

Leaching risk from autumn/winter applications depends on sludge composition and time of application (or, more precisely, the amount of rain after application). Autumn applications of farm wastes cause substantial nitrate leaching if a large proportion of the manure N is readily available (Unwin *et al.*, 1991). Hence, pig slurry and poultry manure are a greater risk than cattle FYM (with most of its N in organic form). Results from recent (DoE funded) experiments with sewage sludge broadly agreed with this, as shown in *Figures 4 and 5*; nitrate leaching was greatest from sludges with more readily available N (especially liquid digested sludge), and the earlier the application the greater the N loss, with N leaching minimal from applications in December onwards. Losses were also smaller from applications to grassland compared with arable soils, presumably because the established sward was able to utilise some of the applied N. Deep injection exacerbated losses because the N was placed well down the soil profile and required less drainage to leach it beyond the crop's rooting zone.

Perhaps a technique with some potential is the use of a nitrification inhibitor. Diciandiamide (commercially available as Didin) is one example and inhibits conversion of ammonium to nitrate; ammonium is less mobile than nitrate so leaching decreases *(Figure 6)*, which would allow the autumn application window to be widened. However, the cost may well be prohibitive and its effectiveness depends on time and rate of application, and subsequent weather (the inhibitor is degraded by microbial action, so rate of decomposition depends on soil temperature and moisture status). More work over the wide range of conditions is therefore needed before this could be recommended as an acceptable technique.

3.5 Longer term implications of sludge application

Sludge applications will contribute substantial organic N to the soil in the long-term, the rate of build-up depending on rate and frequency of application, and the proportion of organic N in the sludge. Current advice in the Code of Good Agricultural Practice for the Protection of Water and in the NSAs aims to avoid a rapid accumulation by setting application limits for organic manures (including sewage sludge). This approach should reduce the risk of increased leaching re-

sulting from mineralisation of a larger soil organic N pool, although further research is required to confirm the longer-term effects.

4. Conclusions

Sewage sludge (and animal manures) are a useful N source for crops, provided that action is taken to minimise losses to the environment. Advice on use generally places restrictions on application rates and times, and recent research supports this advice:

- Do not exceed the crop's N need with large applications of sludge. Annual limits guard against this and also avoid a rapid build-up of organic N. Currently there is some conflict between guidelines in the maximum annual rate *(Table 1)*, and this may be harmonised in the future.
- Take full account of N applied in sludge when applying additional 'bag' fertiliser to avoid overfertilising the crop.
- Do not apply high available N sludge in autumn. The general advice is not before 1 November *(Table 1)*. But what is a 'high available N' sludge, particularly as sludges can be so variable? This is overcome by classifying liquid sludges (both digested and raw) as high risk, with the result that spreading restrictions are placed on both.
- Shallow injection is preferable, as this avoids placing N deep in the profile, with less risk of N moving beyond the crop's rooting zone.

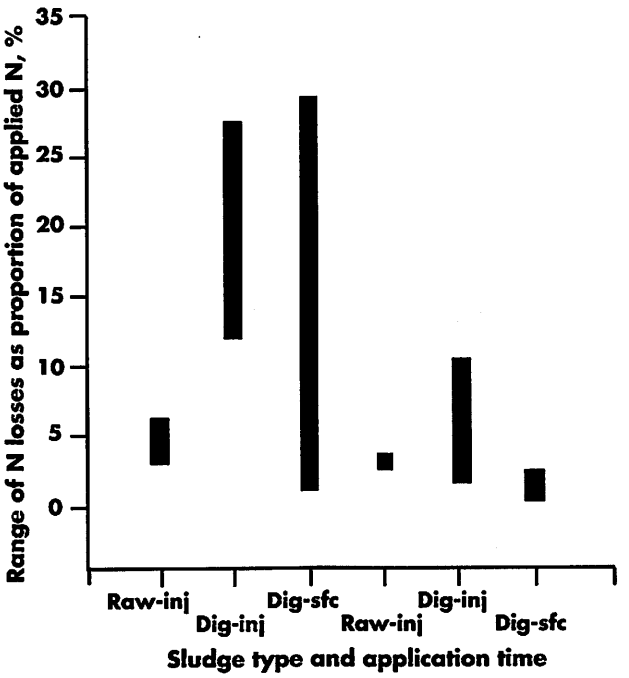

Fig.5 The range of nitrate leaching losses from sewage sludge applications to grassland in the south-west, expressed as the proportion of applied N leached, as affected by sludge type and application time. Two sites in two winters (i.e four site years). 'Dig'=digested sludge, 'sfc'= applied to the soil surface, 'inj'=injected

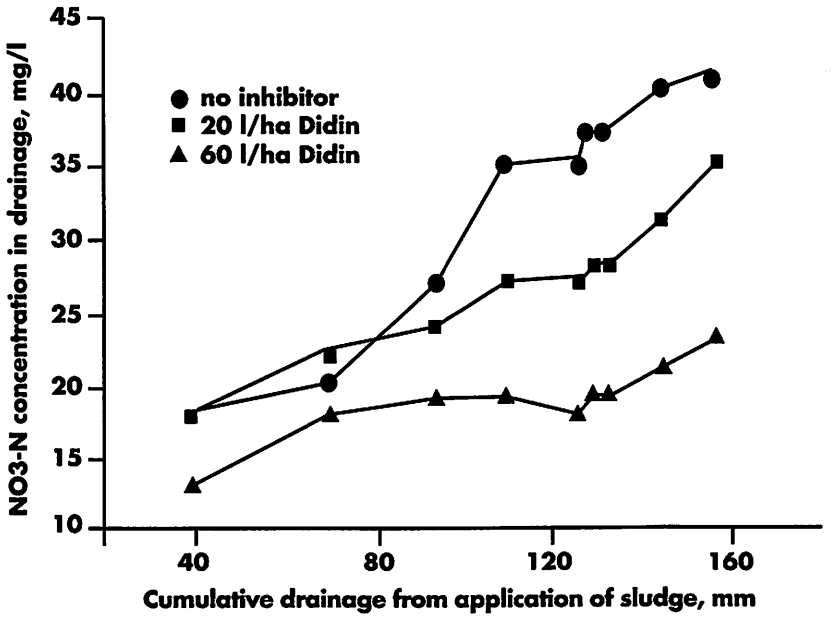

Fig. 6 The effect on nitrate leaching of mixing a nitrification inhibitor with liquid digested sludge applied to bare land. Gleadthorpe Research Centre, winter 1991/92.

- Nitrification inhibitors are not legislated for.

So this is the advice; the next challenge is putting it into practice.....

Acknowledgements

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The agronomy of *Miscanthus*

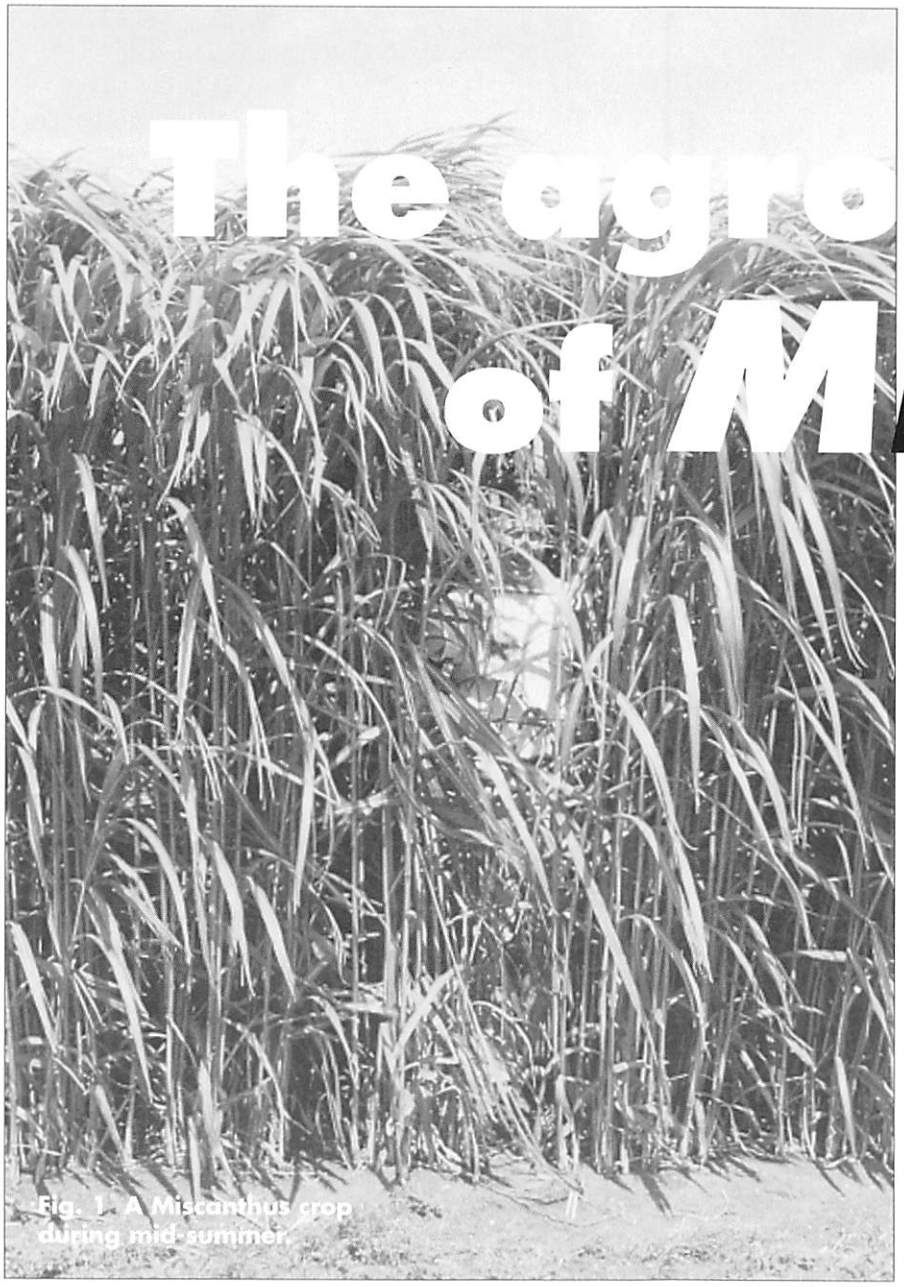

Fig. 1. A Miscanthus crop during mid-summer.

This paper was presented at the IAgrE conference entitled: 'Miscanthus - its future as a UK crop', organised by the Agro-industrial Products Specialist Group and held in The Maltings, Ely on 15 February 1996. ***Dr Mike Bullard is a crop physiologist working at ADAS Arthur Rickwood Research Centre, Mepal, Ely, Cambridgeshire, CB6 2BA***

Introduction

Burning plant material (biomass) to produce heat and light is the oldest form of anthropogenic energy production. In the so called 'developed world', burning biomass has been supplanted as the major source of energy by fossil fuels, nuclear energy and even hydro-power (Scurlock & Hall, 1992). Only recently has interest in the production of energy from farm grown crops been seen once again to have potential. This has been stimulated by the concomitant development of 'set-aside' within the European Union's Common Agricultural Policy, which requires a proportion of agricultural land to be taken out of the production of certain commodities, and the Department of Trade & Industry's Non-Fossil Fuel Obligation (NFFO). The group of energy species which are currently closest to widescale production are collectively known as arable energy coppice (AEC), and include willow (*Salix* spp.) and poplar (*Populus* spp.). However, the search has been on for some time to develop even more productive species for the UK. One genus which is showing potential as both an energy crop and valuable source of fibre is *Miscanthus* (elephant grass) a perennial C_4 grass with centres of diversity in Asia and Africa. This crop has received a great deal of attention throughout Europe in the last ten years (Rutherford & Heath, 1992); its performance in the UK is reported by Bullard, Heath & Nixon (1995) and Kilpatrick *et al.* (1994). ADAS currently has a wide-ranging experimental programme with *Miscanthus* including complex physiological studies, a yield evaluation on seven sites, and a re-classification of *Miscanthus* in association with the Royal Botanic Gardens, Kew, all of which are funded by MAFF. In work funded by Anglian Water plc, ADAS is assessing the value of sewage sludge as a fertiliser source for *Miscanthus*. Finally, ADAS is a partner in the European *Miscanthus* Research Network. This paper reviews the agronomy of the genus *Miscanthus*.

The genus *Miscanthus* consists of woody, perennial, tufted, rhizomatous grasses which have two centres of diversity, Africa and Asia. Several species have been cultivated in Europe for many years as ornamentals, but have not been grown as crops. Only two species are receiving research interest in the UK at the moment; *M. sinensis* and *M. sacchariflorus*. It produces new shoots annually (usually during late April in the UK) which produce erect, robust stems which may grow up to 4 m tall by late August *(Figure 1)* and appear similar to thin bamboo canes (c. 10 mm in diameter). The stems are usually unbranched and contain a solid pith. Competition for light triggers senescence of the lower canopy layers from late July. Senescence accelerates during autumn as nutrients sequester back to the roots and a deep leaf litter develops. The foliage dies at the end of the growing season, fol-

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Michael J Bullard

lowing the onset of frost, and the stems desiccate to a low moisture content during the winter. By February, free-standing leafless canes remain, and it is these which are harvested mechanically *(Figure 2).*

Establishment

There are three main methods of propagation; seed, rhizome and micro-propagation. The *Miscanthus* 'varieties' which are currently under review in the UK do not set viable seed. Even if production from seed were viable the species are highly heterozygous, so clearly the resultant generations would be highly variable (Andrews & Gilbert, 1992). This could, of course, be rectified through breeding.

Both *M. sinensis* and *M. sacchariflorus* spread by means of rhizomes with buds in the leaf axils which break readily when the rhizomes are divided. The rhizomes are easily accessible, forming a tangled mat just below the soil surface, whilst the root system penetrates much deeper. These rhizomes can be split and re-planted to produce new plants. Rhizome pieces must be kept moist before re-planting. Most recommendations suggest that rhizome pieces approximately 10 cm long, with three or four buds, will afford satisfactory establishment. The success of establishment appears to depend on date of planting. A moist, fine tilth affords optimal establishment. It is generally recommended that rhizome pieces are planted in late April.

Micro-propagation techniques involve multiplication from meristematic tissue. Whilst micro-propagation can provide a large number of uniform daughter plants, experiences in the UK at least suggest that they require a high degree of cosseting before, during and after planting out in the establishment year, and initial growth is slower than that of rhizome-derived plants of the same age. In particular, micro-propagated plants undergo a severe transplanting check, and during the early stages of growth it appears essential to maintain adequate soil moisture levels. Micro-propagated plants should be planted in May, after the last threat of frost has passed.

Optimal planting density is likely to lie between 1-3 plants/m^2, and may vary from site to site. As the crop will spread rhizomatously to cover all the available ground, a wide spacing may ultimately be more economic even though initial yields will be lower. There is evidence that different species and varieties have varying optimal planting densities (Kolb *et al.*, 1991), and current ADAS studies are addressing the influence of spacing on yield and crop longevity.

The current cost of establishing a *Miscanthus* plantation is high - approximately £3000-5000 for 10000 plants. These costs will reduce dramatically as demand stimulates the supply of rhizome pieces or plantlets. There is evidence from The Netherlands which suggests that planting costs as low as £250/10000 plants is possible - achieved by power-harrowing existing plantations and harvesting the broken rhizome pieces.

Climatic requirements

The climatic variable with perhaps the greatest influence on *Miscanthus* productivity in the UK is temperature. There are two elements of temperature response which are of interest. The first concerns the limits of survival for *Miscanthus*. Miscanthus accumulates biomass by fixing atmospheric carbon during photosynthesis. In common with many tropical plants the biochemical pathway of its photosynthesis is different to that of most UK crops and is referred to as C_4. One consequence of this is that C_4 crops are generally intolerant of low winter temperatures, and particularly susceptible to frost (Clayton & Renvoize, 1986; Jones & McNally, 1987), and although Miscanthus is a relatively frost-tolerant C_4 plant, questions about its suitability to northern latitudes remain. In northern Europe the failure of young *Miscanthus* stands is often attributed to severe frosts, although the real cause of these failures is more likely to be poor husbandry. Evidence from Japan indicates that *Miscanthus* can tolerate mean minimum temperatures below those ever experienced in the UK (Numata, 1975). In addition, frost tolerant 'varieties', such as *M. sinensis* Goliath are available and there is much scope for genotypic screening for frost tolerance (Long *et al.*, 1989). The end of the growing season is usually caused by the first frosts, and again there appears to be some varietal differences in the ability of the plants to withstand autumn frosts.

The second element concerns the efficiency with which *Miscanthus* converts solar energy into harvestable yield. Plant species with C_4 metabolism may be more efficient at converting solar radiation into biomass but this will only occur under conditions of high temperature and high light intensity. Below approximately 10°C, the C_4 pathway does not function. These species may have a minimum required cumulative temperature at which they yield maximally. Certainly the yields of *Miscanthus* obtained in many trials in northern Europe suggest that it is well adapted to a range of European conditions.

Yield

C_4 crops like *Miscanthus*, have a theoretical maximum yield in the UK (c.55 t ha^{-1} yr^{-1}) which is approximately 60% higher than that for the C_3 (c. 33 t ha^{-1} yr^{-1}) crops. However, this potential yield advantage is likely only to be expressed at high levels of radiant energy and temperature; at low temperatures and light

intensities, C_3 photosynthesis may be more efficient. Another key determinant of yield is soil moisture supply. Some estimates suggest that the equivalent to 750mm of annual rainfall are required if *Miscanthus* yield is not to be limited by moisture.

Evidence from Europe and the UK over the previous 10 years suggests that annual dry matter (DM) yields may lie in the region of 15-25 t/ha. It appears that the method of propagation has implications for DM yields, at least in the first few seasons. Generally, transplanted micro-propagated plants appear to be less vigorous in the first season than do macro-propagated plants derived from rhizomes. Most experiments in the UK are only now entering their 'mature yield' phase, and certainly productivity so far suggests that the yield potential of the crop in this country is very high.

Crop longevity is as important as maximum yield when considering a perennial crop. Clearly a crop that yields 25 t ha^{-1} yr^{-1} DM for 10 years is more valuable than a crop that annually yields 35 t/ha for only three years. The longevity of *Miscanthus* and its ability to sustain maximal yields have yet to be established under UK conditions, but it is anticipated that a stand will remain viable for at least 15 years.

The other critical factor for an energy crop is the moisture content on harvest; the drier the crop, the higher the energy yield. Moisture contents as low as 15% are reported in southern Europe, although the best result in the UK have been in the order of 30%. This may be because the plant is still in its vegetative phase in the UK when it starts to dry back - flowering would trigger natural senescence earlier.

Genetic diversity and plant breeding

The classification of *Miscanthus* material is confused at present, and before any formal breeding programmes are undertaken, this classification needs to be addressed. A joint project between ADAS and Royal Botanic Gardens, Kew is investigating the molecular taxonomy of *Miscanthus* at the moment. Clearly a crop that is at such an early stage of development will lend itself to improvement by breeding. The first stage in this improvement should be the correct classification of available material, followed by spaced-plant screening of fertile-seed producing clones to facilitate mass selection of the most promising phenotypes. Once distinct lines, with identifiable traits, have been developed, further specific refinement may take place. One early goal for the plant breeder may be the selection of genotypes with a different phenology which allows the natural growth cycle to be completed (i.e. flowering) in a UK summer. This should facilitate earlier senescence and a drier crop at harvest (and possibly an earlier harvest).

Soil and fertiliser requirements

High yields have been reported on the continent on a wide range of arable soils, from sands to high organic matter soils and soils with up to 10% clay (Harvey, 1991). Light soils only yield well if rainfall is adequate, and on heavy soils there may be compaction and harvesting problems. Although *M. sinensis* is reputed to be susceptible to waterlogging in its establishment year (Harvey, 1991), there are Japanese observations (Yamasaki, 1981) that *M. sacchariflorus* usually occupies wet areas and yields more dry matter in wet plots than in dry plots. Chatto (1980) also suggests that *M. sacchariflorus* prefers heavy soils or the waterside whilst *M. sinensis* is easy to grow in any soil. A wide range of pH is tolerated, but growth is best between pH 5.5 and pH 7.5. Dark-coloured soils are preferred to light coloured soils because they warm up more quickly and a southerly aspect is preferred because it is warmer than a northerly one. Deep soils tend to produce higher yields than shallow soils (Harvey, 1991) and in Japan, there is a close relationship between depth of the 'A' horizon soil and crop height/yield (Numata, 1975).

N-use efficiency in C_4 crops is higher than in C_3 crops, and the crop actively sequesters large amounts of nutrients into the rhizome during the latter part of the growing season so that nutrient offtake at harvest is minimal. Consequently annual fertiliser requirements are likely to be very low.

Weeds, diseases and pests

Weed control issues have been discussed in detail by Bullard *et al.* (1995). Establishment can be severely checked by poor weed control during the first two years of growth. Sites for *Miscanthus* should be cleared of perennial weeds before planting. A wide range of herbicides including atrazine, propyzamide, mecoprop, fluroxypyr, bromoxynil/floroxypyr/ioxynil mixtures and some sulfonyl ureas has been used effectively with apparent crop safety in Germany, Denmark and the UK. Glyphosate and paraquat have been used in the dormant period between harvest and initiation of spring growth. Particular care is required with micro-propagated plants. If these plants suffer transplant shock it is unlikely that they will tolerate herbicide application at precisely the time when they are most susceptible to weed competition. Mechanical weed control may be the only viable option under these

Fig. 2 Miscanthus ready for harvesting in February.

conditions. Once the crop is mature, *Miscanthus* will smother all weed competition and weediness should present less of a problem. Clearly, if *Miscanthus* is to become cultivated widely, there is a great need for work on weed control in this phase of the crop. In addition, the persistence of perennial crops as volunteers may present a problem when the field is to be returned to main-stream arable production. Thus, herbicidal control of *Miscanthus* itself must be addressed. This may take the form of the

application of high doses of systemic herbicide at the beginning of the growing season, with the land then put down to broad-leaved crops to which graminicides can be applied safely.

Whilst *Miscanthus* spp. are attacked by a number of pests and pathogens in the areas to which they are native, the literature fails to reveal any major pest or disease problems causing serious losses to production (Harvey & Yarham, 1992). Equally, no severe problems have been reported in Europe. However, it must be stressed that this may be due to the very small areas of *Miscanthus* that are currently cropped. If this situation prevails, it will provide an opportunity to reduce pesticide usage. It has been reported (Christian *et al.*, 1995) that micro-propagated plants introduced to the UK are infected with barley yellow dwarf virus. Whilst symptoms only appear when plants are stressed there is some evidence that yields are depressed by as much as 30% in infected plants.

Conclusions

It appears that there are no overwhelming agronomic factors which would preclude commercial exploitation of this crop in the UK. The full environmental range of *Miscanthus* has yet to be determined, and its maximum yield potential or sustainability has not been established. However, results obtained in the UK so far tend to suggest that the crop will grow well, whether or not it will yield at economic levels at a significant number of sites to warrant commercial exploitation has yet to be seen. Experience indicates that establishment from rhizome cuttings is the least problematic method of propagation, although micro-propagation and seed production techniques may be improved as our knowledge of the crop increases.
Certainly, definitive statements relating to the value of this genus for energy or fibre-producing purposes should be delayed until the full range of its genetic diversity has been determined and exploited.

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Book Reviews

Soil Conservation, 3rd ed.

by Norman Hudson
Publisher: B T Batsford Ltd, London
ISBN 071373533

Twenty-five years ago Batsford published Norman's first edition of *Soil Conservation*. The text, predominantly developed from post graduate courses he delivered at Silsoe College, was an instant success and has since become a key work on the discipline. It still remains one of the best teaching texts for students in all countries where soil conservation is a major consideration in agricultural or environmental development.

In this latest edition, the author has retained the basic structure. He has, however, responded to fresh thinking and experiences which have arisen since the second edition was published in 1981. Some of the major changes include:

- the removal of the discussions on wind erosion (argued as now being well covered in other texts);
- the shortening of the account of land capability classifications responding to the trends in national and local planning procedures;
- a wider approach to modelling of soil loss;
- a reduced emphasis on structures for controlling erosion and hydraulic design (again argued as being covered in other texts);
- an increase in coverage of biological control measures.

Generally, all chapters have been revised and updated in response to changing practices. The changes have brought the text 'up to date'. It now emphasises the move to sound land use and farming methods through involvement of farmers at all stages. This, together with all its original assets, makes it an even better work, one which every student and practitioner concerned with Soil Conservation should own.

MJH

Engineering Applications of Pneumatics and Hydraulics

by Ian C Turner (In collaboration with the Institution of Plant Engineers)
Publisher: Arnold, London
ISBN 0340625260
Price: £12.99

This book is based on a series of training modules developed for short courses in basic Pneumatics and Hydraulics which have been used as in company training material. The original material has been expanded to cater for more formal qualification programmes.

This now means that the text is deemed suitable for a range of City & Guilds and BTEC programmes. It is also argued to be suitable for updating practising engineers and students on NSVQ and GNSVQ programmes.

The work is in fact separated into a series of modules ranging from basic principles of Fluid Power Systems through a series including Systems, Symbols, Component Operating Principles to Maintenance and Safety. Modules vary in length from a few to 12 or 13 pages, they are set out with learning objectives followed by the learning material and finishing with structured questions. Refreshingly, answers to these interesting questions are given in an appendix.

The work is also backed up with City and Guild specimen examinations questions as well as relevant technical guides.

The text has a first class presentation, in an easily readable format, with a host of informative illustrations and diagrams.

I strongly recommend it as an ideal reference work for industrial or college based students in this important technology.

MJH

Food and Feed from Legumes and Oilseeds

Editors: E Nwokolo and J Smartt
Publisher: Chapman & Hall, London
1996
ISBN 0 412 459302
Price: £59

This will be a useful addition to the shelves of any library concerned with agricultural production or with human and animal nutrition. Eighteen authors from eight countries have contributed to an interesting résumé of the botanical and ecological background, aspects of production, nutritional (and sometimes anti-nutritional) features and the future potential of a wide range of legumes, a few *compositae, cucurbitaceae, palmae* and four oilseeds. Some five to ten pages are devoted to each in a well indexed and clearly presented text. Each chapter abounds with references which may be called upon to supplement the informative numerical and narrative content.

In addition to accounts of soybean ("probably the world's most valuable crop"), and of the seed of *colocynthis citrullus L.* (the unimproved form of watermelon) and the coconut, the reader's attention is drawn to the little-known (in the UK at least) babassu of S.American origin with its challenge to the engineer to find a means of extracting the multiple kernels from their stone-like all embracing shell. We read of breadfruit, and of castor, but also of the untapped (!) potential of rubber seed oil and protein meal; the latter has a protein content of some 36% and is of great possible interest in monogastric animal nutrition.

Finally, an account of the seed of the Sal tree in of interest, largely for its warnings. Excessive use of this meal in the diet of pigs and poultry can lead to reduced food conversion and production level; even, possibly, to vital organ degeneration. A concluding chapter points out the merits of a 'balanced' diet containing both cereals and legumes and comments on the possible application of genetic engineering for the nutritional improvement of plant seeds. But 'genetic changes must not have any adverse effects on normal seed biology'.

A worthwhile reference book and basic text for those concerned with nutrition and diet.

BCS

Membership Matters

Quarterly The Newsletter of the Institution of Agricultural Engineers Summer 1996

Dr Michael J Dwyer elected President

Dr Mike Dwyer received his engineering education at Southampton University where he obtained a BSc in Mechanical Engineering, an MSc in Noise and Vibration and a PhD for a thesis entitled 'A gasdynamic approach to the design of motor vehicle exhaust silencers'. These were interspersed with a two-year university apprenticeship with Rolls-Royce Aero-Engines in Derby.

In 1965, he joined the National Institute of Agricultural Engineering at Silsoe, which subsequently became Silsoe Research Institute. Whilst there, he worked on implement testing techniques, research on tyre and track performance, tractor-implement control systems, tractor utilisation and transport vehicles, and testing of tractors and safety cabs.

In 1992, he moved to the Ministry of Agriculture Fisheries and Food (MAFF), in London, as Scientific Liaison Officer for Physical Sciences. In this capacity, he is responsible for identifying research needs in engineering and physics which will further the Ministry's policy aims and commissioning and monitoring appropriate projects.

Mike is a Fellow of the Institution of Agricultural Engineers and has served on Council and as Chairman of the Membership Committee for many years. After periods as Vice-President and President-Elect, he became President in 1996. He is also a Fellow of the Institution of Mechanical Engineers and a Chartered Engineer.

Award of Merit for Professor Gordon Spoor

Gordon Spoor, Professor of Applied Soil Physics in the School of Agriculture, Food and Environment of Cranfield University at Silsoe, was nominated to receive the Award of Merit at the 1996 Annual Convention of the Institution of Agricultural Engineers. He is a worthy recipient of this signal honour and it is a great pleasure to members of the Institution that his outstanding achievements have been acknowledged by this prestigious award. Gordon is nationally and internationally known for his work on soil physics, soil management, and especially drainage and irrigation. He is a gifted lecturer, with the ability to present his subject with a clarity and enthusiasm that has captured both practical and academic audiences in many parts of the world.

Professor Spoor received his Masters Degree in Agricultural Engineering in 1961 from Kings College Newcastle, then part of the University of Durham. Gordon taught at the University of Khartoum for two years before joining the National College of Agricultural Engineering at Silsoe in 1963. He progressed from Assistant Lecturer to Professor as the College developed and eventually became part of Cranfield University. During that time he taught and inspired generations of students in soil mechanics, cultivations, drainage, irrigation, soil reclamation, soil/vehicle mechanics and related subjects. Gordon has published 32 research papers, presented some 50 conference papers, a very large number of popular articles, many in North America, and material for short courses and workshops for farmers and contractors in this country and elsewhere. His external contribution includes examining at universities in Britain and overseas, and a leading role on many committees and councils.

Gordon Spoor has made an immense contribution to the science, practice and national awareness of soil management in all its aspects, but most importantly in soil drainage.

Gordon Spoor getting down to the practical details

You can't get a patent for something like that! -

Are you asking me or are you telling me?

Patents provide their owners (or others with their permission) with the exclusive legal right to manufacture, use, sell or otherwise exploit their patented invention in any country where patent protection has been obtained.

As a nation, we have always been one of the most inventive in the Western world and are credited with many famous inventions; the television, radar, the Hovercraft and 'cats-eyes', to name but a few.

All of these inventions were protected by patents (since expired) and, because these are the types of invention that are normally associated with patent protection, there seems to be a belief that you can only get a patent for an invention that is a 'world beater'. This is not the case at all.

Any product or process or an improvement to an existing product or process is inherently patentable, provided that it meets the following criteria. It must:

- be new;
- involve an inventive feature;
- be capable of practical application;
- and not be excluded from patentability according to the UK Patents Act 1977.

Once you have invented something, in order to assess whether your invention meets these criteria, you must talk to a patent agent. Patent agents are the legal experts in this field and will offer advice about the best ways of legally protecting your invention. Although there are several forms of cover, patents protect the underlying concept behind the invention and give the patent owner the exclusive rights outlined above for up to 20 years.

You must speak to an patent agent as soon as possible, preferably at the research and development stage of the invention and certainly before you have told anyone else about your invention. Do not wait until you have started selling you product or using your process, as by then, it may well be too late.

If you are not in a position to exploit your invention yourself (for example, you do not have the necessary manufacturing and distribution network), it is still possible to make money from you patent by licensing the patent to others who do have the necessary network. A patent agent can arrange this.

Ron Hickman, the inventor of the Black & Decker *Workmate* is one of the many who successfully exploited his invention in this way. Black & Decker took the licences in 1972 and, by 1981, 10 million *Workmates* had been sold. Interestingly, Mr Hickman first offered Stanley Tools a licence for his *Workmate* back in 1968; they turned him down because in their view the potential sales of the *Workmate* 'could be measured in dozens rather than hundreds.' Patents can also be sold or mortgaged to any interested third party. Again, a patent agent will arrange this for you.

Finally, some people will tell you that it is easy to get around a patent - all you have to do is change the shape of this or the colour of that. These are individuals who will happily say, 'You can't get a patent for something like that!' We in the profession, resist the temptation to reply, 'Are you asking me or are you telling me?!'

Summary of a guest seminar presented at Writtle College by Dr André Chissel who works for a firm of Patent and Trade Mark Agents: William Jones, Willow Lane, Norwich, NR2 1EU, Tel: 01603 624475

Your man on Engineering Council Senate

Peter Dipper (Institute of Highways Incorporated Engineers) has been elected to represent us on the Engineering Council Senate for its first three years. He is concerned to know and represent your views. Communications will need to be largely by phone or letter as he is employed full time, but he will endeavour to fit in other meetings when in London on EC business. He can be contacted at: **Notter Bridge Training, Saltash, Cornwall, PL12 4RW. Tel: 01752 851 373**

Ag Eng for sustainable development

A joint International Conference on Agricultural Engineering and Technology Exhibition will be held on 15-18 December 1997 in Dhaka (Cosmopolitan Capital City), Bangladesh. The theme of the conference is on all aspects of Agricultural Engineering for Sustainable Development. Organising and participating countries include: Canada, China, Egypt, Ghana, India, Japan, Jordan, Kenya, Korea(s), Lebanon, Philippines, Papua New Guinea, Sierra Leone, Turkey, Thailand, Tanzania, United Kingdom, USA, United Arab Emirate, Vietnam and Bangladesh.

Anyone involved in agriculture and food, directly or indirectly, may submit a paper, the last date for submission of abstract (in English, 200-300 words) being 1 December 1996. All international participants are required to confirm pre-registration and package deal at the time of abstract submission.
Contact: Eur Ing John Kilgour, Agricultural Machinery Design, Silsoe College, Cranfield University, Silsoe, Bedford, MK45 4DT. Tel: 01525 863000

The European Engineering Yearbook 1996

Editor: Ron Kirby, Director of Public Affairs, The Engineering Council

The third edition of the European Engineering Yearbook (1996) available from April, is a vital reference source for all those concerned with the development of professional engineering in Europe.

Published in association with FEANI (the European Federation of National Engineering Associations), the Yearbook contains articles by engineers, industrialists and other professionals from many European countries and focuses on the key issues facing the profession in the final years of the 20th century and the latest developments in engineering education and training. It also includes articles describing the experience of working as an engineer in different European countries and outlines the varying economic and social roles played by engineers throughout Europe. The opening section of the book is on FEANI itself and gives details of the 27 national member organisations.

Contents:

· FEANI: the history and structure, FEANI's objectives, 'European Engineer' - a passport to international jobs

· Engineering in Europe: current national overviews from all the European countries

· Articles of topical interest to European engineers including environmental considerations, engineering achievements and trans-European co-operation

· Qualifications, training and career development: how to become a European Engineer, degree courses, working in other countries, continuing education, student exchange schemes and promoting engineering to the young.

The publication is priced at £11.95 (plus £1.50/ copy P&P within the UK, or £2.50/copy elsewhere. By stating your Eur Ing diploma number and/or your registration number with your national engineering association/society, however, the publication is available at a discounted price of £9.95 per copy (plus relevant P&P).

Contact: **Cambridge Market Intelligence Ltd, London House, Parkgate Road, London, SW11 4NQ.**
Tel: 0171 924 7117

Grain storage management course

This well established and highly regarded course will be held at the Natural Resources Institute, UK, for 33rd time later in 1996. Since 1972, the Grain Storage Management Postgraduate Diploma/MSc course have been attended by 400 students from over 60 countries.

The course covers the principles, practices and management of stored cereals, pulses, seeds and a range of other durable commodities at producer, trader, processor and national levels. The training focuses on the skills required to evaluate commodity management systems in order to formulate and implement operational improvements. The professional ability and confidence of the participants is developed to enable them to influence policy makers and to function on an individual basis or as part of a multi-disciplinary team. At the same time, the course covers the operational and management implications of changing technology.

The course comprises the following units:

Postgraduate Diploma:
Storage and Handling
Biodeterioration Factors
Processing and Quality
Management and Economics
Information and Communication
Project Assignment

MSc includes two additional units:
Research Methodology
Research Project

The 1996 Postgraduate Diploma runs from 2 September until 17 December and students continuing to the MSc will be required to attend the Research Methodology unit from 18 December to 17 January 1997, before beginning a research project either at NRI, or in their home country.

For further detail and application forms, please contact: **Training Contracts Officer, Natural Resources Institute, Central Avenue, Chatham Maritime, Kent, ME4 4TB, UK**

YES: be warned

The Annual Convention will take place at Shuttleworth College on 13 May 1997. The conference will follow the theme, 'The Year of Engineering Success' (YES), demonstrating the Institution's active support for the year long campaign during 1997 to celebrate the role of the engineer and the importance of engineering throughout the length and breadth of the UK.

Several IAgrE members are involved on the YES Engineering in Agriculture Advisory Group to select a list of key Engineering Successes for featuring in the main events, in national publicity material and in the regional programmes. YES Regional Working Groups, again with IAgrE members involved, are in place across the country to concentrate on core engineering themes which include: the home, transport, communications, leisure, environment, safety, energy, agriculture and defence.

Dr Mary Harris who, as Director-General, will spearhead the campaign said, 'YES will focus the attention of society on engineering so that talented people and financial investment are attracted to engineering practice. As an engineer, I am very conscious that every area of modern life, the entire fabric of our economy and society, is underpinned by engineering.' We hope that she will accept our invitation to participate in our Convention next year and tell us about the full impact of the campaign which, by then, will be well under way.

Model tractors pull the crowds

'Guess the sign above the door says it all.'

The 1996 Miniature Tractor Pull Competition was held during the Annual Convention and teams of students from Harper Adams, Rycotewood, Silsoe and Writtle Colleges took part. The aim is to construct a model tractor with the highest power to weight ratio, as measured by pulling a weighted sledge over a fixed distance. The model tractor is powered from a battery using a car electric windscreen wiper motor. The maximum tyre size is 320 mm diameter and the maximum overall length is 1000 mm. The tractor must also be steerable through the course.

For this year's event, a new track has been built by The Engineering School at Writtle and featured electronic timing of the 2 m test runs linked to an electronic scoreboard that calculated and displayed the results. In total, 10 miniature tractors were entered on the morning, but a couple suffered mechanical failures during the initial slalom steering tests and were early retirements. Each tractor was then allowed 3 runs up the track with the competitors choosing the load to be carried on the sledge. After the first run, it was then very dependent on the ability of the batteries to have enough charge left to muster an improvement on the second and third runs. Since the power to weight ratio was the criteria for performance, many attempts had been made to reduce weight to a minimum, while other designs were close to the maximum of 20 kg.

The winning team was from Rycotewood College, with Writtle in second place and Harper Adams in third. Ryan Jackson, a first year Agricultural Engineering student at the controls of the winning design commented, 'We ignored standard tractor design by using small wheels and a high hitch point to transfer as much weight as possible to the rear wheels. The first run was a disaster as we had not allowed for the extra friction of the rubber matting on the underside of the sledge. This caused the tractor to rear up and leave the weights behind *(photographic evidence of this demonstration was censored - Ed)*. After some quick calculations and adjustments, the tractor performed well, giving the winning power to weight ratio of 7.02:1.'

It is intended to rerun the competition on the Cranfield Stand at the Royal Show during lunchtime on the Monday and Tuesday. Entry forms will be available for any young engineer to enter next year's competition. We look forward to seeing you there.

Ryan Jackson (Rycotewood) with the winning entry on the Writtle test track

Membership movements

February to April 1996

Mem No.	Name	From	To
1865	R C Bilborough	Norfolk	London
6132	S R Briggs	Oxon	Uganda
6468	J D Cain	Notts	Barbados
2225	J A Cullen	Scotland	S Africa
3445	B Davies	Lincs	Worcs
5347	K M Elliot	Sussex	Uganda
6130	S Haresign	Lincs	Beds
5053	D J Harris	Kent	Wilts
6242	D S Hood	Staffs	Beds
6419	E J Hughes	Beds	Hampshire
4000	C G Irons	Dorset	New Zealand
3890	C Meek	Northumberland	Malaysia
5857	G V Marks	London	Oxon
5766	G B Moir	Herts	S Africa
6033	I J Muir	Essex	Kent
3898	A Mulder	Spain	The Netherlands
2478	P L Redman	Beds	Cambs
4963	J A C Steel	Tyne & Wear	E Sussex
4900	M W Steidel	Germany	Thailand
6467	T W Waine	Herts	Beds
6015	M Whiting	Somerset	Avon
3657	D B Williams	Warwick	Kyrghyzstan
6465	C B Wylam	Warwicks	Oxon

Gone Away

Name	*Last known address*	*Date*
J A Burley	21 Woodley Close, Abingdon, Oxfordshire, OX14 1YH	25/03/96
C Broughton	11 Traquair Road, Innerleithen, Peeblesshire EH44	01/02/96
G Dart	6 Esk Valley, Grosmont, Whitby, North Yorkshire, YO22 5BG	12/03/96
C R Gibson	The Old Lodge. Melling, Carnforth, Lancashire	28/03/96
S R Glazebrook	35 High Street, Milton, Abingdon, Oxfordshire, OX14 4ER	21/02/96
R H Smith	Snapper Lawn Equipment (UK) Ltd, Hamble Court, Verdon Avenue, Hamble, Southampton, SO3 5HX	29/03/96
P R Williams	East Flat, Knightshayes Court, Bolham, Tiverton, Devon EX16 7RQ	16/02/96

CINTRE correction

The Assistant Vice Chancellor (Research), Massey University, New Zealand, has intimated that, contrary to the statements made in the article 'New Zealand no-tillage research centre' (Membership Matters, Winter issue, 1995), Massey University is not providing any financial support for CINTRE and, indeed, has no association whatsoever with that centre.

Pioneering technology

At the Council meeting in March, a new specialist group was approved, the *Pioneering Technology* Specialist Group. Most of the other specialist groups look at the very latest, and possible future, developments. Whilst this is very important, much of what is studied is only just technologically possible and, in many cases, may never become established. As we all know on any journey, it is always important to look back as well as forward and the comment, 'they are re-inventing the wheel', will be well known to all.

This group has been established to look at the pioneering developments of the past. Those things that in their day were great steps forward and are now established technology or even superseded technology. The aim of the group is to look at these developments and see what we can learn from them. What were the problems met, how they were tackled, and how were the difficulties overcome?

The Council is quite rightly concerned that we do not become a 'dusty history club' revelling in the great days of steam ploughing or vintage ploughing competitions - although we may have a place looking at the great step forward ploughing made to agricultural efficiency and the national economy.

During the recent membership renewal exercise, the questionnaire included a question asking if you interested in 'technology developments'. Over 20% ticked that they were. It is with that support and that of the West Midlands Branch whose members originally raised the subject of this group that it has become established.

It is not our intention at the moment to run 'conferences', but to provide a linking of members and events of interest. If your branch is organising a meeting that falls within this interest area, please let me know and I will try to publicise it.

The first meeting publicised is a visit to The Science Museum reserve collection at RAF Wroughton just south of Swindon on Saturday 22 June.

William Waddilove

IAgrE Council 1996-97

	Name	Grade	E.C.Grade
President	M J Dwyer	F	CEng
President-Elect	B J Legg	F	FEng
Immediate-Past President	R J Godwin	F	CEng
One Other Past-President	J B Finney	F	-
Vice Presidents (3)	P L Redman	F	-
	G J H Freedman	F	CEng
	S D Cartmel	M	-
Honorary Treasurer	D B Tinker	M	IEng
Chairman	J H Neville	HonF	CEng
Membership Committee Chairman, Education and Training Committee	J C Sartain	M	IEng
Fellows (3)	D J Greig	F	CEng
	B C Stenning	F	-
	A J Landers	F	IEng
Members (3)	M St Carr-West	M	-
	W Waddilove	M	IEng
	J P Metcalfe	M	CEng
Companions (2)	J N Coleclough	C	-
	A Hall	C	-
Associate Members (3)	A J Scarlett	AM	-
	P N Wheeler	AM	-
	R Lockhart	A	-
Associates (2)	B J Eyers	A	-
	P N Leech	AM	-
Special Representative for Scotland	G J H Freedman	F	CEng
Special Representative for EurAgEng	B D Witney	F	CEng
Chairman, Examination Board	J H Neville	HonF	CEng

Co-opted to Council

Honorary Editor of Journal	B D Witney	F	CEng
Branch & Specialist Group Co-ordinator	P L Redman	F	-

Branch representatives on Council

1	East Anglia	M H Fuller	C	-
2	East Midlands	D W Tilbury	M	IEng
3	Northern	tba		
4	Scottish	G J H Freedman	F	CEng
5	South East Midlands	J H Neville	HonF	CEng
6	South Western	T J H Hannah	M	IEng
7	Western	P A Webb	M	IEng
8	West Midlands	C M Blackbrough	M	IEng
9	Wrekin	D R White	M	CEng
10	Yorkshire	J K Grundey	M	IEng
12	Herts/Essex	N Oldacre	M	IEng
13	Southern	R Blackford	M	IEng
14	South Eastern	A D Gracey	F	CEng
15	Northern Ireland	J P Frost	M	-
16	Welsh	J Bradshaw	F	-

Institution membership changes

February to April 1996

Admissions - a warm welcome to the following new members

Member: P A Hicks (Thailand), R C Petts (Surrey)

Associate Member:P F Bloxham (Shrops), I Bown (Derby), R W Jackson (Berks), B A Jaspal (London), D Lewis (Bucks), A G Russell (Oxon), D D Smale (Cornwall), R S G Swales (Tyne & Wear), M J Tyson (Cumbria)

Associate: D Clark (Scotland), J R Dixon (Oxon), F H Knock (Essex), G Rowe (Essex)

Student: M Cameron (Scotland), B A P Crenn (Warwicks), K A Doyle (Wilts), C M Heslin (Essex), A M Lawson (Cheshire), R T Murray (Northumberland), M J Oliver (Beds), L D Pritchard (Essex), B Quelch (Scotland), E F Stephenson (Beds), M Stephenson (Norfolk), B Suffield (Leics), S N Townshend (Wales), S A Wilson (Scotland)

Readmissions: R W Hawes (Notts), I M Lea (Cambs), P E Steele (Italy)

Reinstatement: N M Musa (Nigeria)

Transfers - congratulations on achieving a further phase of their professional development

to Member: D W Hatherill (Surrey), S E Jackman (Devon), A G Robbins (Scotland), P J Williams (Cambs), C B Wylam (Oxon)

to Associate Member: A J Parrish (Beds), T W Waine (Beds)

Deaths - with great sadness we record the deaths of:
G A Seaden (Essex),
J C Smith (Cambs)

Engineering Council registrations

CEng: J K Adewumi (Nigeria),
B M Keeble (Essex)

Publish in Lithuania

Dr Algis Prapuolenis, Head of Information Dept at the Lithuanian Institute of Agricultural Engineering, invites authors to submit articles for publication in their journal, Agricultural Engineering, published twice yearly since 1960 by the Institute. In future, they would like some papers published in English. Dr Prapuolenis is Deputy Editor of the journal and also is the Lithuanian representative on the Council of EurAgEng. If you would like to assist, contact: **Lithuanian Institute of Agricultural Engineering, Raudondvaris, LT-4320 Kauno r., Lithuania. Fax: +370 7 227259**

Misusing membership

Some of our members have received letters from Nigeria inviting them to make large amounts of money by sending letterheads, blank invoices and bank details to an address in Nigeria. This sort of letter has been around for a long time, but recently the designatory initials 'MIAgrE' have been used as part of the address, suggesting that a copy of the Members' Register may have fallen into the wrong hands.

I would like to reassure members that names and addresses are treated as confidential by the Institution and are not divulged to third parties. The Members' Register is supplied only to members and on the basis that the contents are not to be divulged outside the membership.

At risk of stating the obvious, I would strongly recommend that such letters be ignored and destroyed.

Michael Hurst
Secretary

Long Service Certificates

50 years

Name	Grade	Date of Anniversary
Benjamin **Burgess**	FIAgrE	8 Apr 1996

35 years

Name	Grade	Date of Anniversary
Harbans Singh **Chadda**	IEng FIAgrE	28 Mar 1996
Edward Hervey **Elwes**	IEng MIAgrE	28 Mar 1996
John Clement **Hawkins**	FIAgrE	28 Mar 1996
Ian Percival **John**	MIAgrE	27 Jun 1996
Elias Andrew **Kashita**	CEng FIAgrE	27 Jun 1996
George Corbett **Mouser**	IEng MIAgrE	28 Mar 1996
Martin Edward **Nellist**	CEng FIAgrE	24 Jan 1996
Ramiah **Ramchandra**	FIAgrE	24 Jan 1996
Hamish Peter **Reid**	IEng MIAgrE	28 Mar 1996
Sunil Shankar **Roychowdhury**	IEng MIAgrE	22 Jun 1996
Liketting **Li Pi Shan**	MIAgrE	22 Jun 1996
Derek Roy **Sheppard**	IEng MIAgrE	28 Mar 1996
Michael **Anderson-Upcott**	MIAgrE	27 Jun 1996
David John **van Rest**	CEng FIAgrE	27 Jun 1996
Ivan Baxter **Warboys**	CEng FIAgrE	24 Jan 1996
John Lewis **Woodward**	EngTech AMIAgrE	28 Mar 1996

25 years

Name	Grade	Date of Anniversary
John **Bailey**	MIAgrE	28 Jan 1996
Ayob **Bin Sukra**	CEng MIAgrE	28 Jan 1996
William Charles Timothy **Chamen**	CEng MIAgrE	28 Feb 1996
David Suffolk **Culy**	CEng MIAgrE	28 Jan 1996
Eric Anthony **Forrester**	AIAgrE	17 Jun 1996
Robert Malcolm **Hobbs**	IEng MIAgrE	29 Apr 1996
David **Howat**	IEng MIAgrE	28 Jun 1996
Allan **Langley**	MIAgrE	29 Apr 1996
David John **Lees**	IEng MIAgrE	29 Apr 1996
Robert **Leggat**	IEng MIAgrE	28 Jan 1996
James Patrick **McAleese**	IEng MIAgrE	28 Jan 1996
Keith Charles **Marsh**	MIAgrE	28 Jan 1996
Michael John **Martin**	IEng MIAgrE	28 Jan 1996
Charles Daniel **Mitchell**	CEng FIAgrE	28 Jan 1996
Christopher Edwin Lister **Morgan**	EngTech AMIAgrE	29 Apr 1996
Martin John **Mountstevens**	IEng MIAgrE	27 Jan 1996
Richard Laurence **Nelson**	IEng MIAgrE	28 Jan 1996
Nigel **Oldacre**	IEng MIAgrE	28 Jan 1996
Charles Richard **Orr**	CEng MIAgrE	28 Jan 1996
Frank John **Pitkin**	EngTech AMIAgrE	17 Jan 1996
David Edward Huntley **Pullen**	CEng MIAgrE	15 Apr 1996
Ian Frederic **Ruston**	AMIAgrE	28 Jan 1996
Michael C **Sheldon**	IEng MIAgrE	28 Jan 1996
Ralph Ernest **Sims**	CEng FIAgrE	28 Jan 1996
Gordon Alan **Tailby**	MIAgrE	28 Jan 1996
Philip George **Tutt**	EngTech AMIAgrE	29 Apr 1996
David Andrew **Williamson**	IEng MIAgrE	28 Jan 1996

News of Members

John W G Young has recently moved to Worcester to be near his head office. John joined his family company, P J Parmiter & Sons Ltd, in 1967 and in 1978 the company joined the Wolseley Group. In 1981, he was appointed Chief Executive of the Agricultural Division which ultimately consisted of By-Py Hydraulics & Transmissions, Pankhurst, Parmiters, Sparex and Vapormatic. Subsequently, the division was extended to include the distribution of photographic equipment and the provision of technical services.

In August 1994, John was appointed Deputy Chief Executive of the Wolseley Group, a FTSE 100 company with sales of £3.3 billion and 20,000 employees. It is now the largest builders' merchant in the world, with market leadership in the US, France, US, Austria, Hungary and the Czech Republic. It also has significant interests in agricultural parts, professional photographic distribution and oil and gas burner manufacture. The head office is now in Droitwich.

In addition to the above, John is currently President of the European Agricultural Engineers Association (CEMA), a member of the governing body of the Silsoe Research Institute and a member of the Court of Cranfield.

Alan Chadborn says that his son ,David (who has taken the surname of Mellis on his marriage in 1994), took his first degree at Warwick University, doing the Engineering Design and Appropriate Technology Course (EDAT). He then did a Masters in Soil and Water Engineering at Silsoe, under the APOS scheme, and as a part of this he is now working at Embu in Kenya for the Dryland Applied Research and Extension Programme.

David B Williams has recently taken up a position in a World Bank project in Kyrghyzstan, Soviet Central Asia, where he will be responsible for technical and procurement functions. The project is due to continue until the end of 1997 and aims to improve the effectiveness of food processing and general industrial production.

Jim Grindey, who has worked overseas on short term contracts since leaving Silsoe College in 1976, will be working in north east Thailand for the next two years.

Augustin Glazebrook, who is now doing his final year of the Agricultural Engineering degree course at Silsoe, has spent his industrial placement year working on a large arable farm. He says that he found it very interesting and feels that a period of tractor driving should be compulsory for all machinery designers. Augustin says, 'No-one would fit plough skimmers on round legs, if they had spent a night ploughing in bad conditions where the skimmers turned on the legs every few yards.'

John A Gander has recently moved to India where he will be the Planning and Management Adviser on the EU funded 'Alkaline Lands Reclamation Programme'.

Jim Brook has recently moved to Saudi Arabia to become Alfa Laval's Manager for Service and After Market for the whole of the Gulf Region. Alfa Laval Agri Export AB is a Swedish company which is part of the Swedish based multinational packaging group Tetra Pak. They manufacture a complete range of products from the time the milk leaves the cow up to the point that it reaches the table, including machinery, consumable items, processing and packaging equipment.

Tetra Pak as a whole have a much broader field, working in markets as diverse as food processing, brewing, distilling, and the oil field and marine industry, supplying advanced liquid separators and heat exchangers. Tetra Pak are perhaps best known for their paper carton packaging which is seen right across the world. The production of UHT treated milk in combination with Tetra Pak's aseptic packaging has made the consumption of milk a reality to many far flung corners of the earth. Jim has worked for Alfa Laval Agri since he left school in 1975. He was first employed as an apprentice and his first year was spent on an EITB off the job engineering course at Newport College of Education. This was followed by 3 years of varied training within the engineering, service, installation and design departments of Alfa Laval Agri, with 1 day and 1 evening per week at Newport College of Higher Education.

Jim says that his first 'real' job with Alfa Laval Agri was as an installation engineer, followed by 13 months as a territory salesman in Yorkshire. In April 1982, he was approached to go Saudi Arabia to work on Alfa Laval Agri's flagship project called SAADco - the Saudi Arabian Agricultural and Dairy Company. This enormous turnkey project was set up in 1979 as a wholly self-sufficient Dairy Farm. At the time, over 3,000 milking cows and 6,000 young stock were on the farm. Today, this has risen to over 15,000 milking cows and 10,000 young stock. All the milk is processed and packed on site to a standard much higher than that in the UK. Jim's job at that time was to ensure that all of the 16 milking parlours remained operational. He did this for 2 years before moving to marketing and sales in the main Alfa Laval Agri Riyadh office.

After marrying in the British Embassy in Saudi Arabia in 1983, Jim and his wife returned home in 1987, and then as he says, 'after a spell in the wilderness', he re-joined Alfa Laval Agri in Cwmbran, South Wales where he was in charge of the dealer service engineers training and also a Technical Representative for their products. He did this for over 4 years before joining Alfa Laval Agri's main subsidiary dealer, Dairy Supplies, in Hereford as their Field Operations Manager.

Jim has sent me some interesting information on Alfa Laval Agri's research farm near Stockholm in Sweden and the project in Saudi Arabia. Jim has kindly offered to arrange a visit for members to the research farm in Sweden and would also be pleased to give a short presentation at an Institution seminar or meeting. Thank you very much Jim for all the information that you have given to me and I am sure that someone in the Institution will be pleased to take up your offer of a visit or a talk.

AAWC

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INSTITUTION of AGRICULTURAL ENGINEERS, WEST END ROAD, SILSOE, BEDFORD, MK45 4DU, UNITED KINGDOM. Tel: 01525 861096 Fax: 01525 861660

Planting and harvesting *Miscanthus* giganteus

Willem Huisman

Introduction

A new crop which is currently receiving considerable attention, especially in Europe, is *Miscanthus*. This is a perennial C_4-grass which originates from East Asia. In Denmark, a clone was recognized with high productivity, now called *Miscanthus x* giganteus GREEF et DEU. The crop is of interest as a potential source of new biomass or fibre. The applications under research are: energy source, building materials, geotextiles, paper, packaging material and substrate for plants. Most research so far has been concentrated on crop production and marketing. Like most other crops, the highest production costs are related to farm labour and machinery, conservation and transport. In 1992, research was started on the mechanisation of planting, harvesting and conservation. First, conventional farm machines were tested and evaluated for their use in the crop *Miscanthus*. To keep all options open, the study of harvest methods was not constrained by the applications for the harvested material. To ensure a year round delivery of product for processing, the harvested material must be stored and conserved, preferably on the farm. During storage, the quality of the material must be maintained. Another important aspect is transport. Transport costs depend largely on the volume of the material. Volume can be diminished by baling or pelleting but, after compressing, drying is difficult.

This paper was presented at the IAgrE conference entitled: 'Miscanthus - its future as a UK crop', organised by the Agro-industrial Specialist Group and held in The Maltings, Ely on 15 February, 1996. ***Dr Willem Huisman is at the Department of Agricultural Engineering and Physics, Wageningen Agricultural University, Bomenweg 4, NL 6703 HD Wageningen, The Netherlands.***

Planting

The new crop can be established using plantlets or rhizomes. The plantlets, propagated by tissue culture, can be planted with a normal planting system (Isensee *et al.*, 1992; Quest, 1994). Another method to establish a new crop is by means of rhizomes. These are pieces of root material obtained by cutting the rhizomes of mother plants, preferably of an age above 3 years. Using rhizomes is cheaper than plantlets and they seem better able to survive the first winter. The rhizomes can be produced by the farmer. On a sandy soil, special fields are planted with a plant density between 3-6 plants/m^2 *(Figure1)*. After 2-3 years, the fields are treated with one pass of a rotary tiller at a speed such that the size of the pieces is between 40 and 100 g. Then they are harvested by a flower bulb harvester or adapted potato harvester. Depending on the weeds and stones also harvested, a cleaning and grading action may be necessary. Oversize rhizome pieces are cut

Fig. 1 Planting rhizomes with a specially designed planter.

into smaller pieces by hand but, with proper speed of the rotary tiller, this is not an arduous task. The multiplication grade in this way is about 50. By harvesting whole plants and then hand cutting the rhizomes, a multiplication grade of 100 can be reached. (Jonkanski, 1995).

Fig. 2 Chopping Miscanthus with a forage harvester.

The cost per rhizome is about 0.04 ECU, based upon a multiplication grade of 35. If planting is performed within a few days after harvesting and when the rhizomes are not dried out, the plant emergence was found to be 70 - 95%. Planting also can be performed by semi-automatic planting machines. Planting depth is about 10 cm.

Harvesting

The above ground crop of *Miscanthus* dies after the first frost in the Autumn. This is the beginning of the drying period. Depending on weather conditions, the moisture content drops and harvesting is possible when the moisture content is 15% (wet basis) or higher if drying in storage is possible (El Bassam *et al.*, 1992). In The Netherlands, this moisture content is reached generally at the beginning of April. Regrowth of shoots starts when soil temperature reaches about 10 °C. In The Netherlands, this is about the end of April. Depending on the weather conditions and accepted moisture conditions at harvest, this results in a harvest period that starts in March and finishes at the end of April. Existing harvesting machines can be used and were tested (Johanning & Wesche, 1993; Kath-Petersen, 1994; Huisman & Kortleve, 1994). After mowing, three handling methods can be chosen: chopping, baling or bundling.

1) Mowing and chopping

A chopping forage harvester used for harvesting silage maize or grass is also suitable for harvesting *Miscanthus*. In an older crop, the rows are not distinguishable any more so a row-independent mowing attachment is preferable. Experiments with a Kemper 'Champion' 3000 mowing attachment gave good results *(Figure 2)*. The material was cut at different lengths, 11 mm and 44 mm. The densities in dry matter mass of the chopped product were 95 kg/m^3 and 70 kg/m^3, respectively. (All weights in this paper concern oven dry matter.)

2) Mowing and baling

Baling decreases transportation volume, whether by means of big bales (h = 0.8 - 1.6 m) and round bales (diameter 0.6 - 1.8 m), or by a prototype machine forming compact rolls (diameter 0.3 - 0.5 m). Before baling, the crop must be mowed and put into a swath. Conventional swath mowers, either cutterbar or disc-type, can be used for this operation. Due to broken pieces and problems with picking up the product properly, the field losses were found to be 10 - 30%. Also, a flail type mower-chopper attached in front of the baler was tested. This works well, especially when working at the side of the tractor. Mowers mounted in front of a self-propelled baler are recommended in order to reduce pick-up losses. To provide a lower cutting height, a special mower, based upon the sugar cane harvester, was developed by Claas. A lower cutting height results in more harvested material, higher leaf content (from fallen leaves) and therefore higher moisture content (Kath-Petersen, 1994).

The different types of baler produce different densities. According to Johanning and Wesche (1993) and our experiments, the densities in dry matter can vary from 130 kg/m^3 for a high pressure big baler or round baler to 300 kg/m^3 using an experimental machine called the compact roller.

3) Mowing and bundling

When it is necessary to harvest whole stems as raw material for geotextiles or building materials, the appropriate harvest method is mowing and bundling. This method is commonly used in reed culture. After tests with small reed harvesters, it was concluded that the principles will work in *Miscanthus* but they need to be adapted for the larger and stiffer stems. It is also clear that, in order to minimise labour costs, handling of large bundles is the only way. In 1995, four hectares were harvested with a self-propelled reed harvesting machine on tracks *(Figure 3)*. On this machine, small bundles are made and directly loaded by two workers onto a platform on which large bundles up to 2 m diameter can be compressed mechanically and tied by hand. The density of the small bundles was 110 kg/m^3. The density of the big bundles will be about the same. They can be handled by a shovel or a tractor with forklift. This harvesting machine should be adapted for *Miscanthus*. Concepts of short rotation willow harvesters should be included for mowing and handling of the stems. In future, no handwork should be included in such machines.

Costs

For the cost comparison of harvesting chains, drying, storage and transport should be included in the calculations because the harvesting method defines density and hence costs of storage and transport. Also the moisture content at harvest and product shape affects drying cost, while the harvesting method limits the maximum moisture content at harvest. In this paper, however, moisture content at harvest and drying are not considered.

The density after chopping is rather low. Therefore a compacting treatment is introduced as a possible pretreatment at the farm, just before transport, with a mobile compactor modified from

Fig. 3 Making bundles with a reed harvester.

a stationary, recycled paper compactor. The density of the bales of *Miscanthus* is 265 kg/m^3.

In *Figure 4,* total costs are shown for the chains with various harvesting machines. Only the pull-type chopper (MC) is owned by the farmer, all other harvesting machines being owned by a contractor.

The cost factors for production on a farm are: a margin for the farmer which includes all costs for land, buildings, farmer's labour and standard machines; annualised production, which includes soil tillage, establishment and grubbing up cost; harvest costs; storage costs based upon plastic sheets; transport for a round trip of 72 km with a semi-trailer and loading (0.5 h) by means of a shovel. The compact roller and whole stem harvester are machines which are not yet on the market but price, capacity and depreciation are derived from similar machines. The total costs apply for a production cycle of 15 years and a harvested yield of 12 t/ha.

Conclusions

Total costs for baling and chopping do not differ much. These machines are on the market at the moment. Drying of chopped product is possible, for bales difficult, and for compact rolled material impossible. The compact roller, although not yet commercially available, was estimated to be 13% more expensive than a baler. Only whole stem harvesting is substantially more expensive due to a lower harvesting capacity of 0.5 ha/h. A fully automated bundling machine could have a capacity of 1 ha/h and would incur costs similar to those for the other systems. The advantages of this method are the long harvesting period since harvesting at moisture contents of up to 60% is possible, and no drying costs through the use of natural drying in long piles of a width equivalent to the length of the stems.

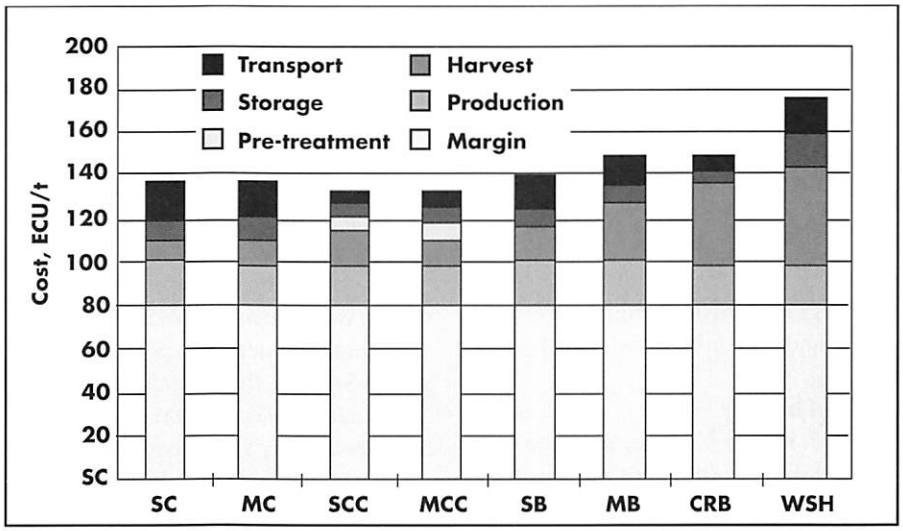

Fig. 4 Cost of production chains with various harvesting machines: self-propelled chopper (SC), small chopper mounted at tractor (MC), SC with compactor (SCC), MC with compactor (MCC), self-propelled baler (SB), pull-type baler (MB), compact roller (CRB), whole stem harvester(WSH)

These results only can be preliminary. No account was taken of the workability for the different methods. Since workability, machine costs and drying costs vary with the weather of specific locations and years, the real influence only can be calculated by simulation. A project has been started to calculate the workability for the various harvest chains for *Miscanthus,* based upon a model of crop moisture content and trafficability as a function of local weather data. With these data, timeliness loss, machine costs, drying costs, and yield loss through soil damage will be calculated and optimised (Huisman 1994).

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An important debate

- the future of Agricultural Engineering

Sir:

In two recent contributions to the *Agricultural Engineer* (Vol 50, No's 2 & 4, 1995), Gowing suggested that the future of academic agricultural engineering - and, by implication, of the Institution - can best be achieved by changing from an agricultural to a biological and/or environmental basis in which to apply engineering expertise. I wish to contribute to this important debate which is central to the future of the Institution. To me, agricultural engineering is the application of engineering science and technology to the solution of problems within the agricultural industry. An agricultural engineer, therefore, must have a sound knowledge of engineering principles and the agricultural industry.

A bit of history

In 1947 King's College, now the University of Newcastle upon Tyne, offered a taught MSc course for students with a first degree in either engineering or agriculture, Engineers being offered agricultural courses and Agriculturalists being offered engineering. Many who graduated from these courses made significant contributions to their profession. Undergraduate degrees were offered by the University, Newcastle and by the National College of Agricultural Engineering, Silsoe, in the 60's and postgraduate studies were expanded at both centres. Agricultural engineering studies were also initiated at a number of Agricultural Colleges, several courses having subsequently achieved degree status. The Institution actively encouraged the establishment of university studies in agricultural engineering.

It has always been recognised that, due to the relatively small number of students and their subsequent employment, the scope of agricultural engineering studies in the UK must be limited. In the USA with a larger number of colleges and employment prospects, a much wider range of subjects could be offered and four main areas of study were recognised:

1. power and machinery
2. soil and water conservation
3. crop processing and sometimes farm electrification
4. livestock and farm buildings

These were the initial basic areas of agricultural engineering specialisation in the USA and they remain so today. They each, however, have been found to be eminently suitable to be extended to meet new requirements and embrace new technologies, for example: power and machinery *and* soil vehicle and machinery dynamics; livestock and building *and* animal welfare; and soil and water *and* the environment. These four areas can also be extended to tree crops, forestry. All areas of agricultural engineering have made use of electronic and computers. In the UK, both postgraduate and undergraduate studies were mainly concerned with power and machinery but this was expanded to include at least aspects of studies from each of the other three areas.

It has been successful

Over the past four decades, agricultural engineering graduates in the UK have made significant contributions to their profession and have contributed to the success of the Institution. In the public sector, they have achieved international status, for example, in soil mechanics and crop drying; and they have been well represented in the advisory service and as consultants both in the UK and abroad. In industry, agricultural engineering graduates have had a worthwhile role with the major international tractor and combine harvester manufacturers. Here the requirements were for fewer but larger and more complex equipment. Unfortunately, the smaller and medium sized farm machinery manufacturers have not thrived during this period and, with few exceptions, these firms have not proved satisfactory roles for graduate engineers.

It is not straight forward to determine the areas currently of principal interest to agricultural engineers. One indication should be articles and papers published in recent issues of the *Agricultural Engineer* and the *Journal of Agricultural Engineering Research* in the UK, and the *Transactions of the ASAE* in the USA. It is interesting to note that most of the papers and articles describe activities which fall into one or other of the areas of specialisation listed in a previous paragraph. Forestry has recently been of considerable importance. Over the past decade, there have also been occasional articles putting forward the case to replace agricultural engineering with some variation of biological or environmental engineering. Despite this and the fact that a large number of agricultural engineering departments in the USA have incorporated either additionally or as an alternative, the term biological or environmental in the titles, these changes do not seem to have had much significance on published reports of work.

Is a new label required?

Initially when agricultural engineering courses were offered in the UK, a viable number of good quality students enrolled. In the last few years, however, student enrolment has declined to such an extent that the future of these courses was questionable. There are a number of reasons for this decline. As with other engineering and science courses, it must be due partly to the decline in the number of applicants with adequate 'A'

level grades in maths and physics. It also in some way must be due to the economic pressure evident throughout the University system which, in order to increase student enrolment, has reduced standards and offered less demanding courses. More rigorous courses have been unable to compete. A lack of apparent employment opportunities within the agricultural engineering industry must also have been a factor. Furthermore, the removal of agricultural engineering from the names of such well know organisations as the National Institute of Agricultural Engineering, the National College of Agricultural Engineering and the Dept of Agricultural Engineering, University of Newcastle upon Tyne must have diminished the public awareness of our profession.

The significant reduction in the enrolment of agricultural engineering students has been of serious consequence for the teaching staff concerned. A solution favoured on both sides of the Atlantic has been to replace, either partly or completely, agricultural engineering with either a biological or environmental label. It was felt that this would exploit the popularity of environmental issues and attract additional students, at least in part by avoiding the engineering entrance requirements of maths and physics. In particular, I find it difficult to understand the logic and, if it was implemented, the consequence of ideas such as Gowing (1995) that biology is the logical basis for our profession (agricultural engineering). It seems to me self evident that the basis must be engineering, with the objective of providing solutions to problems within the agricultural industry.

What do all these labels mean?

Another aspect of the attempt to provide or justify an alternative biological/environmental basis for agricultural engineering is that the multiplication of activity headings, such as environmental management and amenity engineering, biosystems and ecological engineering, biomaterials and bioprocessing engineering, does not seem useful. Is it proposed that courses of study be established for each of these? Will there be subsections for membership within the Institution? Does it create a serious, coherent image of our activities to prospective employers of graduates and to the general public? Do we seriously wish to sponsor such diversity and to what purpose? I do not think such proposals are feasible, let alone desirable.

We all must eat

It can be assumed with some certainty that there will be a continuing and increasing requirement for food world wide. Food production, however, will be based on improvements in current agricultural practices. Stephen Lewis in "Food for Thought in a Changing World", *The Financial Times*, 10.2.96 stated that during the last twenty years the (food) balance between supply and demand was dependent on half the world's population having less to eat than they would like. He identified many factors which will increase the demand for food; chief among these is the Chinese government's determination to improve living standards, but the inability of Chinese agriculture to meet the increasing demands of a rapidly growing urban work force in the foreseeable future.

There is a bright future

There are large areas of the world that realise that they do not have the 'know-how' for modernisation of their agriculture. Furthermore, in areas with productive agricultural industries, it would be disastrously complacent to assume that further improvements are neither desirable nor possible. There must be a continuing and perhaps increasing role in world agriculture both within the UK and particularly abroad.

It is my belief that the Institution should recognise that academically trained agricultural engineers are essential for its future viability. While there are undoubted difficulties to overcome, I feel that the Institution should make every effort to encourage, support and, where necessary, re-establish agricultural engineering studies which will attract students of the highest quality. It should ensure, as far as possible, that there are worthwhile employment prospects for such graduates.

Yours faithfully,

D S Boyce
Camlann, Banks
Brampton, Cumbria, CA8 2JH

New HND in forestry

A new HND in Forestry has been set up in Lincolnshire by De Montfort University's School of Agriculture and Horticulture. De Montfort University is nationally and internationally recognised for its innovative, wide ranging courses from further education to post-degree levels. With centres in Leicester, Milton Keynes, Lincoln and Bedford, DMU has around 28,000 students.

The course is the latest addition to an established portfolio of forestry programmes which have been running for more than 15 years at the county's former agriculture and horticulture college.

The needs of commercial forestry both in Britain and overseas are catered for by the new course through subjects including harvesting and marketing, forest management, business management, silviculture, geographic information systems, engineering, forest ecology, environmental impact assessment, mensuration and botanical sciences. Timber utilisation and timber processing modules have also been included to give foresters from De Montfort a thorough understanding of the timber trade.

"New developments in these areas promise better and more skilled students who are well-equipped for the contracting sector," said head of forestry Mr Tony Cowell. "Forwarder training in Sweden, for example, has been developed as part of an international student exchange arrangement, and links also exist with France, Finland and Canada".

The introduction of a higher education course builds on the success of Diploma and Certificate courses which will continue to be offered. Fourteen students are currently enrolled on this year's HND.

Contact: **Tony Cowell on 01400 272521, ext 5317**

Crop fumigation improvements for Ethiopia

Thirsk-based company Power Plastics Ltd have secured an £80k contract to manufacture specially prepared PVC sheeting to cover cut crops in remote areas of Ethiopia - ready for fumigation. The Company has been commissioned by government-based agents who contract UK companies for overseas work as part of UK-based aid to areas of need.

The current method of fumigating many cut crops in Ethiopia is to use ill-fitting, often porous, tarpaulin draped across the stacks of grain, a method which can achieve a success rate as low as 50%. However, the new tailor-made boxed sheeting currently being manufactured by Power Plastics will provide a non-porous, sealed environment that will cover the stacks of grain more efficiently - and because the sheeting comes in two parts, it can be handled with much greater ease than a heavy tarpaulin. The Company has incorporated special plastic 'zips' so that two large sheets can be manoeuvred into place over the grain and then joined in the centre to form a gas-tight seal. The sheeting will then be secured around the base of the stacks to allow treatment with a suitable fumigant.

With this method large quantities of cut crops can be fumigated on site and stored for a longer period of time, thus enabling the local population to use their stored grain more efficiently.

Power Plastics Managing Director, David Price, points out: "This is an important contract for two reasons, firstly, only the most professional companies are approached by Government Agencies for such work and, secondly, this represents a tremendously useful application of our product that will have immediate and long-term benefit to the people that need it most". He adds, "We tend to take efficient fumigation of food crops in this country for granted, but getting the job done in very remote areas of Ethiopia with little or no equipment provides much more of a challenge.

For further information about custom-made PVC fumigation chambers, contact: **David Price, Power Plastics Ltd, Station Road, Thirsk, North Yorkshire, YO7 1PZ, UK. Tel: 01845 525503**

50 years of Coventry built tractors

Fifty years ago this year, Coventry launched a new tractor which was to change the face of mechanisation on farms throughout the world. It was, of course, the renowned TE20, affectionately and universally known as the "little grey Fergie". The first production machines came off the assembly lines at what is now Massey Ferguson's Banner Lane, Coventry plant on 6 July 1946. And their success is enabling farmers to cultivate and produce crops more efficiently, economically and safely than ever before, laid the foundations for the remarkable record MF tractors hold today of having been the biggest-selling tractor brand world-wide for the last 33 successive years.

The 315 machines the factory built in that first year brought a new industry to Coventry and they became the forerunner of nearly 3 million tractors which have been made in the factory to date. Consistently high levels of exports, accounting for about 90% of production, have earned the UK many billions of pounds.

The start of production in the Coventry plant after World War II was a classic in the 'swords into ploughshares' mould. During the war, its 80-acre site had been used for building engines for fighter aircraft.

On 18 September 1956, Harry Ferguson was able to announce that large-scale production of the new tractor had started. The son of a Northern Ireland farmer, his inventions not only provided a fundamental breakthrough in farm mechanisation, but he also campaigned tirelessly to governments and statesmen for the importance of farming in national prosperity to be recognised. On that occasion, he told an audience of more than 250 people from government departments, industry and the press, gathered to see a demonstration of his tractor on land beside the factory: "Prosperity begins on the farm. Unless the farmer is prosperous, industry cannot be prosperous - nobody can be prosperous, and the best way to make the farmer prosperous is through the use of mechanised farm equipment".

The unique and continuing contribution of the factory and its products to world farming, the UK economy, the commercial life of Coventry and a swathe of British manufacturing industry will be marked by various events during 1996

From the archives of 50 years' tractor production in Coventry - a TE20 'little grey Fergie' being put through its paces at Chartwell, watched by Winston Churchill with his son-in-law Christopher Soames, and Anthony Eden.

celebrating the Golden Jubilee.

They include a special Harvest Festival service at Coventry Cathedral on 6 November to commemorate the life of Harry Ferguson and the enormous contribution of Coventry-built tractors in helping the world to continue feeding itself in the second half of the 20th century.

At the Royal Show in July, Friends of Ferguson Heritage - the nearly 4,000-strong club formed by enthusiasts and devoted owners of TE20 tractors to preserve them and successor models for posterity - will stage a major event in the Grand Ring each day showing how tractors and farm mechanisation have developed over the last 50 years.

In addition, the celebrations will continue with a variety of other events throughout the UK being planned locally by enthusiasts, agricultural shows and other organisations.

Oil edible from GM oilseed rape

The Government has accepted advice from the Advisory Committee on Novel Foods and Processes (ACNFP) and cleared oil produced from a fourth GM oilseed rape, following a request submitted by Monsanto Europe SA/NV.

The GM oilseed rape has been modified to exhibit tolerance to the herbicide glyphosate. This involved the introduction of two bacterial derived genes known as the Roundup-Ready' genes, as in combination they confer resistance to glyphosate - a broad spectrum herbicide. This herbicide is frequently used to control and suppress weeds in the production of the oilseed rape crop.

In its food safety assessment, the Committee considered that oil from this GM oilseed rape did not differ in composition from oil from conventionally bred varieties and was safe for use in food. The Committee was also satisfied that none of the gene products from the introduced genes were present in the processed oil. The processing characteristics of seed from the GM and conventionally bred oilseed rape were also compared and were found to be equivalent.

The Food Advisory Committee (FAC) has decided that there is not need for any special labelling in this case.

Plants challenge superbugs

Two potent naturally occurring insecticides have been isolated from a South American plant. The compounds are effective against important insect pests such as whiteflies, aphids and mites which show resistance to many of the current commercial insecticides. This discovery is of potential major significance in the control of agricultural pests world-wide.

Researchers at IACR-Rothamsted isolated the active compounds from the *Calceolaria andina* plant which grows in the mountains of Chile and is related to the familiar garden 'slipper' plants. An outstanding property of these compounds is that they are effective against a range of resistant insect strains including the notorious B-biotype of the tobacco whitefly, *Bemisia tabaci*, which is devastating crops worldwide. This "Superbug" multiplied five time faster than other biotypes, transmits up to 60 viruses, and can colonise 600 different crops and weed species.

The new compounds, identified as naphthoquinones, are easy to extract from *Calceolaria andina* and are present at up to 5% on a dry weight basis. More active synthetic analogues have been produced at IACR-Rothamsted and offer exciting opportunities for a continuing development programme of new insecticides. The well known dye, henna, can be used as an intermediate in the synthesis of these resistance defeating compounds, and the plant from which it is obtained, *Lawsonia inermis*, is already cropped in North Africa, and elsewhere.

The discovery results from a five year collaborative project, funded and co-ordinated by BTG. The project is centred on IACR-Rothamsted. The other institutions involved are the Royal Botanic Gardens, Kew, the Agrochemical Evaluation Unit at the University of Southampton, and the University of Chile-Probio Ltd.

Over 400 plant species, selected and collected in Chile, were sent to Southampton's Agrochemical Evaluation Unit. Extracts from the plants were screened for activity against a variety of insects. As a result of this work the most promising extracts were sent to IACR-Rothamsted where activity against resistant insects was established, and the active compounds were isolated and identified.

Kew is actively investigating a range of plant material to find species that could be cropped in the UK and elsewhere, and other species that may contain related active natural compounds.

BTG has applied for patents on the compounds and is currently discussing their development with several companies. If successful products emerge, all parties involved will benefit from the proceeds.

Ian Harvey, Chief Executive, BTG plc said: "By bringing together the world leading expertise at Rothamsted, Kew, Southampton and BTG, we have made a breakthrough with the University of Chile which could be the most important crop protection discovery since the Pyrethrins. The multidisciplinary approach used and the unique collection of resistant insects at Rothamsted have been cornerstones in developing the new compounds."

To date over 100 other plant extracts with crop protection activity have been identified, and BTG anticipates that a range of plant-derived products will be developed for potential use in pest management world-wide.

Traction control for telescopic handlers

Michael Mckee

Recent research work has produced a braking system that is intelligent enough to automatically apply the brakes to reduce wheelslip and aid traction. The pilot study was based on the JCB 526 Telescopic Handler, a 2.6 tonne capacity machine which has proved to be a popular choice for both the construction and agricultural markets *(Figure 1)*

Michael Mckee wins Johnson New Holland Trophy Award

Michael Mckee received the Johnson New Holland TRophy Award for this work, undertaken at JCB on a traction system for the 526 machine, and submitted as his final year dissertation at Harper Adams Agricultural College. The award is presented annually, with the object of encouraging and recognising innovation by younger students, to the best final year project submitted by a student or group of students, as part of a First Degree, Higher National Diploma or Higher National Certificate course in Agricultural Engineering In addition to the student prize, the college submitting the prize-winning project receives the trophy to hold for one year. This year the presentation was made by Mr Robert Humphrey, Marketing Director for New Holland UK Ltd, the kind sponsors of the Johnson New Holland Award.

Michael's employment since leaving school has been in agricultural engineering, rising from an apprentice tractor fitter on a BTEC National Diploma course, to his present position as a design engineer with JCB. He began a BEng degree at Harper Adams in 1991, and won the Top Student Award in 1995.

The demanding working conditions for the machine highlight the potential benefit of the prototype traction control system which has been developed through a Harper Adams Agricultural College B Eng student project in conjunction with JCB. The traction control system incorporate electrohydraulic technology into the standard power braking system to energise the individual brakes of the machine, and helps offset the drive torque being lost through a slipping wheel. Traction control systems have become the natural extension of the anti-lock braking systems fitted to cars and, as such, the technology neede to produce the system has become readily available.

Initial testing of the prototype system has proved that the concept works well. However, it is still only in the first stages of development. The system has potential for other uses on the machine,

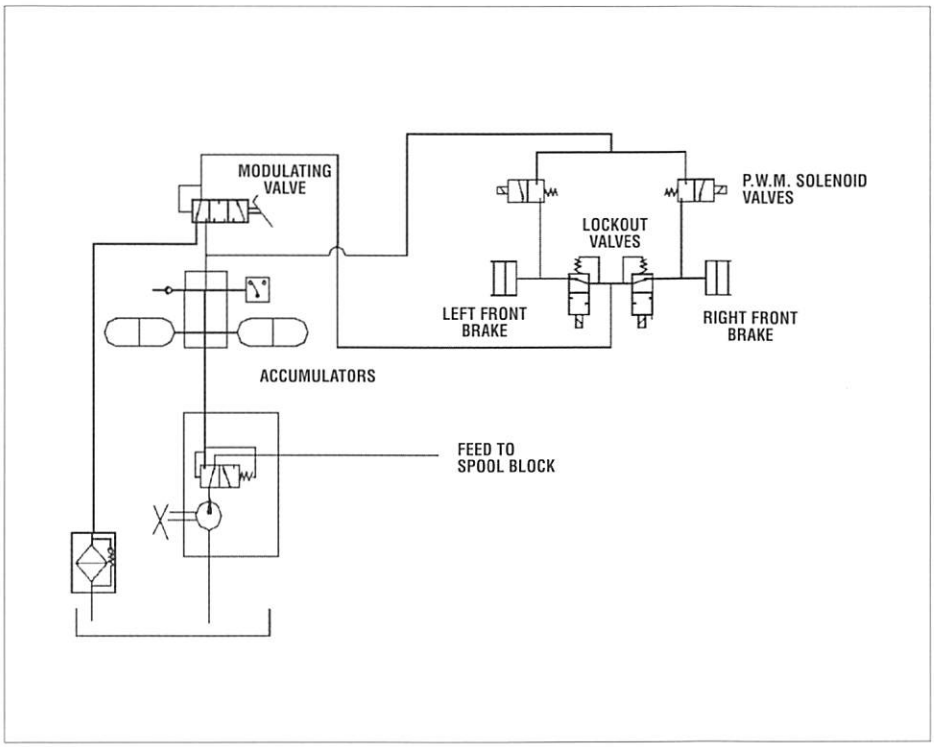


Fig.2 Hydrulic schematic of traction control system.

such as automatic stability control and safety lock-out device, and could be linked to the current safe load indicator system fitted o the machine.

The system works by measuring wheel speed via magneticpulses generated from a Hall effect sensor and gear wheel fitted to the axle half shafts. A micro computer then analyses the level of wheelslip in relation to forward speed. When it exceeds a set level, the controller energises the braking system valves to release hydraulic pressure to the brake of the slipping wheel, thus allowing the axle differential to direct drive to the other wheel.

The machine's driveline currently incorporates a torque converter which provides similar characteristics to the engine control regulator fitted to some car based traction control systems. The torque converter smooths the changes in driveline torque loads caused by the operation of the tractin control system, thus ensuring that the machine operates smoothly.

The modified brake system incorporates two electrohydraulic valves *(Figure 2)*. The first valve is an electronically activated lock-out valve which is used to isolate the individual brake. The system can then increase the pressure in the brake via the second valve which is a simple pulse width modulated (PWM) solenoid valve. The control system activates the PWM valve at 10-20 Hz to control the flow of oil to brake and therefore the speed of operation.

The micro-cotroller is the brains of the system and hass a software based control algorithm which denotes the set of rules it follows to make it's decisions. This has allowed very flexible testing where several scenarios were tried out to obtain the best possible response.

Safety is of paramount importance and the system has been programmed to deactivate automatically when the machine reaches a forward speed of 11km/h. Thus, traction control is limited to speeds in the 1st and 2nd gear range. Also, the control system constantly monitors the brake pedal so that, when the brakes are activated by the operator, the traction control system defaults to the off position and restores full four wheel braking.

Initial testing of the prototype system has proved that the concept of traction control is suited to this type of application and further work is planned.

Agro-chemical sprayer testing

As the trade association representing the manufacturers and principal importers of agricultural machinery, the AEA is very conscious that the inaccurate application of agro-chemical sprays is against everyone's interest - consumer, environmentalist, farmer, chemical company and sprayer manufacturer. A meticulously designed sprayer carrying a rigorously proven product will achieve little if the machine's in-field performance is not maintained in the face of wear and the demanding agricultural environment.

To address this problem, the AEA Chemical Application Committee has devised and validated a test protocol for field crop sprayers which is thorough, practicable and economic; ideally it requires an examiner and assistant for 1-1+ hours. By freely placing this in the public domain, we are providing an industry-approved model for anyone who may be considering a voluntary or mandatory test scheme. The spread of national sprayer test schemes across Europe already impinges on our members and the enclosed document is seen as a constructive and timely UK contribution to the debate which will inevitably follow in British agricultural circles.

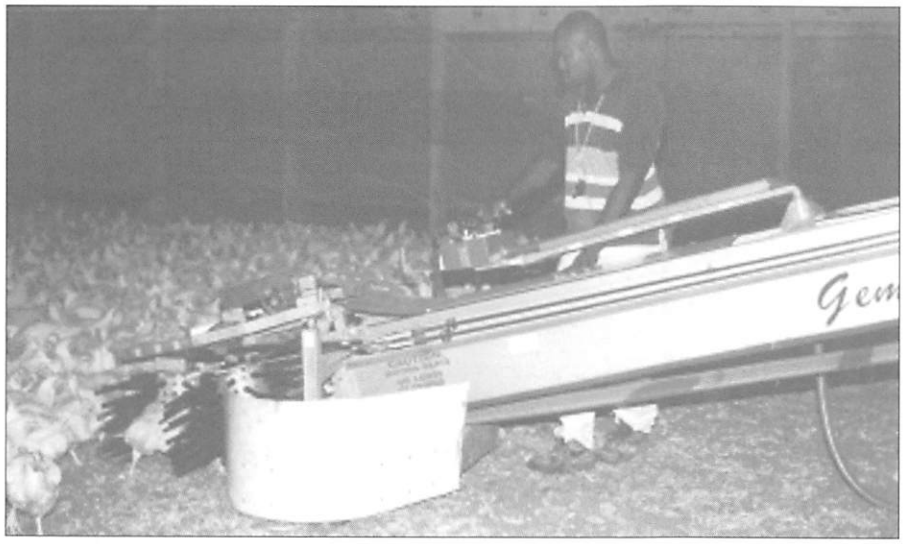
The AEA has no commercial interest or wish to operate test centre, provide examiners or execute a certification service, but nor does it wish to see a costly, time-consuming and overly bureaucratic scheme imposed in our industry. It is for that reason that we have taken this initiative at this time.

For a copy of the AEA Sprayer Test document, contact: **R F Saunders, AEA.**
Tel: 01733 371381

Johnson Food Equipment, Inc. to sell broiler harvester in USA

Johnson Food Equipment, Inc. and Cattaruzzi International have signed a joint venture agreement under which Johnson will manufacture and sell the broiler harvester in the United State of America.

The broiler harvester, which is an innovative method of collecting chickens for transportation, is protected by patents owned by BTG. BTG and Cattaruzzi signed a licensing agreement in November 1991, for the rights to manufacture and market the harvester worldwide. Cattaruzzi has subsequently sub-licensed Johnson Food Equipment for the US and Canadian markets after a successful six month evaluation period. Cattaruzzi, the largest manufacturer of poultry processing equipment in Italy, has been manufacturing and selling the broiler harvester throughout Europe.



Bruno Cattaruzzi, Managing Director of Cattaruzzi International, said: "The US market, which processes 140 million birds per week, represents a significant opportunity for the broiler harvester. It will eliminate one of the most stressful manual jobs remaining in the poultry industry".

Johnson, the leading supplier of poultry processing equipment in the US for over 50 years, will start production of the harvester in 1996. David Crawford, Senior Vice President of Johnson Food Equipment, said: "The broiler harvester is a significant addition to our complete line of products and services for the poultry industry. We look forward to co-operating with Cattaruzzi in manufacturing and marketing the broiler harvester in North America."

The broiler harvester, which was developed at the Silsoe Research Institute, is a more humane and gentler method of catching birds than the current manual way. Using the broiler harvester can result in significant cost saving for the farmer. There is less carcass downgrading due to bird damage, labour costs can be reduced as the harvester requires only three people to operate and it is fast, with an optimal catching speed of 6,000 birds per hour by each catcher.

A recent dispute with Anglia Autoflow (AA) regarding AA's design of a broiler harvester has resulted in AA's confirmation that their redesigned pick-up method now falls outside the scope of BTG's patent.

The broiler harvester is also licensed to American Calan in the US and Ar Tekniikka Oy in Finland.

Contact: **Mary Clark, BTG.**
Tel: 0171 403 6666.

Venturi spray nozzles

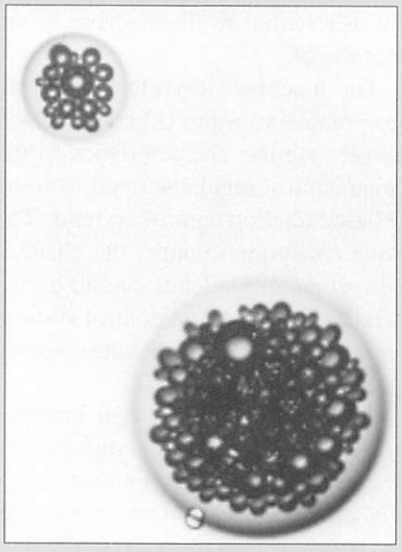
The TurboDrop twin fluid nozzle introduces air into liquid using the energy of the pressurised liquid, eliminating the cost of generating compressed air. This technique produces air filled droplets which are claimed to offer an exceptional reduction in drift together with an improved level of plant penetration.

In addition to spray drift reduction, the injection of air into the droplets is said to give greater coverage of the foliage.

The air filled droplets splatter on impact and adhere well to crop surfaces when solid droplets of an equivalent size may bounce off or roll off the plant. The impact of this innovative technology has been endorsed by results of usage in Europe and trial work in the UK.

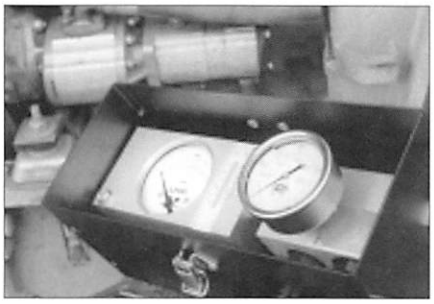
The TurboDrop nozzle is suitable for all applications traditionally requiring a standard nozzle. It can be retrofitted to most popular spraying machines in seconds.

Contact: **Alison Buck, Lurmark Ltd, Longstanton, Cambridge, CB4 5DS. Tel: 01954 260097**



An air-filled droplet which has been produced by the venturi technology used in the new TurboDrop nozzle by Lurmark.

Hydraulic test units



A new series of portable hydraulic test units give measurements of flow, pressure and temperature. Four sizes are available for flows from 0 to 30, 6, 120 and 180 litre/min. A 0-400 bar liquid filled gauge is mounted onto the loading valve. Burst discs are designed to rupture at 10 bar over the maximum gauge pressure. When these safety discs burst, the oil bypasses the loading valve at low pressure and continues to flow through the system, giving protection to both the tester and system components. The assembly is mounted in a strong steel case which provides protection against accidental damage.

Contact: **Paul Hensman, LHA Products, Sandy Way, Amington Industrial Estate, Tamworth, Staffs, B77 4DS. Tel: 01827 69369**

Case buoyant and acquisitive

Case had net income, before accounting changes and extraordinary items, of US $346 million in 1995, more than double that, reported last year. Case's annual net sales were $4.9 billion, up 16% over 1994. The company accomplished several important actions in support of its growth initiatives, including forming a construction equipment joint venture in China, completing a $45 million sale of combines to Turkmenistan, and increasing its level of investment in new products. In addition, Case completed the acquisition in January 1996 of Concord Inc., the number-one seller of air drills in the US.

Case worldwide performance

Wholesale sales of Case equipment to its dealers increased significantly in 1995. Europe led the company's sales performance with a substantial year-over-year increase, largely due to a sharp jump in sales of agricultural equipment. Wholesale sales of construction equipment also increased in Europe to support market demand. In North America, sales of Case construction equipment were up strongly, and sales of agricultural equipment also increased for the year. In other international markets, wholesale activity was up slightly year-over-year, despite weak economic conditions in Latin America that began in the second quarter of 1995.

Agricultural equipment

Case's two new lines of agricultural equipment, the 9300 Steiger® four-wheel drive tractors and 2100 series Axial-Flow® combines, both achieved significant retail unit sales gains in North America during the fourth quarter. Retail unit sales of Case four wheel drive tractors climbed 31% in the quarter, while Case combine sales increased 7%.

In Europe, retail unit sales of Case agricultural equipment remained strong throughout the year. In the fourth quarter, retail unit sales of Case 30-plus kilowatt tractors were up 18%, more than double the industry increase of 8%. Retail unit sales of Case's Magnum® tractors (90-plus kilowatt) were up 46% for the year.

Market outlook

Case expects the worldwide markets for its agricultural and construction equipment to be fundamentally strong for 1996, with mixed growth rates in various product and geographic markets.

The worldwide markets outlook for agricultural equipment is positive, driven by very favourable conditions around the world. The record set in 1995 for exports of US farm products is expected to be surpassed in 1996. Combined with sustained, strong pricing levels, these conditions have created healthy farm incomes and balance sheets. Similar conditions exist in Europe. Low carryover stocks (wheat and course grains are at 30-year lows) are expected to keep demand and pricing firm in 1996.

Case agreement with Alitec

In keeping with its policy of acquiring market system solutions to meets its customer's requirements, and in fostering real partnerships with key suppliers, Case Corporation has announced a world-wide co-branding and supply agreement with the Alitec Corporation, a leading manufacturer of hydraulically powered attachments.

As a result, Case-branded Alitec attachments all of which carry full 'CE' approval, can now be purchased through virtually all the company's construction and agricultural equipment dealers. The attachments, in Case livery and bearing a combined Case Alitec logo, have all passed Case engineering and safety tests. Case was involved in the design and engineering of key products to ensure full compatibility with its equipment. Attachments have undergone rigorous testing by the Uni-Loader engineering group at Case's Wichita, Kansas manufacturing plant.

Products include such units as cold planers, rock wheel, vibratory rollers, augers, stump grinder, mowers and tillers. Whilst primarily, the agreement covers attachments for Case Uni-Loader skid steers, it will also offer attachments for backhoe loaders and excavators.

"This agreement reinforces Case's commitment to supply more than just the prime mover", says Bob Weiglein, Case's application systems marketing manager. "We are providing systems for customers rather than equipment, and the agreement means they can now purchase their equipment from one source, with the guaranteed service and support they expect from every Case product.

Case and dealer personnel in Europe recently attended training sessions at Alitec's Nottingham facility and were given the opportunity to test the new attachments. The agreement enables Alitec's expertise in designing, manufacturing and marketing attachments to be combined with Case's world-wide distributors. For the European market, attachments will be shipped direct from Alitec's distribution base in Nottingham to the dealers facility. Spare parts will be marketed through the Case Parts Organisation.

Contact: **Case UK Ltd, Marketing Division, PO Box 121, Wheatley Hall Rd, Doncaster, S Yorks DN2 4PN. Tel: 01302 733393**

Record profit from Kverneland

Kverneland AS, the Norwegian based manufacturer of agricultural equipment for the tillage, grass, potato and livestock sectors, made a pre-tax profit of NOK 143 million in 1995. This signifies an increase of 40% over the NOK 102 million profit recorded in 1994. Group turnover rose to 12% on 1994 levels. The Board has proposed payment of a dividend of NOK 2.20 per share.

Market situation

In 1994, the European market for agricultural machinery grew by around 7% after several years of decline. A positive trend continued into 1995, but with substantial variations within the individual product areas. Growth in 1995 has predominantly been connected with the soil preparation sector. This is due to a strong focus on the world food situation, record low grain stocks, a sharp increase in grain prices and a reduction of the EU set-aside programme from 15% to 10% of the land area for 1996. Good grain harvests in most of Europe have helped to increase farmers' incomes for 1995 which, together with generally positive economic factors such as a low interest rate, has led to a positive development in demand.

In the grass sector, which by its nature is more stable, drought in parts of Europe led to a certain reduction in demand for grass machines. In the potato sector, there was a stable to positive development in most markets. Kverneland continues to increase its market shares in most countries as a result of implementing the Group's strategy regarding marketing and product range.

Prospects

The increased focus on the world food situation and the sharp increase grain prices has helped to create greater optimism among the grain producers than has been the case for many years. At the beginning of 1996, this looks like having a positive impact on demand for soil preparation equipment. For the other product areas Kverneland expects market development to be virtually flat. Kverneland anticipates a continued growth in its market shares and a strengthening of the Group's position in relation to most of its competitors.

Simba makes the grade - in China

Simba International Ltd, the leading manufacturer of agricultural and civil engineering equipment, has sold its first road grader into China. The implement will be used to maintain roads around an expanding sugar processing plant, which is part run by British Sugar Overseas (BSO). The sugar refinery is part of a join venture between BSO, which owns 60% of the project and Guangxi Yizhou Sugar Development Company 40%. The project aims to expand production at the factory from 3,000 to 6,000 tonnes a day in about two years. This will greatly increase traffic levels on the local gravel roads.

The Simba road grader.....has the potential to provide cost-effective maintenance of unsurfaced roads.

Mike Hodge, Simba's Export Manager, believes there is a growing market for this type of machine across the world: "The upkeep of rural roads is one of the key limitations on economic development across huge areas of the world. The grader is designed to be used by local labour, and can be run as part of a team of machines, each being able to restore a couple of kilometres of road each day.

It is drawn by an independent tractor unit rather than having its own integral engine, which means that - in the event of an engine failure - the grader can recommence work as soon as another tractor can be attached to it, rather than having to wait for its own engine to be repaired, considerably reducing potential downtime. The controls and hydraulics are also minimal, which further reduces the breakdown risks".

The implement weighs 2.25 tonnes unladen, but is usually ballasted up to 5.75 tonnes for use. Its main blade can be angled to dig or maintain roadside ditches.

Contact: **Guy Leversha, Simba International Ltd, Woodbridge Rd, Sleaford, Lincs NG34 7EW. Tel: 01529 304654**

Compair breathes life into London rainforest

Some of the world's rarest plants are being protected by CompAir compressors. The Royal Botanic Gardens, Kew is using four compressors to maintain air humidity at two of its glasshouses, the Princess of Wales conservatory and the famous Palm House. Both screw and rotary vane compressors help sustain twelve micro-climates, ranging from arid desert at 0% humidity to mountain rainforest with 100% humidity.

Weather stations pass information to a control system which brings environmental systems into action - pressurised by Hydrovane and BroomWade compressors. The compressors power air propelled fogging nozzles fitted around the borders of the plant houses to produce a fine mist, to raise or lower the humidity to suit fine pre-set conditions.

Special precautions have to be taken to protect these delicate man-made environments and the public who visit them To stop any impurities entering the atmosphere the oil lubricated compressors are fitted with filters and dryers to produce totally clean air. Even the mist they spray is drawn from tanks of filtered, UV disinfected, de-ionised water, or rainwater, held in large tanks around the site.

Proper management of such a store of unique flora it vital. Without compressed air systems providing humidity control and other environmental controls, the plants would quickly succumb to the harsh British climate. At the same time, the plants cannot be allowed to grow too fast or they would outgrow the buildings that house them.

"This unusual application shows how versatile CompAir compressors can be, said Howard Dry-Parker, Sales Director of Motivair Compressors, authorised distributors for CompAir. "We used a blend of CompAir equipment to meet exacting standards of air quality, producing a very flexible system. In addition the ISO 9000 systems we have in place give Kew 24 hour priority over in the event of a breakdown, essential for such a valuable resource".

Contact: **CompAir BroomWade Ltd, Hughenden Ave, High Wycombe, Bucks HP13 5SF. Tel: 01494 465000**

Monitoring tyre pressure on-the-move

In the car of the future, the driver will be able to check tyre pressures without leaving the driving seat, thanks to a battery-powered sensor microsystem that can be installed in each tyre. This is just one of the potential uses of a sensor device that ERA Technology has been developing with Otter Controls of Buxton, Derbyshire.

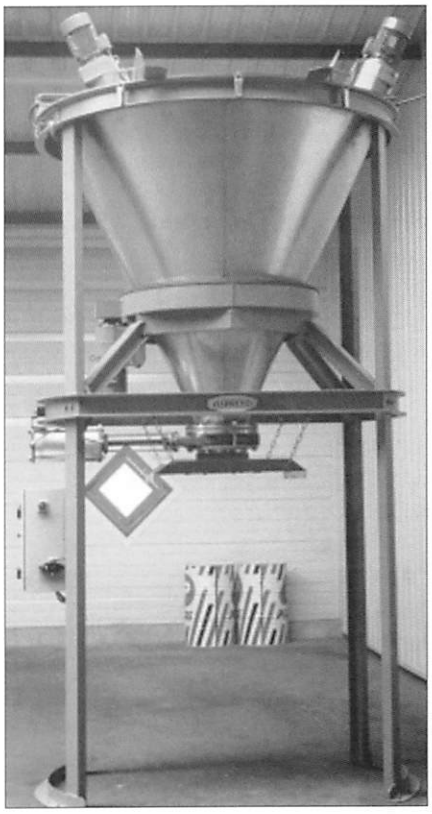
In this application, the sensor uses a miniature radio transmitter to send signals to the dashboard which displays tyre pressure and temperature - critical factors for improving fuel economy and reducing the risk of blow-outs. ERA Technology developed the pressure sensor for this system.

The sensor microsystem itself, comprising a low power capacitive pressure sensor, low power interface electronics and a radio transmitter mounted on a single substrate, is also offered as a stand-alone system and both ERA Technology and Otter Controls welcome discussion with potential end-users on possible applications.

This micro-machined silicon capacitive pressure sensor offers a number of important advantages over the competing silicon piezoresistive technology. These include: low power consumption, high temperature operation (above 125 degrees C), lower intrinsic temperature coefficient, higher stability with time and high over-pressure capability.

Contact: **Dr John Tudor, ERA Technology Ltd, Cleeve Road, Leatherhead, Surrey, KT22 7SA. Tel: 01372 367000**

A Mixer for Powders, Granules and Pastes

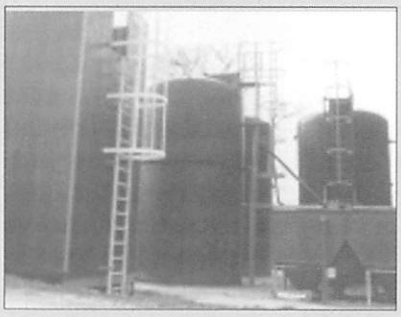


French company LAZARETH has developed a new mixer with a conical rotating tank. The rotary movement of the tank and the Archimedean screw act on the materials inside the tank, which start to move in three directions. All the particles are mixed evenly. This process offers a high quality mix without destroying the various components. It reduces mixing times while causing only a slight increase in product temperature. Moreover, the tank can be emptied quickly and easily.

LAZARETH offers a wide range of mixers made of different materials (such as E 24 steel or stainless steel) with capacities ranging from 100 to 5,000 litres. It is currently seeking distributors.

Contact: **Monsieur B Lazareth, LAZARETH INTERNATIONAL, Z.I. Les Glaisins, Rue du Pré Paillard, 74940 ANNECY LE VIEUX, France. Tel: (00 33) 50 64 00 90**

Bio Plank



An innovative application of GRP pultrusion technology, BioPlank replaces steel or timber in many applications. BioPlank is corrosive resistant, integrally coloured and incorporates a unique jointing system, sealing and connecting one plank to the next without the use of bolts. This enables rapid construction of floors, walls and walkways up to complete housings from a flat pack.

Pultrusion is an automated process for manufacturing composite materials into continuous constant cross sectional profiles. Mechanical properties exceeding those of traditional materials can be achieved by the use of continuous fibre reinforcements.

A major application for BioPlank is a modular filtration housing for waste water treatment. The new BioTower using BioPlank requires minimum site preparation, is fast to assemble and easy to adapt or resite later.

Contact: **Olivia Schofield, FibreFORCE Composites Ltd, Fairoak Lane, Whitehouse, Runcorn, Cheshire, WA7 3DU. Tel: 01928 713572**

Vision Techniques expands rear vision horizons

Vision Techniques announces an extensive new repair and maintenance service for any manufacture of mobile CCTV based on its in-depth knowledge of the industry and support of Mitsubishi systems. The service is readily available to users of Clarion, Ichikoh, Mitsubishi C-Vision, Orlaco, Panasonic, Rear-View and Sony systems.

To reduce the risk of accidents, the Health & Safety Executive's guidelines on Reversing Vehicles highlights a closed circuit TV system - such as C-Vision - in the cab as a measure to increase the area a driver can see.

Vision Techniques Ltd now offers an extensive repair and maintenance service for any make of rear vision and mobile CCTV system.

Michael Hanson, Managing Director of the Blackburn based company states, "Vision Techniques , with its vast knowledge and expertise in the vehicle industry, has used this major benefit to establish itself with the Mitsubishi product lines. Now, that knowledge and practical expertise can be put to further advantage, particularly, for users of other mobile CCTV systems who simply cannot get the back-up service and support for their systems, from simple breakdown to major repair."

Vision Techniques was established in 1988 to distribute and sell Mitsubishi's C-Vision which enables drivers of huge quarrying and mining machines, waste disposal trucks, road sweepers, PSV's, forklift trucks and even fishing boats to keep as safe eye on what is happening around them.

C-Vision systems comply with EC EMG regulations and carry the 'CE' Mark. They are exclusively available in the UK from Vision Techniques who can also fit, as optional equipment, auto-brightness control, multi-camera switching, a washing system to clean the camera lens and an impact resistant, polycarbonate cover which is said to be ideal for quarrying and mining application.

Contact: **Michael Hanson, Vision Techniques, Glenfield Park Site, 2 Blakewater Road, Blackburn, Lancs, BB1 5QH. Tel: 01254 679 717**

CE marketing of chainsaw protective clothing

Recent tightening of the Health and safety legislation has led to Spaldings upgrading their entire range of chainsaw protective workwear. The range includes jackets, seatless trousers, wellingtons and gloves, all manufactured to current European PPE Standards and carrying a full CE approval.

With thess amendments to specifications for chainsaw clothing becoming effective in 1995, Spaldings recommend that all users inspect their current protective workwear and, where needed, upgrade to comply with this revised legislation.

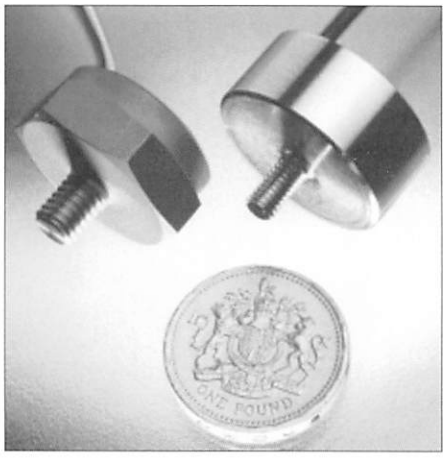
Contact: **John Chamberlain, Spaldings (UK) Ltd, Sadler Rd, Lincoln LN6 3XJ. Tel: 01522 500173**

Accelerometers

A new range of competitively priced miniature capacitive accelerometers are suitable for static and/or dynamic applications up to ±100g. They incorporate integrated electronics, eliminating the need for dedicated signal conditioning.

A typical ±10g unit has a measuring frequency of dc to 350 Hz and a signal output of 60 mV/g. The required stabilised energising voltages are 3-16 V dc. The stainless steel housing is hermetically sealed and the claimed resistance of the units to mechanical shock is 10,000g.

Contact: **Mr J Beck, Graham and White Instruments Ltd, 135 Hatfield Rd, St Albans, AL1 4LZ. Tel: 01727 861110**

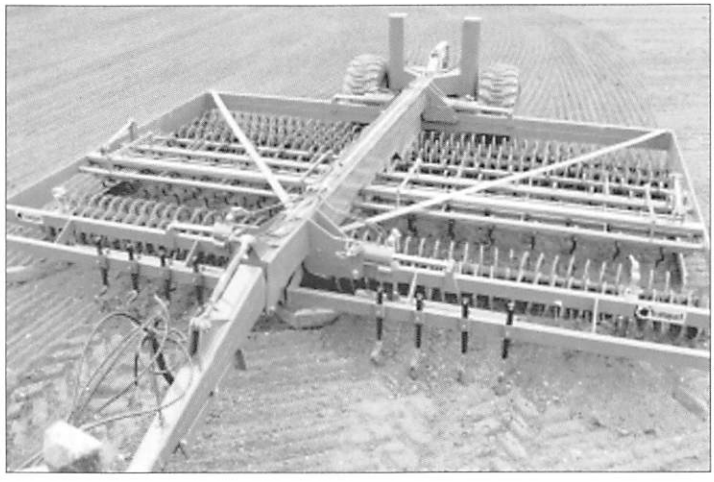


High speed seedbed cultivators

Intensive soil-working to create a fine seedbed from ploughed or rough cultivated land in one pass is claimed for the latest Franquet cultivator.

In operation, the Synchrogerm's track eradicators loosen soil in the wheeling indentations left by the tractor, while the angled levelling boards fill them for a level finish. Soil is then packed by the leading coil or coils to give the following tines more 'bite' in breaking down the surface structure, while the following coils crush any surviving clods and firm the soil at depth to leave ideal conditions for precision-sown crops such as sugar beet.

The coils on the two- or three-coil Synchrospire units are close-coupled with the steel loops interlocking, resulting in a more intensive clod crushing and soil consolidating action. An excellent self-cleaning action allows work to continue in sticky conditions that would defeat a conventional coil design.



Contact: **Charlie Dyke, Anglia Imports Ltd, Foldgate Rd, North Walsham, Norfolk, NR28 0AN. Tel: 01692 407233**

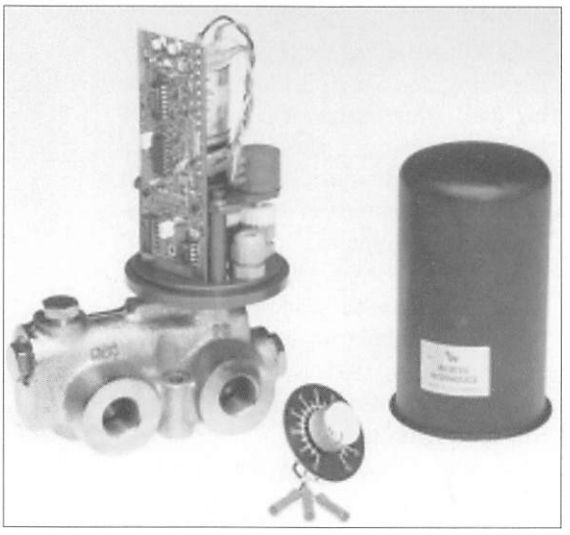
Variable flow divider with remote control

A Variable Priority Flow Divider with Remote Electrical Control makes it possible to control the speed of hydraulic motors for applications such as spreaders and conveyors from the cab. Three methods of control are available:

by panel mount rotary potentiometer;
4 to 20 milliampere loop;
by switch.

These flow dividers accept up to 114 litres per minute at the inlet and the regulated flow can be varied between 1 and 75 litres per minute. The excess flow port can be used for a second hydraulic circuit, or returned direct to tank.

Supply voltage is 12 V dc at 1 A max. Working pressure is up to 3,600 psi.

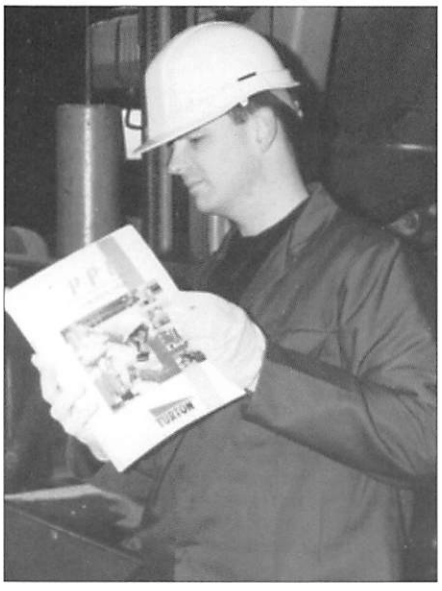


Contact: **Ron Skeates, Webtec Hydraulics, 16 Edison Rd, St Ives, Cambs, PE17 4LZ.**
Tel: 01480 463203

PPE catalogue

Turton Safety Ltd have updated and extended the company's dedicated PPE product catalogue. Now featuring many additional brand leading products, the catalogue provides an ideal source of products that conform to increasingly demanding safety legislation and European directives on CE marking.

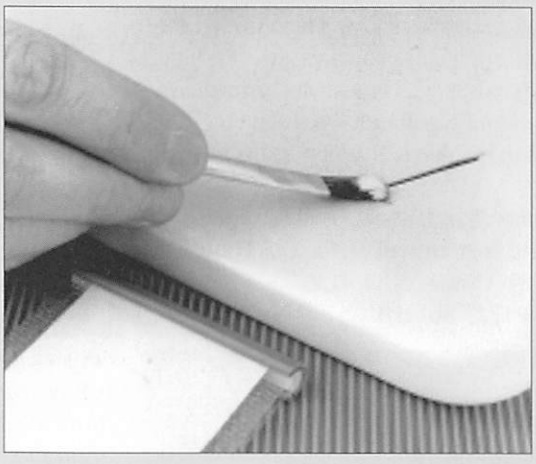
For a free copy of Turton Safety's 132 page full colour PPE sourcing catalogue, contact: **Central Sales Office, Turton Safety Ltd, Units 4 & 5, Shenstone Trading Estate, Bromsgrove Rd, Halesowen, West Midlands, B63 3XB. Tel: 0121 550 9014**



Syon plastic tank repair kit

A new repair kit for making colour accented permanent repairs in place on sprayer tanks as well as baths, showers and other surfaces in homes, is being introduced by Syon Corporation of Ashland, Massachusetts and is being distributed by Lurmark Ltd of Cambridge.

The Seal-N-Place Plastic Tank Repair Kit, available in white and almond colours, features a pre-measured two-part epoxy resin system which is mixed inside a pouch. Applied with a brush along with a fibreglass patch to the damaged area, this repair kit lets users make permanent repairs to any surface without removing the affected part.



Capable of fixing a 25 mm dia. hole in less than 20 minutes, repairs made using the Seal-N-Place Plastic Repair Kit are strong. Tests have proven that a 15 mm hole repaired in a heavy tank will withstand over 40 bar internal hydrostatic pressure and the patch is not affected by water.

Contact: **Tom Comer, Marketing Manager, Lurmark Ltd, Station Road, Longstanton, Cambridge, CB4 5DS. Tel: 01954 260097**

Institution of Agricultural Engineers
FORESTRY ENGINEERING GROUP

Thursday 5 September 1996, 9.30-4.30
Newton Rigg College, Penrith

Computers in Forestry Production

Conference Programme

- **GIS explained-**
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- **GIS developments within Forest Enterprise-**
  Jo O'Hara, GIS Development Manager, Forest Enterprise
- **Planning and control of timber procurement in Finland-**
  M Välikoski, Senior Harvesting Manager, Metsälitto
- **Location-based software for better management of civil engineering works-**
  Mark Ketterman, Sokkia
- **Computer controls of Forest machines-**
  Tommi Ruka, Ponsse
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