IAgrE Journal

Landwards

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Agriculture • Forestry • Environment • Amenity

As the Millenium approaches, there are signs that the design of many of the machines used in the production of high quality potatoes is in the process of major change. This Conference takes a look at the trends in the machines used for each of the important stages in potato growing, and asks where we are heading.

Details from:
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The IAgrE Scottish Branch Conference 1998
Wednesday 18 February 1998, 10.00 - 4.30, Stakis Hotel, Dundee

Potato Machinery heading for the Millenium

CONFERENCE PROGRAMME

Stone Windrowing Machines

The need to maximise the operating rate without sacrificing the quality of the operation, has led to changes in windrowers. One of these changes is the use of finger rollers instead of a main web. Will webs keep rolling and how are designs of web machines changing? A speaker from Reekie Manufacturing, Forfar will discuss the developments.

Planters

Should seed potatoes be designed for the planter, or planters for the seed potatoes? *Fraser Milne*, SAC Crop Handling, Edinburgh, will give his views on the current performance of planters and the ways planter design may go.

Potato Damage during Harvesting

The questions of whether potato damage is on the way out, and whether present harvester designs are in need of an overhaul, will be addressed by internationally acclaimed expert, *Douglas McRae*, formerly Head of SAC Crop Handling, Edinburgh

Lifting the Crop

A well known potato grower/merchant, *Alistair Melrose*, gives his views on current choices of harvester and his experience of one of them in the field.

Solving the Riddle of Grading

Electronics systems are replacing conventional methods of sizing and inspection for both external and internal defects in potatoes. *Andrew Muir*, SAC Crop Handling, Edinburgh, talks about the pioneering work at SAC on new equipment and what we might expect in the near future.

Boxing Clever

Britain has led Europe in the development of box storage systems for potatoes. *Bob Pringle*, SAC Engng and Mechanisation Unit, Aberdeen, will describe the latest research and developments in box storage ventilation systems. *Bill Leslie*, Director of Farm Electronics, will present a manufacturers viewpoint on the design of box store ventilation equipment.

The Conference Chairman will be *Oliver Statham* of The British Potato Council, well known for his work on potato storage and organiser of the worlds largest potato planting and harvesting demonstrations.

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

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Front cover: *Hose reel irrigator (photo: ADAS).*

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Irrigation in England: a review of the 1995 MAFF Survey


Raingun irrigation of sugar beet.

Christopher B Stansfield and Sally J Hutchings

MAFF irrigation surveys

MAFF carry out a survey of irrigation, in the past every 2-3 years, now in dry years only. The surveys are designed to provide a unique set of statistics based on actual irrigation practices that can be used to predict future irrigation requirements. Thus, they are a key element in the water resources planning process. They have the full support of the Environment Agency (EA), National Farmers Union, Country Landowners Association and the United Kingdom Irrigation Association. The data obtained from the irrigation surveys form a consistent national series, held by MAFF Censuses and Surveys Division. Since the present series of questions were introduced in 1982, six surveys have been carried out in 1982, 1984, 1987, 1990, 1992 and 1995; and three of those years, 1984, 1990 and 1995, have coincided with peak years for irrigation and provide very robust information (MAFF 1983, 1985, 1988, 1991, 1993 and 1997).

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Earlier reviews of MAFF irrigation surveys written by Chris Stansfield have appeared in The Agricultural Engineer in 1989 44(3): 95-97, 1992 47(1): 6-8, and 1994 49(2): 52-55.

Prior to 1995, all surveys covered both England and Wales and, in the following tables, comparisons are between England only figures in 1995 and England and Wales figures for earlier years. To put this in perspective, the area of irrigation in Wales for 1992 was 1.4% of the total for England and Wales (0.8% of volume) (MAFF 1997).

The surveyed population consists of all holdings recorded as irrigators in the most recent June census, together with respondents to the previous irrigation survey, and can be considered as a census of irrigating holdings. Over 7,800 holdings received questionnaires and a response rate of 77% was achieved. The results are raised to account for the non response and are subject to a degree of error due to this. Although this review concentrates on the picture for England as a whole, Census Branch does produce figures on a regional and county basis which are available on request.

Some general points about irrigation follow. Nationally, the amount of water used for irrigation varies from 0.4 to 1.7% of all surface and ground water abstractions, excluding that used by the Electricity Industry (DOE, 1996). This hides the fact that spray irrigation normally only takes place between April and September and, even then, most water is used between June and August when resources are lowest and recharge is minimal. There are also major regional differences, with Anglian Region EA having the lowest rainfall and the largest area of crops requiring irrigation. On peak days in Anglian Region, irrigation uses more water than all the Water Companies' combined use for public supply (Evans 1994). Even in Anglian Region, however, the average effective rainfall (rainfall minus evapotranspiration) exceeds total forecast demand for all purposes by a factor of four (DOE 1992). This means that three quarters of the rainfall that nature provides is lost; and when difficulties occur, it is really due to poor national planning of our water resource.

A further contentious issue is the leakage losses by Water Companies; and again, nationally, a reduction of 2% in leakage would supply all of farmers irrigation needs. However, it is not as simple as that because, if leakage volumes are small over large areas, the water will replenish ground water and is available for re-use. It is only the leakage that occurs to saturated land and which escapes through the drainage system to the sea which is lost to inland water users!

Why farmers irrigate

Farmers are primarily food producers, with the standards of produce quality dic-

Table 1 Area of outdoor crops irrigated.

Crop	Area irrigated, ha					
	1982	*1984*	*1987*	*1990*	*1992*	*1995*
Potatoes: harvested by 31 July	8,050	7,720	5,360	8,510	8,180	8,730
harvested after 31 July	22,810	34,610	29,520	43,490	45,290	53,380
Sugar beet	15,770	25,500	10,100	27,710	10,520	26,830
Orchard fruit	3,100	3,250	1,330	3,320	2,280	2,840
Small fruit	3,610	3,560	2,230	3,470	2,750	3,310
Vegetables for human consumption	14,810	17,460	11,040	25,250	20,200	27,310
Grass	16,440	18,940	6,970	15,970	7,240	10,700
Cereals	14,800	24,700	7,510	28,100	7,160	13,440
Other crops grown in the open	4,100	4,890	2,440	8,650	4,320	8,930
New woodland plantations and other trees*						190
Total area	**103,490**	**140,600**	**76,520**	**164,460**	**107,940**	**155,660**

*Category introduced in 1995.

Table 2 Volume of water applied by crop.

Crop	Volume of water applied, m^3 x 1000					
	1982	*1984*	*1987*	*1990*	*1992*	*1995*
Potatoes: harvested by 31 July	4,680	4,920	2,350	6,770	5,590	9,340
harvested after 31 July	15,280	32,730	14,700	51,170	38,520	74,460
Sugar beet	8,260	17,370	3,430	20,320	4,860	21,290
Orchard fruit	2,180	2,430	550	2,930	1,220	2,420
Small fruit	1,890	2,660	970	3,180	2,000	4,340
Vegetables for human consumption	6,830	11,390	4,640	18,450	12,180	25,500
Grass	10,030	13,550	3,550	13,100	4,280	9,920
Cereals	5,040	8,300	2,160	11,830	2,260	5,620
Other crops grown in the open	1,020	4,030	1,270	6,040	4,160	10,990
New woodland plantations and other trees						180
Total volume of water applied	**55,210**	**97,370**	**33,630**	**133,790**	**75,070**	**164,070**

tated, to a large degree, by customers through the buyers of the multiple retailers. These now sell about two thirds of all vegetables sold. On light soils in the drier parts of the country, irrigation is now an essential component of competitive crop production systems.

The reasons farmers irrigate crops include:

- improving total saleable yield
- improving the quality of saleable yield
- continuity and reliability of supply
- timeliness of harvest
- improving crop establishment
- reducing disease
- protecting the business investment.

Crops irrigated and volumes of water used

The most important information relates to the area of crops irrigated and the amount of water used. These data are shown in *Tables 1 and 2*.

The most important crops irrigated are potatoes which in 1995 made up 40% of the area irrigated, with vegetables and sugar beet accounting for 18% and 17%, respectively.

The seasonal pattern is dependent on variation in normal rainfall and is quite marked, with 1990 and 1995 being dry for most of the irrigation season. This contrasts with 1992 where an early drought was followed by heavy rain in July which reduced the area of sugar beet irrigated by over 40%. A similar pattern is seen in the volumes used, shown in *Table 2*.

From a volume point of view, the important crops are the same but in 1995 potatoes used over 51% of the total irrigation water, with vegetables accounting for 16% and sugar beet 13%. It is the potato and vegetable crops which will continue to be the main users of irrigation water because produce quality is the key issue. It is also important to remember that these two crops are grown without Government support. The success of UK producers is judged against world

Fixed mini sprinklers can achieve 85-90% uniformity.

Table 3 Amount of water applied by source.

Source	Volume of water					
	1984		1990		1995	
	m^3 x 1000	%	m^3 x 1000	%	m^3 x 1000	%
River,stream or other watercourse	47,480	49	62,330	47	76,760	47
Spring or well	7,580	7	8,590	6	8,620	5
Deep borehole	24,840	26	41,950	31	53,710	33
Pond, lake or gravel working	9,730	10	11,740	9	14,660	9
Public supply	3,840	4	3,860	3	4,440	3
Other source	3,540	4	5,330	4	5,890	4
Total	**97,730**	**100**	**133,790**	**100**	**164,070**	**100**

markets and current performance is very encouraging, especially as water use by agriculture is treated as second class by the regulatory system. Cereals and grass are also irrigated but, as water supplies become more restricted and costs increase, the justification becomes very questionable.

Table 4 Water storage in lined and unlined reservoirs.

	1982	1984	1987	1990	1992	1995
Number	NA	2,700	2,420	2,580	2,840	3,220
Capacity, m^3 x 1000	21,660	32,670	36,740	36,690	41,240	63,930
Average size, m^3 x 1000	NA	12.10	15.18	14.22	14.52	19.85

Importance of irrigated crops to the economy

In 1995, the area of crops irrigated was 1.8% of the total tillage, grass, woodland and set aside area of over 8.4 million hectares in England (MAFF, 1996a). This masks the importance of these crops nationally as irrigation is used on 48% of the potato crop, 24% of field scale vegetables and 14% of the sugar beet crop in dry years. The value of the irrigated crops per hectare would of course normally be expected to be in the upper quartile of production output and the estimated value of the crops irrigated in 1995 was £710 million (MAFF, 1996b). This represents 7.8% of the total UK agricultural output of £9 bn. Irrigated crops therefore represent an important part of our agricultural industry.

If irrigation was not available, cropping patterns would change, quality would deteriorate and for some crops where quality was too low, there would be no market at all. With many assumptions, it has been calculated that if irrigation ceased the loss of output would equal £433 million (Stansfield, 1997).

Reservoir storage has trebled since 1982.

The UK is 75% self sufficient in indigenous food and feed or 59% self sufficient in all food and feed (MAFF, 1996a). It has been reported that of the £6 billion food and drink trade deficit, 63% is for products that are imported from northern European Countries and could be grown here (Fletcher, 1996). Many of these crops would need some form of irrigation to obtain marketable quality.

The socio-economic effects of a full irrigation ban are even wider. The UK irrigation equipment, engineering and food processing and distribution industry is estimated to employ 2000 people who rely solely upon irrigation as a source of income.

Where does the water come from and how much is stored?

In terms of water sources, the main trend in recent years has seen the reliance on rivers, streams or other watercourses which are the cheapest form of water remain static, while that from boreholes has increased. *Table 3* shows major changes using data from surveys in 1984, 1990 and 1995.

In 1995, the question about water sources was split into summer and winter abstraction. This indicated that 10% of water applied was abstracted in winter but this is at odds with the amount of water stored in reservoirs and tanks which totals 64,840,000 m^3, the bulk of which would be expected to be abstracted in winter.

A very pleasing result is to see the amount of water stored in reservoirs. This is shown in *Table 4*.

Water storage capacity has trebled

Trickle irrigation in potatoes.

since 1982 and now represents approximately one third of the total water used for irrigation. Not only have the number of reservoirs increased by over 13% between 1992 and 1995 but average capacity has increased at a faster rate of 36% in the same period as larger reservoirs were constructed. Recent activity indicates that the move to construct larger reservoirs is continuing.

Although winter storage reservoirs are costly to construct and take up valuable land, their construction reflects farmers concerns over the reliability of summer supplies for irrigation. It is another example of farmers controlling their own destiny because if they have water in their own reservoir they know exactly how much they have and can plan accordingly. Any farmer who uses irrigation as a key part of the business is at severe risk if they have to rely on surface or ground water, the vagaries of the weather and the licensing system. The trend to more farmer stored water will continue.

It should be remembered that licences for spray irrigation abstraction have least protection; because of the effects of these large abstractions in periods of drought, the licensing system gives the EA power to ban abstractions for spray irrigation (DOE, 1991). Bans are legally enforceable but in some regions, notably Anglian, a dialogue has been set up between the EA, farmers and farmers' organisations so that notice is given before bans are instigated. Farmers can then change plans to optimise water use with the most economic crops. Unannounced bans can be very damaging to crop growth, produce quality, farm incomes and UK competitiveness.

Table 5 Application methods.

	1984	*1987*	*1990*	*1992*	*1995*
Total number of self-propelled irrigators	4,770	4,880	5,550	6,120	6,610
Area equipped for trickle irrigation, ha	1,550	1,330	1,420	1,970	4,120
Area equipped for frost protection, ha	2,080	2,710	2,170	1,890	2,470

Table 6 Predicted irrigation water volumes for each EA region, 1996-2021, for most likely projections (modified from original data for revised regions).

Region	*Water volume, m^3 x 1000*		
	1990	*2006*	*2021*
Anglian	77,015	105,269	122,916
Midlands	39,324	50,096	54,410
North East	10,448	14,119	16,127
North West	2,577	3,545	4,371
Southern	9,436	13,382	16,823
South West	4,591	5,325	6,139
Thames	9,712	9,606	10,089
Wales	3,867	5,355	6,532
Total	**156,970**	**206,697**	**237,407**

Methods of application

The survey also asks for details of application methods and these are shown in *Table 5*.

This shows clearly the advance of self propelled irrigators, mainly raingun types which reduce labour costs. Application accuracy is becoming more important for two reasons, one to make better use of scarce resources and also because the agronomic requirements are better understood and amounts and timing of irrigation are becoming an exact science. This means that more overhead, boom type irrigators are being used which apply water more accurately with less waste. Trickle irrigation is also gaining, and recent discussions with growers would indicate that the area of trickle irrigation is understated in the survey. This is because trickle irrigation is sometimes used as a method of obtaining water without the need for a licence and its use is not reported. Water savings of up to 30% are being claimed by some users.

Predicting future requirements

One of the first predictions of future irrigation water demand was carried out by the Advisory Council for Agriculture and Horticulture in England and Wales in the 1980 "The Strutt Report" (Strutt *et al.*, 1980). This forecast a four fold increase for irrigation by the year 2000 to 350 Mm^3, based on the 5th driest year in 20. Strutt recognised that this was the "upper limit" but should be "borne in mind by Water Authorities and other responsible bodies as a guide to the load which may well be placed by agriculture on available water supplies". If only the water industry had acted!

Using a quantitative analysis of irrigation requirements based on crops needs, soil types and climate, the crop irrigation requirements have been calculated as 240 Mm^3 per year (Bailey and Minhinick, 1989). The EA, in its water resource strategy to the year 2021, have based demand for irrigation water on a study by Silsoe College (Weatherhead *et al.*, 1993). Allowing for changes in agri-

Table 7 Farmers' estimates of likely irrigation requirements in a dry year.

	1984	*1990*	*1992*	*1995*
Area of crops likely to be irrigated, ha	189,310	202,620	218,550	194,000
Volume of water likely to be applied, Mm^3	167	179	234	244
Depth of water likely to be applied, mm	90	90	110	130

cultural policy, technical, market and other factors (but excluding climate change), they predict a minor increase in the area farmers wish to irrigate but a larger increase in the volume of water required. The most likely prediction for growth in volumetric demand is 1.7% per annum from 1996-2001 and 1% per annum from 2001 to 2021 for the "dry year". The breakdown by EA Region is shown in *Table 6*.

This equates to a requirement of 237 Mm^3 per year with a range of 168 - 341. Farmers require guaranteed supplies in drought years to avoid the current stop go system.

But how much water do farmers want? This is another question which farmers are asked in the survey. Again the purist may argue about the validity of the question but it does provide a users perspective and is as useful as any other method! The figures are shown in *Table 7*.

Although the area that would be irrigated varies from survey to survey the volume of water required is considerably higher than expected and is increasing. Farmers are also expecting to apply a larger depth of water per unit area. A further aspect of this data is the use of the 5th driest year for planning purposes. This is regarded as the normal design figure for optimum economic returns. Where high value crops are grown on long term contracts it may be prudent to make the driest year in 20 the "planning year" for farm irrigation design purposes, and definitely for water storage purposes.

Climate change

None of the forecasts take into account climate change. The general consensus indicates that by 2021 the average temperature rise in the irrigation season April - September will be 1.1°C (Herrington, 1996). The number of rainy days will increase but soil moisture deficits in summer will increase by between 10 and 50% depending on radiation, wind speed and humidity changes. With this scenario for Anglian region, EA *(Table 6)* where forecasts indicate a 60% rise in the volume of irrigation water required between 1990 and 2021, climate change is likely to increase this by a further 45-50%. These, taken together, will mean a severe burden on water resources, a loss of potential farm income and an increase in imports.

The future

In summary, the crops most irrigated are potatoes, field scale vegetables and sugar beet; and with quality dictating what growers can sell, there will be growth in the irrigation of potatoes and vegetables. With the market requirements and business implications, farmers need to be in control of their own water resource and a further increase in farm reservoirs and storage of winter water is likely. On the equipment side, more precision is needed and the use of trickle systems, overhead booms and fixed close spaced sprinklers are likely to gain ground. With climate change, not only will more irrigation be needed for existing crops with those farmers currently not irrigating being forced to irrigate to sell their crops but also it is likely that a wider range of crops will be grown and many of these will need irrigation at some time during development.

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Landscape management courses take root at SAC

The extensive facilities for horticultural education and training at SAC's Auchincruive campus, near Ayr, will prove a major asset for students attending the new courses on landscape management which started in October. Increased demand for staff, trained and qualified in landscaping skills, is coming from various sectors of the industry, including local authority leisure or environmental services departments, landscape and environmental consultancies, landscape construction companies and independent bodies, such as the National Trust and conservation organisations.

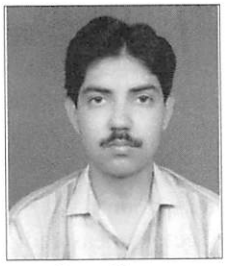
The landscape management courses, which can be studied at progressive levels from Higher National Certificate to BSc Honours, use the distinctive combination of expertise within SAC to explore the interfaces between landscape management, horticulture, environmental science, and landscape design in rural and designed landscapes. The courses examine the biological and physical interactions underlying landscapes and explore social and cultural bonds with the landscape.

Career opportunities are likely to be enhanced by SAC's strong links with the national and international landscape and horticultural industries who employ landscape design technicians, landscape managers and supervisors, landscape contracts managers, project managers, lecturers and landscape architects.

Contact: **Dr Richard Jefferies, Landscape Management Course Tutor, Horticulture Department, SAC Auchincruive, Ayr KA6 5HW Tel: 01292 525311**

Performance of Chinese raingun PY_1-20 in wind

Azhar Ahmad Shauq



Abstract

The Chinese raingun PY_1-20 was installed and tested at the NARC High Efficiency Irrigation Systems Site, Islamabad. The pump was driven by a 5 kW diesel engine mounted on a portable trolley. The head of raingun can be manufactured for the use on lateral sprinkler irrigation systems. Various irrigation parameters such as pressure, discharge, diameter and area of coverage, wind speed, and uniformity of distribution were measured. High wind speeds adversely affected uniformity which is important to efficiency, yield and economics. The evaluation of parameters relating to the raingun show that the system is effective for irrigation practices, with less wind sensitivity at lower pump pressures and most even water distribution at wind speeds of not more than 8 km/h.

Introduction

Irrigation systems are often designed without due consideration to the adverse effects of wind speed on overall performance. In ordinary circumstances, when the sprinkler system is not in use on the soil and crops, hot dry winds may also occasionally have beneficial effects. Arnon (1972) reported that moderate winds may enhance photosynthesis by continuously replacing the carbon dioxide absorbed by the leaf surfaces. It has been found that photosynthetic efficiencies improved with increasing wind speed. The favourable effect of wind on photosynthesis was most marked at the lower leaf layers. Wind also affects growth mechanically and physiologically. The physiological effect of winds consists mainly of increasing transpiration as well as evaporation from the soil. That is the reason why many crops in rainfed areas are planted with some moisture in the soil, if there is no rain to alleviate the soil moisture deficits. In desert areas and arid regions, the water available for irrigation is limited so the irrigation system must apply water efficiently.

The raingun distributes the water in rain-like droplets over the land surface in a circular manner. The head of the Chinese raingun PY_1-20 can be manufactured for use with lateral sprinkler irrigation systems as well as for raingun irrigation systems. The term 'raingun' is used to describe them because of the large size of nozzle used and its ability to throw substantial quantities of water over large areas. Usually, this system is designed to supply the irrigation requirements of the whole farm. The objective of this study was to find out the effectiveness of this system for irrigation practices on the surface of the soil by evaluation of different parameters. The effect of wind speed on area of coverage and uniformity of distribution was examined at different discharge pressures.

Materials and methods

As rainguns are a type of lateral sprinkler irrigation system, it was possible to evaluate this equipment using techniques already developed for that type of system. A 5 kW diesel engine, mounted on a portable hand move trolley, was equipped with a high pressure, multistage pump with six impellers and located at the well of the NARC High Efficiency Irrigation Systems Site. A 6.09 m reinforced rubber suction pipe with foot valve dipped into the well to deliver the water to the supply line. A 51 mm rubber pipe from the pump to the field outlet was used to supply the water to the raingun. Male and female couplers were used to connect different length of pipes laid on the soil. The system was water tight when the pipes were under pressure and the component parts were easily disconnected.

The head of the raingun with tripod and pegs was 1.3 m above ground level. The PY_1-20 raingun has two nozzles of 7 mm and 4 mm diameter opposite each other, the trajectory angle of the larger nozzle being 30 degrees and that of the smaller nozzle being 15 degrees. A pressure gauge was fixed to the delivery side of the pump. The raingun discharged jets of water in the air, the head being rotated in a start and stop manner as a spring loaded arm strikes and then rebounds from one of the jets. The spring in the head of the raingun returns the arm to strike the jet again and again and the process is repeated. It has fixed diameter nozzles, the discharge being proportional to the square root of the operating pressure. Operating pressure and nozzle geometry (size, outlet cross-section and trajectory angle) are the primary factors that influence the operation of the sprinklers. The PY_1-20 raingun completed its circle in 62 seconds.

For the evaluation of the effect of wind speed on uniformity of water distribution, four quadrants were laid out with the help of the magnetic compass needle. The direction of the quadrants

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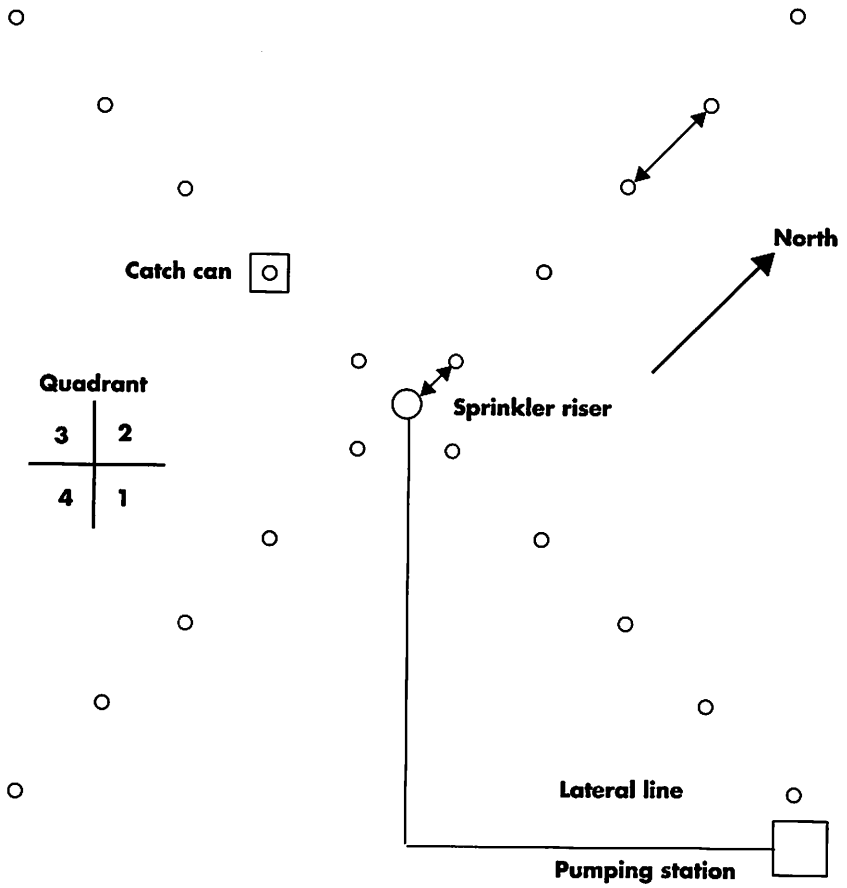

Fig. 1 Layout of catch containers for testing the evaluation parameters of the raingun.

Table 1 Raingun mean performance characteristics over a range of wind speeds.

Pressure, bar	*Discharge, l/s*	*Av. wind speed, km/h*	*Effective radius, m*	*Coverage area, m^2*	*Christiansen's coefficient, %*
2.1	1.05	8.0	15	707	87.3
2.8	1.25	8.1	17	908	80.1
3.5	1.53	8.0	17	908	80.2
4.2	1.72	10.8	19	1134	75.3
4.9	1.96	9.0	17	908	73.8

were North-South and East-West as shown in *Figure 1*. Fourteen catch cans were set in each of the quadrants, fifty six catch cans in all. The first catch can was placed one metre from the centre of the raingun and thereafter at two metre intervals. Each catch can was set in an upright position with its top parallel to the ground and surrounding vegetation was removed from all sides of the catch can. The water volume in each catch can was measured with the help of a graduated cylinder.

Coefficient of uniformity

The function of sprinklers is to distribute water uniformly over the land without runoff and excessive drainage (i.e. deep percolation) from the root zone. Christiansen's coefficient of uniformity was adopted for the assessment of the uniform distribution of water over the field because it is more related to the average depth in the lower half of the spread pattern than alternative procedures.

The irrigation system was operated for two hourly periods at 2.1, 2.8, 3.5, 4.2 and 4.8 bar of pressure head. Four sets of data were collected at each pressure head. The amount of water caught in each collector was measured and Christiansen's coefficient of uniformity was calculated by the formula:

$Cu = (1-\Sigma|x_i-x_m|/nx_m)100$

where:

Cu = Christiansen's coefficient of uniformity in per cent

x_i = individual collector amount (deviation from the mean)

x_m = mean collector amount

n = number of collectors measured.

Merriam and Keller stated that three factors cause a loss of water between the sprinkler and the collectors or catch cans:

1. evaporation
2. drift of droplets out of the sample area
3. splash loss from collector cans.

A significant wind would increase all three types of losses. In testing the different parameters for the raingun, no water was assumed lost due to the factors explained above.

Results and discussion

The raingun mean performance characteristics over a range of wind speeds are presented in *Table 1*.

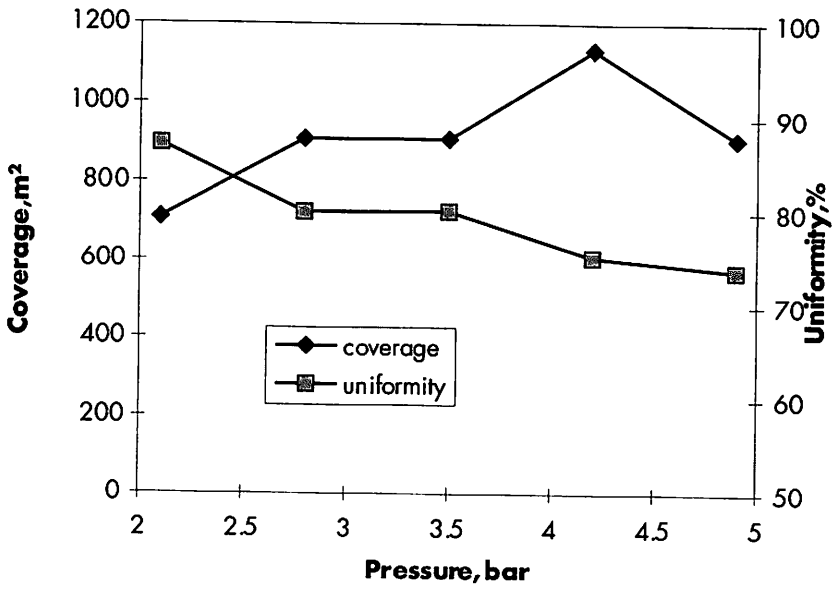

Fig. 2 Mean coverage and uniformity for the raingun over a range of wind speeds.

Discharge

For a multi nozzled raingun, the discharge is the sum of both the nozzle outlets. The discharge of the PY_1-20 raingun was directly proportional to the pressure head *(Table 1)*.

Coverage and uniformity

The effective radius of coverage in *Table 1* is for that part of the wetted area within which acceptable uniformity of water distribution was obtained. Outside the effective radius, overlapping of the sprinkler wetted areas is necessary to provide uniform application. The coefficient of uniformity values for the low pressure of 2.1 bar was consistently higher than at the other settings *(Figure 2)*. At this pressure, the coefficient of uniformity was 87.3% and the area of coverage was 707 m^2. The coefficient of uniformity values at a pressure of 2.8 bar and 3.5 bar were 80.1% and 80.2%, respectively, and the area of coverage for both settings was 908 m^2. Increasing the pressure from 2.1 to 3.5 bar normally increased the water applied as smaller droplets, and decreased the coefficient of uniformity because of greater sensitivity to wind drift.

The coefficient of uniformity values at a pressure of 4.2 bar was consistently higher than those for higher pressure 4.9 bar. The coefficient of uniformity value at 4.2 bar was 75.3% and the area of coverage was 1134 m^2, while the coefficient of uniformity value at 4.9 bar was 73.8% and the area of coverage was 908 m^2. Greater pressure increases the initial velocity of the drops, resulting an increased distance of flight, as shown by the enlarged area of coverage for this particular raingun when pressure was raised from 2.1 bar to 4.2 bar. When this system was operated at extremely high pressures (i.e. at 4.9 bar), the greater proportion of small droplets usually fell closer to the sprinkler. This is the reason why the values of the coefficient of uniformity and the area of coverage both decreased at this pressure.

Effect of wind speed

The effect of wind speed on the maximum radii of throw were investigated for each pressure setting of the raingun *(Figure 3 a - e)*. This figure shows the maximum predicted upwind, downwind and crosswind radii for each of the wind speeds in the test. For this system, cover-

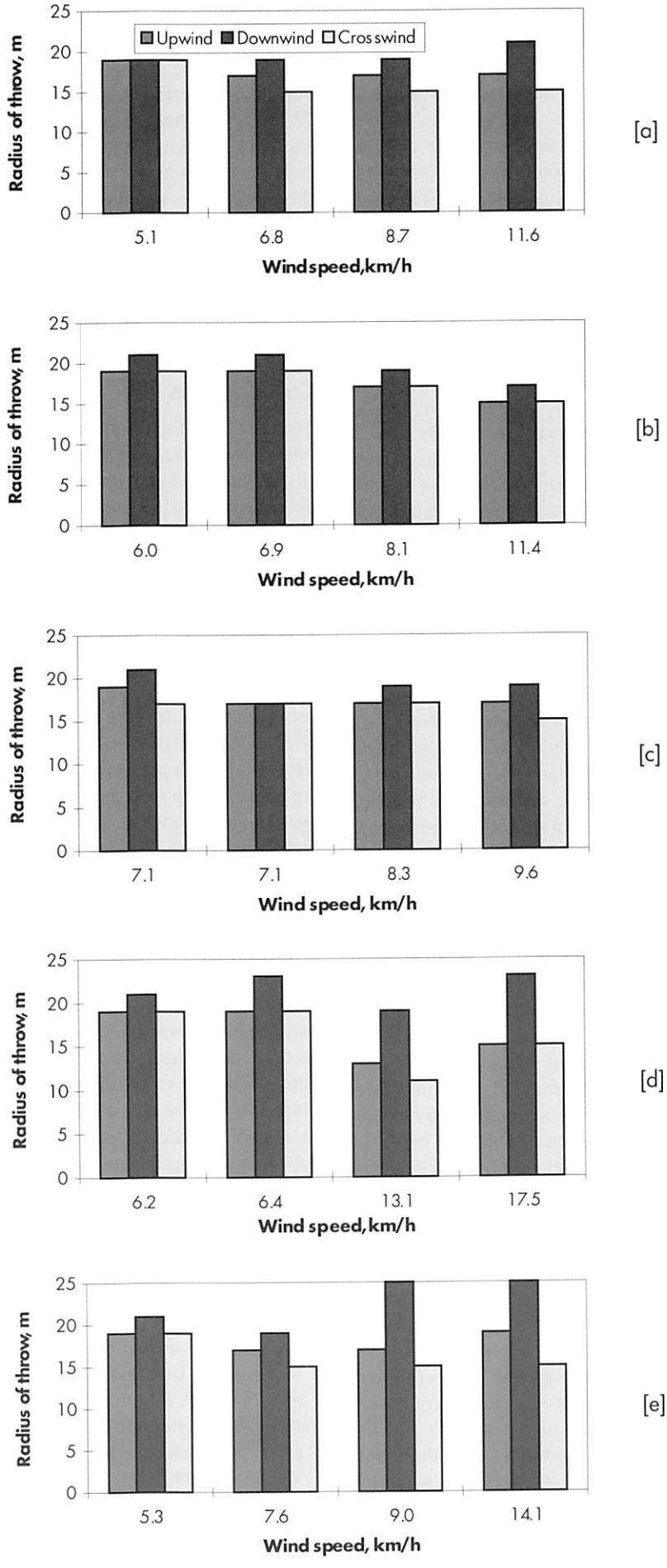

Fig. 3 a-e Effect of wind speed on maximum throw radii of the raingun at pressures of 2.1, 2.8, 3.5, 4.2, and 4.9 bar, respectively.

age radii at each wind speed were less affected by crosswinds than those either upwind or downwind. The value of the coefficient of uniformity is also higher at this point. This data refers only to the maximum radii and not to the distribution of water along the radii, whilst the coefficients of uniformity in *Table 1* are those for the effective radii where acceptable uniformity is obtained. In *Figure 3 a - e*, the remaining portion of the wetted area between the effective radius and the maximum radius of throw needs some overlapping to achieve satisfactory uniformity of distribution. Nozzle shape and opening size which were fixed in the case of the PY_1-20 usually do not affect distribution patterns as much as operating pressure, and distance of throw rose as pressure was increased. Nozzle angles of 30 degrees and 15 degrees depended on wind speed and the height of the sprinkler relative to crop height.

The wind direction for most of the test was from the north. A slight increase in the wind speed caused a reduction in the value of the coefficient of uniformity for the area on the north side. In the PY_1-20 raingun, the rotation mechanism breaks the jet from the larger nozzle and an area of greater depth was observed near the raingun head. An area of medium or consistent water depth was noted near the centre of distribution, whilst an area of lesser depth was found near the end of distribution. Most researchers agree that the coefficient of uniformity decreases as wind speed increases (Vories & Van Bernuth, 1980) and these test results were no exception. The reason is that pressure increased the initial velocity of the drops, resulting an increased distance of flight. Droplet size is an important factor affecting the formation of seals on bare soil surfaces. Droplet size is especially important when PY_1-20 rainguns operate in wind. Low pressure in this system produced a larger diameter of drop. Distribution consisting of more large drops should result in more consistent coefficient of uniformity values over a range of wind speeds. The wind speeds of greater than 8 km/h decrease the value of the coefficient of uniformity and area of coverage. High pressure in the PY_1-20 increased the proportion of small drops and the sensitivity to wind drift. A slight increase in wind speed greatly affected the value of the coefficient of uniformity. When wind speed was 11.6 km/h at 2.1 bar, the value of the coefficient of uniformity was 77.1% and at the same pressure when wind speed was 5.1 km/h the value of the coefficient of uniformity was 89.3%. At the high pressure of 4.2 bar, when wind speed was 17.5 km/h, the value of the coefficient of uniformity was 72.7%. At the same pressure when wind speed was 6.4 km/h, the value of the coefficient of uniformity was 81.0%. When this system was operated at 4.9 bar and wind speed was 9.0 km/h, the value of the coefficient of uniformity was 84.0% and at the same pressure when wind speed was 14.1 km/h, the value of the coefficient of uniformity was 69.9%.

Conclusions

The data from this study indicates that a lower pressure head will lead to less sensitivity to the wind and most even water distribution at wind speeds of not more than 8 km/h. When the Chinese raingun PY_1-20 is operated at low to medium pressure from 2.1 to 3.5 bar, the results are best for typical field crops having medium root depths in medium textured soil. When this system is operated at high pressures of 4.2 and 4.9 bar, the value of the coefficient of uniformity decreases due to effect of wind on the smaller size of droplets. These high pressure characteristics are best for deep rooted orchard and forage crop growing where the water requirement is substantial. When this system is operated at the highest pressure of 4.9 bar, it produced some fog or mist which is greatly affected by wind. In deserts areas in which no precipitation may occur for several consecutive years, however, some species of vegetation derive their water requirement from fogs or mist. In the test, accurate estimates of droplet size distribution and relative volumes of water required more research work. Different designs of replaceable nozzles could be developed to improve uniformity and jet break up.

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IPD Forestry Index sponsored by Savills

In 1996, an investment in forestry would have served you better than one in commercial property or gilts. That was the message delivered by the fourth Investment Property Databank (IPD) Forestry Index, launched recently by Bridget Bloom, Forestry Commissioner, and presented by Ian Cullen, Joint Managing Director of IPD.

Launching the Index at the City of London office of Savills, Miss Bloom spoke of the Commission's backing for the Index and the role it plays in encouraging a market in forestry. "Investors must be able to commit themselves (to forestry) with confidence and the Index allows investment decisions to be based on good information, which shows that forestry can be a useful and profitable part of an investment portfolio."

This view was supported by Savills, the co-sponsors of the Index. Richard Stirling-Aird, one of the directors, underlined the optimism for future prospects saying: "The strong performance of forestry in 1994 and 1995 has continued through 1996 by showing an 11.4 per cent return. Although below the returns achieved by let land, equities and property shares, forestry surpassed the returns on commercial property and gilts. Over the last three years, nominal returns have averaged 9.9 per cent a year, equating to a real return of 6.8 per cent per annum."

Further evidence of the strength of the forestry market came from figures for the south of Scotland which achieved a return of 18.2 per cent, reflecting demand in the region where private sector planting in the 1960's and 1970's had led to more mature plantations. This connection between the private sector and the Commission was also highlighted by Miss Bloom who said: "Within 10 to 15 years, private forests will become the most important domestic source of timber, overtaking the Commission. This is something we have worked towards for many years and will continue to do so."

Miss Bloom also reassured the audience that the Government was committed to a strong private forestry industry.

Barry Gamble of Fountain Forestry said that the Index captured only some of

the benefits forestry investment could provide. "As well as the underlying rate of return," he said, "private investors can benefit from tax-free income, Capital Gains Tax and Inheritance Tax advantages. Pension funds may find the tax-free income from forestry investment more attractive following the abolition of tax credits on share dividend payments."

Summing up the mood of the launch, Bridget Bloom said: "I am pleased that we continue to see very significant investment taking place. This is a strong note of confidence in the future of our industry."

First UK centre for environmental water management

Wales' largest public company, Hyder, has joined with Cardiff University to create Britain's first research group in Environmental Water Management. Through its engineering and environmental consultancy, Hyder Consulting, and its water utility Dwr Cymru Welsh Water, Hyder is sponsoring the first-ever academic Chair in Environmental Water Management for an initial three years. Roger Falconer, formerly Professor of Water Engineering and Head of the Department of Civil Engineering at Bradford University, has been appointed to the Chair.

Graham Hawker, Hyder Group Chief Executive said: "This is an exciting and significant opportunity, which will bring together the tremendous expertise of Professor Falconer with Hyder's world-wide track record on water and environmental projects. We are also delighted that the first Chair in Environmental Water Management should be based in Wales."

Located in the University's School of Engineering, Professor Falconer will lead a team of two academic staff and, initially, ten PhD research assistants and students to work on a number of key environmental water management problems. He is acknowledged as one of the world's experts on designing computer models to predict the likely effects that urbanisation and industry has on the quality of water in rivers, estuaries and reservoirs. "The human race is producing vast amounts of waste, a great deal of which eventually drains into our rivers and seas. My concern is to manage this output and to prevent widespread and long-term pollution," said Professor Falconer.

He has been responsible for designing a hydraulic computer model, known as DIVAST (Depth Integrated Velocities and Solute Transport). Taking into consideration such pollutants as sewage, heavy metals, thermal discharges and industrial waste, the computer model forecasts whether these elements will be harmlessly dispersed or will accumulate and pollute the local aquatic environment. Used in more than 80 commercial and industrial projects world-wide, the award-winning DIVAST is based on a two-dimensional map of a given coastal or estuarine location, divided into a dense grid of cells.

Within Wales, Professor Falconer has used computer modelling for projects concerning tidal currents and sediment transport in the Severn Estuary; water quality of the River Dee; tidal flow for the development of Barmouth Harbour; and an impact study of the Cardiff Bay Barrage. His new appointment will enable him to develop and refine a wider range of computer models to enable water engineers, scientists and planners to address a wide range of environmental water management problems. These include:

- coastal, estuarine and river water quality
- coastal erosion and estuarine geomorphological processes
- water quality of lakes and reservoirs
- management of rivers, floodplains and wetlands
- real time flood forecasting in rivers and estuaries
- optimising the design and operation of water treatment works
- design and operation of combined storm water overflows
- risk analysis and assessment software development for decision making
- modelling disinfection processes to minimise health risks.

Understanding the European Union

The European Commission has launched a promotion designed to bring about a better understanding of the European Union among its citizens. High on its list of priority information sources is agriculture. Focusing on key publications produced by EUR-OP, the official publishing outlet of the Union, the information programme aims to show how easy it is to obtain factual detail about what is happening in European agriculture today and how the EU is developing.

EUR-OP publishes a large volume of official material every year, ranging from legislation which structures the progress of the EU to specific publications on topics such as the environment and consumer rights. Even though publications are distributed through sales agents in all EU countries, they are not widely used outside official circles. In order to let business, educational establishments and the general population know more of what exists in the work of EUR-OP - and how it can be of benefit - the promotion will focus on key publications in a number of thematic sectors.

The campaign features advertising in trade and specialist journals, complemented by mailings to organizations supporting the main target sectors. The focus on specific themes - environment, education, consumer affairs and tourism - as well as the better known areas of EU activity such as law and monetary union, means that the campaign can be structured to deliver information to those who need it without the danger of overload. Ease of access is also a key element of the promotion and, to help in this respect, the EUR-OP World Wide Web site has been extended to allow examination of the publications and on-line ordering.

"It's a central function of EUR-OP to ensure that everyone has access to the information they need to understand fully how Europe is developing," explained EUR-OP Director-General, Lucien Emringer, "and we are actively spreading information about our publications so that we can help increase knowledge. This latest campaign is exciting because it comes at a time when the need for EU information is at a peak and also because we have been able to harness the latest technologies to offer our work to the widest possible audience."

If the extended Web site proves popular, it will become a permanent feature of EUR-OP information services. Bringing the facts directly to the people in this way is seen as a big step towards increasing understanding and knowledge.

The EUR-OP Web site can be found at **http://europa.eu.int/en/lcomm/opoce/keypub.htm**

Tractor-based systems for traffic control in Australia

Jeff N Tullberg

Introduction

The large tractor is the basis of modern agricultural systems where mechanical power is used to enhance the productivity of people, crops and soil. There are, however, some major problems: evidence provided here demonstrates that a large proportion of tractor power is used to undo the damage done by the tractor itself, and that we rarely succeed in undoing all that damage. A colleague recently said it all when insisting that we had to use a bigger tractor for a particular experiment, because the smaller unit couldn't pull the subsoiler!

In this paper, I will be looking at the impact of traction on tillage and vice versa, in terms of soil, crop and economic outcomes. Before doing this, I will briefly outline the environment and cropping system of northern Australian, where controlled traffic is being practised by a number of growers using relatively conventional equipment. I will end by speculating on the relevance of Australian results to the UK farming system.

This paper was presented at the IAgrE conference entitled: "Profit through Traffic Control?", organised by the Soil & Water Management Specialist Group and held at Silsoe College, Cranfield University on 20th November 1996. ***Dr Jeff Tullberg FIAgrE is Head of the Farm Mechanisation Centre in the Department of Plant Production, University of Queensland, Gatton College, Lawes, Queensland 4343, Australia.***

Grain production in northern Australia

The areas I am concerned with are in the sub-tropics, close to the east coast of Australia, scattered from about 300 km south to 700 km north of Brisbane, and between 150 and 350 km inland. The total cropping area is about 2 Mha, of which the Darling Downs is probably the best known. The predominant soil type is a deep black heavy clay which has high natural fertility and water storage capacity, and is self mulching. Major characteristics of this environment can be summarised in terms of:

- rainfall ~ 700 mm/yr, summer-dominant, highly variable, often high intensity (> 100 mm/h)
- severe water erosion unless soil is protected by crop or residue, and/or contour banks
- evaporation ~ 1600 mm/yr, crops moisture-limited, mean dryland yield ~ 2 t/ha
- 'broadacre' farms ~800 ha, large tractors ~160 kW, wide trailed implements ~10 m
- 'opportunity cropping', i.e. planting whenever moisture is adequate
- 'conservation', i.e. non-inverting tine or sweep tillage with no mouldboard ploughs
- zero tillage optimal in theory, but difficult/expensive to achieve in practice.

Furrow irrigated row cropping scattered amongst the dryland has a major focus upon cotton, grown on a 1 m row spacing. These irrigators were the first to see the advantages of controlled traffic in 'permanent bed' reduced tillage systems, and already had equipment with a wheel spacing in multiples of 2 m.

Traction and tillage

Traction, or the development of thrust from wheels or tracks, is not a very efficient process. It is inefficient because soil deforms in response to tyre forces, until it has compacted enough to resist that force. Tractive efficiency is the ratio of power available at the drawbar to power input to the wheels. Optimum tractive efficiency means maximum tractive performance.

Tractive efficiency of 4WD tractors ranges from approximately 70% on tilled

The author, with a tractor modified for controlled traffic (3 m track width).

soil, to 80% on firm soil, and it is difficult and expensive to improve on this. In our conditions, for all practical purposes, a tractive efficiency of about 75% can be expected in operations such as tillage and planting. In other words, about one quarter of tractor power is used to deform trafficked soil 30-50 mm downward and about the same distance backwards.

Planting and tillage operations occur after rainfall, starting as soon as soil is traffickable. The surface 20 mm is often quite dry, but soil within and beneath the tilled layer is at a moisture content just below field capacity, and within the 'plastic' moisture content range. At the dry surface, traffic produces a brittle grinding/powdering action. Walsh (1994) has demonstrated deformation further down in the profile, where the action is one of shearing and densification.

The major effect of traffic is a large reduction in porosity and a small increase in density. The area damaged is proportional to tyre width/implement width ratio. Surface damage is proportional to tyre pressure, and sub-surface damage to total axle load.

Tillage or planting operations loosen the surface soil, so the implement hides the surface and sub-surface wheeltrack effects very efficiently. We only identify a 'compaction' problem in the sub-tillage zone because it's not practical to operate at sufficient depth to remove all of the wheeltrack effect. It is easy to forget that most soil 'compaction' occurs in the tilled layer and is broken up immediately by the implement. The lines of cloddy soil behind the tractor wheels demonstrate that tillage isn't only a soil loosening operation.

A visible 'tillage pan', or smear effect at tillage depth convinces some people that the implement is the problem. This seems unlikely when implement weight/ unit width is about 5 kN/m, or 10% of the weight per unit width on tyres. Implements can emphasise compaction effects by their tendency to return to the same depth, and trailed implements also cause some compaction with their wheels. These usually carry less than 10 kN, so the damage is small, but their rolling resistance can represent a significant proportion of implement power requirement.

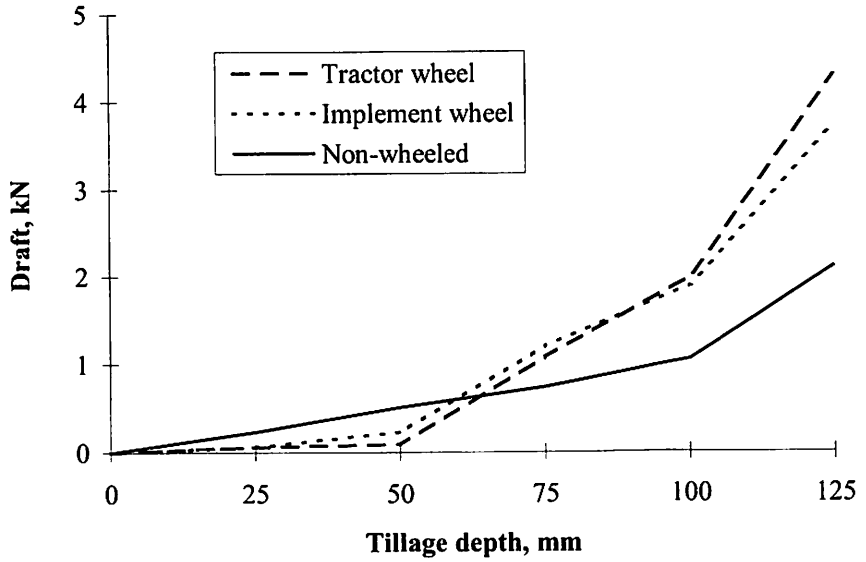


Fig. 1 Wheeling effects on the variation of tine draft with tillage depth in medium clay, moisture content 23% (0 - 100 mm) and 27% (100 - 200 mm).

Tractors and implements are always used together, but their performance is normally assessed independently. Only recently have we started making measurements of the impact of tractor wheel effects on tillage implement energy requirement, using a 3 point linkage unit which allows direct comparison of the draft of 'wheeltrack tines' - operating in the tractor wheeltracks - with the draft of identical 'control' tines, operating at the same depth, but well outside the wheeltrack (Tullberg and Luhrs, 1994).

At very shallow tillage depths, the draft of the wheeltrack tine is less than that of control tines, because of the wheeltrack depression (i.e. wheel rut). At normal tillage depths (~100 mm), the wheeltrack effect can more than double tine draft, and when tines operate at depths >150 mm, the increased draft can be very substantial. Broadly similar effects have been observed with 450 mm sweeps and 50 mm chisels.

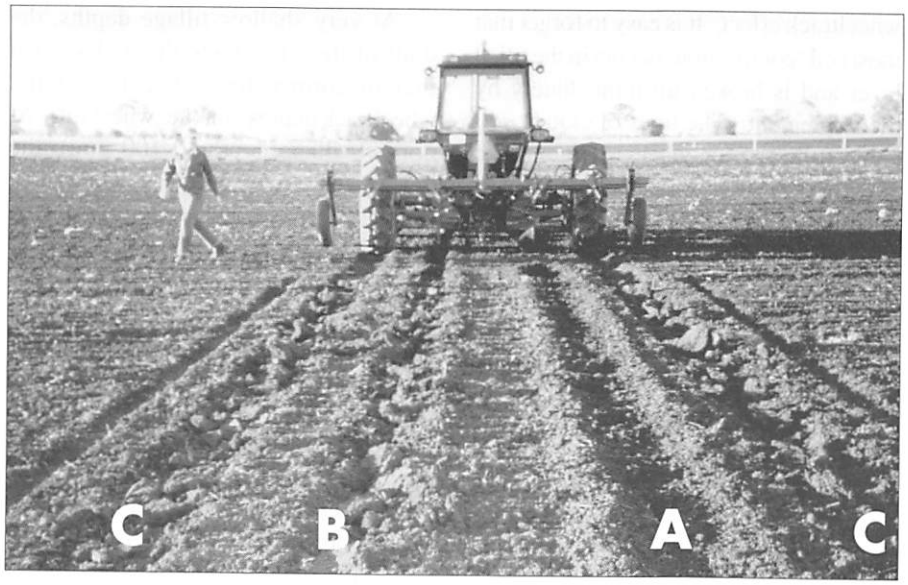
This draft increase effect has been found in soils at normal tillage/planting moisture content, with or without prior tillage. Under dry conditions, the wheeltrack effect on tine draft is small until depth is sufficient to disturb moist soil. Most of our results have been taken in the wheeltrack of a 70 kW 2WD tractor with static rear weight of 55 kN on 16.9R x 38 tyres at 180 kPa pressure. Similar results have been found at shallow depth behind a 10 x 16 implement tyre with a vertical load of 10 kN. These are illustrated in *Figure 1*.

Our results suggest that the best approximation of tractor wheeltrack effects in our conditions is an increase in the draft of wheeltrack tines by a factor of two. At greater tillage depths, the additional tine draft has never exceeded the rolling resistance of the tyres ahead of the tines.

Data from earlier work on tractor performance and reliability can be used to assess the significance of this wheeltrack energy effect. The survey showed, for instance, that the average 'broadacre' 4WD tractor of 160 kW available power was delivering 120 kW to its axles, of which 90 kW was transmitted to the implement. The tractor was moving at 7.2 km/h, its mass of 13.0 tonnes carried on dual tyres wheeling a 1.8 m strip. The typical implement was a 9 m chisel plough requiring 45 kN pull (5 kN/m), with a mass of about 5 tonnes, itself wheeling a 1.2 m strip.

If we look carefully at this situation, in terms of where the power is going, our data indicates that the specific draft required for chisel tillage of non-compacted soil would be only 3.3 kN/m, which is 30 kN for the whole 9 m implement. If we could eliminate traffic effects on the implement, we would need only two thirds of the power to do exactly the same tillage job.

This would represent a drawbar power of 60 kW, not the 90 kW measured.



Effect of sweep tillage (100 mm nominal depth) on: A) non-trafficked soil; B) soil trafficked by implement wheel; and C) soil trafficked by tractor wheel. The additional cloddiness of trafficked soil is very clear in this photograph taken late in the day with low sun.

One third of implement input power, or 30 kW, is used to no good purpose re-loosening the wheeltracks. But these same wheeltracks have already absorbed a 'tractive inefficiency' of 30 kW from the tractor, so the total power input to making and breaking up wheeltracks is 60 kW. Summarising these wheeltrack energy penalties:

- prior wheeling doubled the draft on a 3 m strip, increasing pull by 10 kN, requiring 20 kW
- rolling resistance of the 5 tonne chisel plough frame would exceed 5 kN, requiring 10 kW
- tractive inefficiency of 25 % represents the loss of an additional 30 kW.

These figures are based on some approximations, and they have been rounded to keep the argument simple. It is nevertheless broadly true that *half* the power delivered to a tractor's wheels is wasted in compacting and decompacting wheeltracks. The bad news becomes worse when we remember that our 'broadacre' tillage doesn't remove deeper compaction, and re-loosening of compacted surface soil is unlikely to provide an optimal seed bed.

The good news is that given effective control of field traffic, we can achieve the same work rate doing the same job, with a tractor of half the size. This represents a major economy, which gets even better when we consider the reduction in tillage depth and intensity that could occur in the absence of wheeltrack effects.

Soil compaction

Tillage implements do an efficient job of removing compaction effects in the tillage layer, but when we see compaction, it is in the sub-tillage layer, and people observe symptoms like 'right angle root disease' in susceptible crops. There is, however, a much more important effect of compaction that cannot be seen easily by farmers: this is the reduction in infiltration and increase in runoff from wheeled soil.

We have been monitoring this effect in the trial at Gatton over the past three years, in an experiment designed to measure tillage system (tillage v. zero tillage) and traffic (one working tractor pass/year over complete area v. controlled traffic) effects on runoff and crop performance. The major effects are illustrated in *Table 1*, and these results are consistent with mean yield and soil water storage data from research at other sites in Queensland. (see Yule and Tullberg, 1995).

Options for reducing compaction depend on reducing ground pressure, reducing trafficked area, or avoiding operation on wet soil. Each option has major problems. Crop operations must be carried out at the right time, and farming equipment is too heavy to carry on hovercraft, but the costs and consequences of random traffic are excessive. Controlled traffic, or the use of permanent traffic lanes, becomes the best option, and a substantial number of Queensland farmers appear to share this view.

Adoption — Queensland and UK

The Central Queensland Soil Compaction Project has an extension component which now involves about 35 growers, cropping 300 ha to 4000 ha. Many have aged 'giant' tractors which they don't want to replace. Several have found their efforts to reduce tillage defeated by tractor wheeltracks. Most have had to change their operating pattern from 'round and round' to 'to an fro', and now realise the value of tramlines for field guidance. Partial controlled traffic - ignoring harvester wheeltracks - is the most common option.

These early adopters all understand the potential benefits of reduced energy input and increased rainfall infiltration/ soil moisture storage. The specific advantage all would claim is improved frequency of cropping, in terms of the ability to plant another crop as soon as soil moisture is available, without delay for surface-leveling tillage, and taking advantage of the better trafficability of permanent wheeltracks. We have also seen some really innovative developments

Table 1 Tillage/traffic effects on runoff (from 1354 mm rain in two years) and crop yield.

Traffic system	*Runoff, mm*		*Crop yield, t/ha*		
	Conventional tillage	*Zero tillage*	*Wheat 1994*	*Sorghum 1995*	*Maize 1996*
Wheeled	322	282	1.23	5.25	6.48
Controlled traffic	266	166	1.51	5.51	7.45

All differences between wheeled and controlled traffic treatments are significant @ P<0.01)

such as the use of a simple, conventional planter in a zero till situation, by using the improved precision of controlled traffic to plant between the rows of residue from the previous crop.

These farmers are convinced of the merits of controlled traffic, and most will improve the degree of control as they standardise wheel spacing when replacing equipment. All hope to buy a smaller tractor next time round. I have no doubt that they are finding real advantages, but the information is all anecdotal at the present time, and there are no hard data on yield improvement in the farm situation.

How might this apply in the UK? Much of the basic research underlying controlled traffic was carried out in the UK, but climate, soils, cropping systems and pressures on the farm business are all totally different from north-east Australia. The essential advantages of controlled traffic - reduced energy input and improved soil structure - are equally important in all parts of the world, but the problems of sustainability are less stark in the well-developed agricultural systems of Europe. Crop residue is also a totally different issue in these two environments.

The major lesson I have learnt is that the early-adopting farmers can see the benefits, and are interested to try controlled traffic, provided we don't make it too difficult. Much better to accept partial and imperfect controlled traffic to start with, and let them decide to spend more money to improve it. In this respect UK and Australian farmers are probably very similar!

Conclusion

The need for more conservative cropping practices is clear in recently developed areas such as north-east Australia, where inappropriate farming systems have produced soil degradation on a large and obvious scale. The contribution of field traffic to this problem is only now being recognized. These problems will be less acute in the UK environment, but the impact of field traffic is probably greater in more intensive production systems.

Current random traffic cropping systems waste energy, money and good soil structure in the continuing conflict between the requirements of traffic and crop production. Controlled traffic will enhance the economic and environmental sustainability of agriculture, by facilitating the management of permanent crop zones for optimum crop production, and compacted laneways for traffic and runoff control.

Acknowledgement

This work was supported by the Australian Centre for International Agricultural Research, as part of project 9209: 'Conservation/Zone Tillage for Dryland Farming'.

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Towards another merger

When the proposed merger was announced earlier this year between the Institution of Electronics and Electrical Incorporated Engineers (IEEIE) and the Institution of Mechanical Incorporated Engineers (IMechIE) to form the Institution of Incorporated Engineers in electronic, electrical and mechanical engineering (IEE), the Council of the Institute of Engineers & Technicians (IET) approached IEEIE and IMechIE. Their respective Councils welcomed the suggestion that IET should become a founder member of the new Institution when it comes into being on 1 April 1998.

Now IET's Council has agreed the fine details of the merger and will invite a vote of their members, the results to be announced at an EGM to be held early in December. (The membership of IEEIE and IMechIE have already ratified their Councils' recommendation to merge.)

If IET members approve their Council's recommendation, the new body will have some 38,000 members and as such will be the largest for Incorporated Engineers and Engineering Technicians and the fourth largest of the 39 nominated bodies of the Engineering Council.

IET will be 50 years old in April 1998. Dr Tony Deeson, the General Secretary, said: "Over these years, it has served the needs and interests of its members but these needs are growing more and more complex and it is becoming increasingly difficult to give members the quality and quantity of support to which they are entitled. The new grouping, to which we hope our members will vote 'yes', will give our Incorporated Engineers and Engineering Technicians strong and effective representation in professional and educational matters previously never enjoyed. I hope the route our Council has taken will encourage other institutions to think on similar lines."

Branch diary

Scottish Branch

Wednesday, 28th January at 7.30pm
Royal Hotel, Bridge of Allan
Members' Night
Various members will speak on a selection of topics after a bar meal

Wednesday, 18th February at 10am
Stakis Hotel, Dundee
Annual Conference
Potato planting, harvesting, handling and storage
Followed, at 4.30 pm, by
Branch Annual General Meeting
Hon Sec: Gwilym Owen Tel: 01968 675943

South East Midlands Branch

Monday, 2nd February at 7.30pm
Silsoe Research Institute, Conference Room
Machinery Selection & Performance
Machinery Planning and Replacement
by John Bailey, ADAS
True Cost of Owning Farm Machinery
by John Jinks

Monday, 23rd February 4.00-5.30pm
Hayters Ltd
(Technical Visit - Bishops Stortford)
Contact Secretary by 22nd January, giving name and company affiliation

Monday, 2nd March at 7.00pm
Silsoe College, Dining Room
AGM
Engineering & Supply Challenges for Vegetable Producers
by Jeremy Harwood
Technical Director G's Marketing
Hon Sec: D Pullen Tel: 01525 863038

West Midlands Branch

Monday, 9th February at 8pm
Warwickshire College
AMPLAS
by Dave Thomas
In depth presentation on design and manufacture of plastics for bale wrapping

Monday, 9th March at 7.15pm
Massey Ferguson, Banner Lane, Coventry
Branch Annual General Meeting
Followed, at 8.15pm, by
High Speed Tractors and the Law
by Mike Braithwaite, one of the few experts in this field.
Hon Sec: M C Sheldon Tel: 01926 318258

Western Branch

Wednesday, 4th February at 7.30pm
Royal Agricultural College, Cirencester, Glos
Widening Agricultural Horizons
by T Tyrrell, Marketing Manager, Claas UK Ltd
Diversifying the machinery market, including detailed focus on the Claas Xerion and Challenger projects.

Wednesday, 18th March
Branch Annual General Meeting
in conjunction with a demonstration and presentation by Kubota UK, garden machinery importer.
Details to be announced
Hon Sec: David Mehaffy Tel: 01380 722361

AEA On-line

The AEA has now opened its web site, AEA On-line, to the public after a period of development. It contains information on the agricultural engineering and outdoor power industries, on the AEA and its services to members. Additionally, there is a member directory/product locator.

Directory (Member directory/product locator)
This Directory consists of two sections - one for products supplied in the UK and the other for products supplied for export. Enquirers can search the directory choosing a machine type in which they have an interest. A list of companies supplying that product is shown, and the enquirer can choose an individual company to obtain greater detail and, where available, can link directly to a company web-site via a hyperlink to obtain further product information. An additional facility enables enquirers to identify brand and product names with supplying companies.

Access
The site address is **http://www.aea-online.org.uk.**

The AEA On-line service is carried by Farming On-line (FOL) and can be accessed directly by FOL and Rural Business Network (RBN) users via the FOL Corporate Services area.

World-wide web users can also link in via Farming News' dotfarming site (http://www.dotfarming.com) within the Farming Links - machinery area.

AEA On-line is based within a frames environment allowing simple click button search options - word searches for products, brands and companies are also possible.

Membership Matters

Quarterly The Newsletter of the Institution of Agricultural Engineers Winter 1997

A day in the life of Herts & Essex Man

The first meeting of 1997 season of the Herts and Essex Branch was a series of three speakers from the branch talking along the lines of 'A day in the life of .....'

The first speaker was **Richard Barrowman** who works with New Holland at Basildon. He outlined the company structure and admitted that he worked for two bosses, those of 'hydraulic' and 'driveline' sections. He is involved in Product Engineering which includes the areas of current models, new product lines, and research and development.

Richard chose to talk about his typical Tuesday, which usually starts at 7.30 am with a short Italian language class. He then reverts to problem solving which on this occasion involved a hydraulic brake circuit. The problem was that the operator on the assembly line was having difficulty filling all the fluid in the allowed time of 2.5 minutes. Eventually, Richard isolated the culprit to a leaking seal and is currently looking at alternative designs.

Other problems he spoke about included a PTO spool valve, a gasket design and aspects of the driveline on the 'Supersteer' front axle. With this unit, he was looking at using a constant velocity joint, rather than a universal joint, but the disadvantage at the moment was that the rubber boot would not stay in one piece at propshaft speeds up to 4,500 rev/min.

Richard summarised by saying that problem solving is the common thread for much of his work. As far as design is concerned, he could identify four steps: feasibility, development, acceptance and validation. There were no short cuts at all, and nine-tenths of the work was pure perspiration.

The second speaker was **Chris Leamon,** a local pig farmer and ex-HND (1981-84) student from Writtle. He operates a partnership at home, and the business has grown from 125 sows when he started, to 350 sows now. They produce around 7,000 baconers per year, and he estimates there are only about 2,000 producers of his scale in the UK.

Chris pointed out that he likes to think they are progressive farmers, always willing to try out new techniques and equipment. He identified 3 main parts to his job:

- repairs - usually electrically re-lated and requiring extensive use of a test meter for problem-solving;
- computers;
- purchasing and adapting equipment.

Moisture is potentially a serious problem in piggeries with control boxes only lasting 3 years when Chris started working on the farm. Now, the standard of construction has improved, with a 10 year life being normal.

The farm operates with five people in all, working a rota system for night and weekend duty. Chris emphasised that livestock farming was 365 days per year and if something broke down on a Sunday evening, it had to be fixed there and then.

The farm monitors all costs and especially electricity consumption (being a large component) very carefully. A few years ago they installed hot water underfloor heating in order to reduce electrical costs, and at the same time utilised economy 7 supply as much as possible. A straw boiler was purchased to produce hot water and this worked very well, but this has now been superseded by a woodchip-sawdust boiler. (They manage to get a supply of timber waste for nothing).

The computer age has arrived on the pig farm and it is now possible to program many variables into the feeding system. For example, the computer can adapt the feed so that when a batch of pigs moves from one house to another, the feed stays the same and follows them around. One employee had commented to Chris that there were now more computers than wheelbarrows on his farm.

In summarising, Chris said that his work was enjoyable and satisfying because it included both brainwork and the chance to get his hands dirty. He pointed out (to the students present) that the larger farms do have positions for enterprising agricultural engineers.

The third speaker was **Graham Higginson,** another ex-HND Writtle student who finished in 1992, and who has been working for Coleman Engineering for the last 2.5 years. This company, as Case IH dealers, was growing all the time and now did some business nationwide. Graham's main work was involved with trials machinery, including drills, combines, maize harvesters.

They had responsibility for not only selling and delivering this machinery, but also adaptation and re-design work on a lot of it. Repairs and maintenance were carried out on farms, sometimes being called out simply because a circuit had failed due to a blown fuse. Graham emphasised the need to cover subjects such as pneumatics in College as well as the normal hydraulics, electrics, etc. He clearly enjoys his work, and the variation in jobs as well as all the travelling around are an important part of it.

The evening concluded with some general questions, and had been an enjoyable, if slightly more informal, session than usual.

RWL

Richard A Jossaume, FIAgrE

We sadly report the death on the 18th August 1997 at age 76 of Dick Jossaume of Saffron Walden, Essex. Dick who had been a member of the Institution since 1956 served an apprenticeship before the war with Wrights of Dereham, Agricultural Engineers. He joined the Fleet Air Arm in 1939, serving as an aircraft mechanic in several parts of the world. At the end of the war in 1945, he joined what was then the Massey Harris Company and for over a decade worked internationally on agricultural mechanisation including a close involvement with the Groundnut Scheme in East Africa. In 1957, he left to join the family car, truck and tractor business, Cleales of Saffron Walden, set up by his father. The agricultural side of the business was closed in 1980 and Dick eventually retired in 1986 to give more time for his favourite sport of fishing and to enable him to care for and demonstrate his treasured model T Ford which he found in 1946 and his original Crawley Agromotor (self-propelled plough) which after many years searching he found in 1986. As well as being an avid collector of historic equipment, he kept careful records of his experiences and Chris his son has generously offered his fathers large collection of photos, slides, cine film and books, much of which concerns the infamous Groundnut Scheme, to the Institution. As we do not have the facilities to properly catalogue and care for such valuable historic material, we have arranged for the collection to be held for posterity by Cranfield University (Silsoe College) Library.

DHS

Brian Scantlebury, CIAgrE

Brian Scantlebury CIAgrE, a stalwart of the Herts & Essex Branch, died at the age of 58 on 17th August 1997. He had been a member of the Institution since 1972, a founder member of the then SE Branch and a branch committee member continuously since 1975, serving as Chairman in 1987-89.

He had been a very active supporter and helper in organising a number of branch events including Irrigation in 1976, Electronics in Agriculture in 1979, Materials Handlers in 1981, Front End Linkage in 1987 and All Terrain Vehicles in 1989. In 1988 at the Essex Show, he organised a grand ring event entitled '50 Years of Agricultural Machinery Development' publicising the IAgrE. In addition, he had hosted two branch summer visits to his farm, and had served on the Institution's Membership Committee and Council.

Brian was educated at Felsted School and, from 1956-58, at the Essex Institute of Agriculture where he obtained his first practical experience on the home farm of 400 acres of heavy chalky boulder clay. In 1961, Brian and brother Hugh (who also attended Writtle) started farming in their own right in a partnership as Scantlebury Brothers and built up to 1200 acres. In 1963, he married Jean, and they had two children, Michael and Catherine. In 1985, with their families growing up, the partnership was amicably dissolved into two 600 acre units. Brian pulled out of potatoes and grew only combinable crops, although herbage seed had always been retained from his boyhood days.

He was always busy making/modifying several pieces of equipment as well as putting up buildings, installing fans, ducting etc. New Holland used him as a test bed for new/uprated tractor models. He was held in high regard by his fellow farmers and all who came in contact with him, as was testified by over 300 people crowding into Matching church to attend his thanksgiving service. His brother Hugh summed him up so well, as follows: "He was always happy when putting up buildings and making/modifying machinery. He enjoyed his shooting, planting trees and making a garden when he and Jean moved into a new house a few years ago. He always enjoyed life and kept his sense of humour and he will be remembered, among other things, for his easy disposition, friendly smile and his ability to do things and see them through to completion."

He was awarded the Branch Meritorious Award at the Annual Dinner and Awards Ceremony in May 1997.

NO

Agricultural Engineering through the ages - Kent County Show 1997

It was the initiative of the 1997 'Year of Engineering Success' that spawned the idea of a special demonstration entitled 'Agricultural Engineering Through the Ages' at this year's Kent County Show. Along with Hadlow College, the Health and Safety Executive, a number of Kent-based commercial organisations and individuals who collect items of vintage agricultural machinery, the SE Branch was invited to put on a demonstration covering the topic with a local 'flavour'. As it presented us with the chance of promoting our Institution while saying something about the historical achievements of our profession, this was far too good an opportunity to miss.

Our particular historical theme was based on how ideas of early Victorian engineers have been developed by advances in engineering technology revolutionising our agricultural industry. This was to be illustrated, firstly with mechanical refrigeration, an idea originally conceived in the 1830s, and secondly the first field gantry system (steam driven) from roughly the same period; both being supported by contemporary examples of their application. The problem was how to present this in the form of a simple, low-cost display. Well here, as usual, Mike Hurst came to our rescue with the Institution's display unit, designed by William Waddilove. We soon discovered that the

display unit possesses the two essential attributes - adaptability and portability - for exhibiting at shows and other events. With a modicum of ingenuity and help from a PC printer, we ran off artwork to modify the basic panels, making a highly professional looking low-cost display suitable for this occasion. The made-up panels fold away into a case which fits comfortably into a larger car boot or small estate vehicle and can be assembled on site in a matter of minutes. What more could one ask for?

The Show went well - more than 100,000 attended in the three days - and along with such items as a pair of rare 1875 Fowler ploughing engines and balance plough, various vintage tractors (one a 1914 Dungy model in working order) and other field equipment, the exhibit illustrated just a few of those engineering innovations which have helped to secure British agriculture's place amongst the leaders of the Western world.

JW

Institution membership changes

Admissions - a warm welcome to the following new members:

Companion
R K A Bendall (Lancashire)

Associate Member
A S Azhar (Pakistan)
J N P Kathiomi (Kenya)
K O Maung (Myanmar)
U Mohamed Najeeb (Sri Lanka)
L U Opara (New Zealand)
D H Yewalekar (India)

Associate
M J A Jones (Buckinghamshire)

Student
N Jain (East Sussex)
O A Kemp (Kent)
P D Mitchell-Roberts (Shropshire)
K A Naylor (Essex)

Readmission
I J Loynes (Devon)
A G Stone (Devon)

Reinstatement
A E Turner (Argyll)
S J Watson (Lincolnshire)

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

Member
C Taylor (Scotland)

Associate Member
D Bentley (Bedfordshire)
S J Brown (Nottinghamshire)
R W Causer (Surrey)
N J Handy (Wiltshire)
S A Lawlor (Surrey)
Y Persaud (Guyana)
J G Wilson (York)
C Wingfield-Hayes (Scotland)

Associate
G Berry (Bedfordshire)
S J Brown (Devon)
M Cameron (Scotland)
J J Dale (Hereford)
K A Doyle (Ireland)
M P Duggan (West Sussex)
H Korte (Germany)
E Lusambo (Tyne & Wear)
G K Moller (Scotland)
D J Montgomery (Surrey)
R T Murray (Northumberland)
A S Nyirenda Jnr (Gloucestershire)
M P Osborne (Devon)
B Quelch (Scotland)
T J Reidy (Ireland)
P G Ridley (Hertfordshire)
C Saunders (Devon)
A Sanaei (Tyne & Wear)
L G Shail (Worcestershire)
M Shamsi (Bedfordshire)
A J Taylor (Yorkshire)
S N Townshend (Wales)
G R Tulloch (Wiltshire)
J O Williams (Suffolk)
S A Wilson (Scotland)
P R Young (Bedfordshire)

Deaths - with great sadness we record the death of:
R A Jossaume (Essex)
B Scantlebury (Essex)
J D Wilken (Hereford)

Engineering Council

Registrations

CEng
S R B Done (London)
P Homer (Bedfordshire)
N J Skea (Scotland)
M V Westwood (Oxfordshire)

IEng
M J Holden (Essex)
C B Wylam (Oxfordshire)

Transfers

CEng
J Livingston (Wales)

New standards to keep UK engineers among world's best

Radically revised standards for the education and training of professional engineers were announced in September by the Engineering Council, the profession's regulatory body. The raised standards are contained in the new edition of the Council's policy document, Standards and Routes to Registration (SARTOR), which aims to ensure that UK engineering qualifications remain equal to the best internationally.

Mike Heath, Director General of the Engineering Council, said: "The new levels of education and professional development of engineers are intended to ensure that we continue to possess a world-class engineering workforce, at least as well educated and trained as the very best of international competition."

The new standards, which qualify engineers and technicians for admittance to the Council's National Register as Chartered and Incorporated Engineers and Engineering Technicians, will be applied in phases from 1999. The main changes, compared to the current 1990 edition, are:

- **Chartered Engineer (CEng)**: four years' academic study, instead of three, to be met by a four-year accredited MEng degree or equally by a three year accredited BEng (Hons) degree plus a further year of additional learning.
- **Incorporated Engineer (IEng)**: three years' academic study, instead of two, by either a three year accredited IEng degree or a two year HND plus a further year of additional learning.

Key educational requirements for registration are in three stages, all of which are being boosted: an accredited engineering course; initial professional development by an accredited programme to build competence and professional breadth; and a professional review to assess competence and commitment. Membership of an engineering Institution remains obligatory.

The new SARTOR clearly reflects the engineering profession's commitment to raise educational standards, said Mr Heath, and the policy is compatible with the recent report of the National Committee of Inquiry into Higher Education, the Dearing report. He said the new policy is driven by recognition of changed national and international circumstances - the most important being the globalisation of markets for goods and services which underline the need for internationally recognised qualifications. But other factors include:

- change from a selective to a mass system of higher education and a consequential need for universities to provide courses of different types and levels;
- doubt about the equivalence of output standards from different universities;
- increasing use of occupational standards by employers

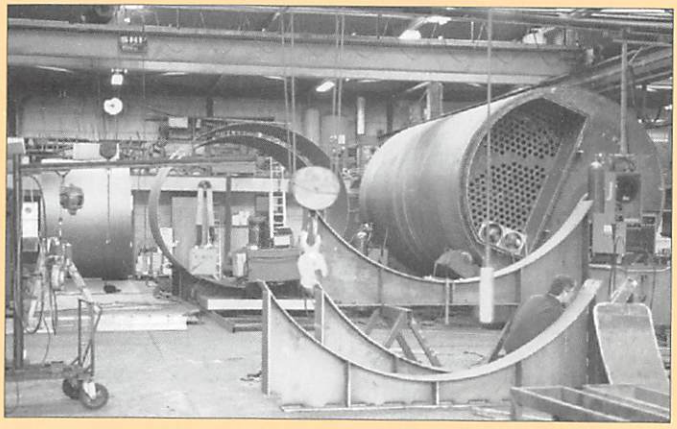
Investigations by a number of organisations into the future needs of engineering formation identified a need for more students of high potential in engineering courses, that more co-operation is needed between schools, universities and employers, and that the team-working skills of young engineers should be developed. Higher priority for training and professional development throughout careers was also one of the identified key needs.

The new SARTOR is the product of a lengthy period of consultation involving employers, academia and the engineering Institutions, with the policy being developed by the Engineering Council through an engineering profession working group.

Standards and Routes to Registration (3rd edition, ISBN 1 898126 22 4) - SARTOR - is available price £20.00 from the Engineering Council, 10 Maltravers Street, London WC2R 3ER.

Horticultural Engineering Specialist Group

A Visit to the Netherlands, 4-6th November 1997



The boiler assembly plant at Den Hoorn. Dalsem build their industrial boilers to the British Standard Specification which they claim is the most stringent of its type in the EEC.]

Although, strictly speaking, our Group's launch took place earlier this year when Malcolm Bradley of Horticultural Research International presented his inaugural address at the IAgrE Annual Conference in May, the Netherlands visit was the occasion when we "pushed out the boat" on our own. This was, principally, to attend the Nederlandse Tuinbouw Vakbeurs cv (NTV), the major international horticultural engineering show of the year held in Amsterdam and, at the same time, just-down-the-road at Aalsmeer, the equally prestigious, International Flower Trade Show.

Our group of five (one non-member, Ian Martin, Horticultural Consultant to The Cornish Millennium Project which promises to become the largest conservatory structure ever built) flew in to Schiphol (Amsterdam Airport) all according to plan and we made haste to the Show. With a total of 960 exhibitors, however, one had to be selective! The 30 UK manufacturers exhibiting were attracting plenty of interest, though some claimed that the stronger £ had made business more difficult. Mechanisation, automated

crop handling (in particular), environmental control systems and recycling to meet EEC standards were the major themes.

After a rewarding, if taxing, time at the Show the following day was spent as guests of one of the major Dutch greenhouse manufacturers. Dalsem Tuinbouwprojekten B.V. supply advanced turnkey greenhouse systems and, in recent years, have specialised in the development of Combined Heat and Power (CHP) applications specifically for horticulture: it was the latter in which we were particularly interested. After touring the Dalsem factory at Den Hoorn near Delft, we were taken to see some of their most up-to-date glasshouses incorporating mechanised crop handling, computer-controlled environmental systems, water recycling and CFP; all located nearby in the Wetland district. From here we went south, over the border into Belgium (the only indication of the border was an insignificant EEC sign by the side of the motorway!) and on to Antwerp. Our destination was a 7 ha tomato production glasshouse incorporating a 700 kW CHP gas engine unit generating electricity for the local network while supplying heat and pure CO_2 (via a catalytic converter) for the grower; a system both highly energy efficient and environmentally "clean". This concluded what was, for us, a really most interesting day fully compensating for the motorway congestion we encountered, endemic in the Low Countries.

Day three saw us back at the Show (with a brief visit to the magnificent flower exhibits at Aalsmeer), footslogging around with little time left to visit those we had missed on the first day: then the usual rush to catch our flight back to the UK. If our trip achieved nothing else, it certainly gave us a glimpse into what the future holds for the development of our own protected-cropping industry.

JW

Pest control and grain purity, present and future

A well attended meeting of the Drying, Storage and Processing Specialist Group was held on Tuesday 25th November, at the Farm Energy Centre, Stoneleigh, coinciding with the Grain 97 event.

Paul Cogan of the Central Science Laboratory (CSL), York, spoke of the need for increasing awareness and action, among farmers, merchants and grain processors to combat the presence of foreign matter in harvested grain. Statistical summaries were presented showing that a very significant number of grain stores and grain products are affected - impurities arising from the presence of vertebrates, insects and mites.

Perhaps the first problem to be faced was the detection of the foreign material. Mr Cogan developed the argument for the judicious use of traps and lures - particularly insect and mite traps - in stored grain to enable the degree of infestation to be judged. Treatment of infested grain was discussed at some length, attention being given to its effectiveness, development of resistance and to restrictions imposed on the use of chemical treatments.

In looking to the future, the speaker referred to current research work at CSL and elsewhere, in which various insect detection techniques were under investigation, including the 'electronic nose'; also means of minimising or removing infestation by combinations of carbon dioxide and fumigant gases in the store atmosphere, enabling chemical residues to be kept to a minimum.

A lively discussion followed the talk recognising the importance of grain purity in the modem world.

Future meetings of the Drying, Storage and Processing Group under consideration are:-

1. Quality Assurance
   May 1998
2. Visit to Sugar Processing Plant
   August 1998

Other ideas will be welcomed by the Group Secretary, Dr Martin Nellist, c/o IAgrE.

BCS

International Conference on Engineering in Agriculture

Sponsor: The Society for Engineering in Agriculture (SFAg), a Technical Society within the Institution of Engineers, **Australia.**

Co-sponsors: The Asian Association for Agricultural Engineering (AAAE), headquartered in Bangkok, Thailand, and ASAE.

Host Institution: The University of Western Australia, Perth, Western Australia.

Location: Conference Centre, The University of Western Australia, Nedlands (a suburb of Perth), Western Australia, 6009.

Conference Theme: Engineering Better Agricultural Environments

Timing: **September 27-30, 1998.**

Financial Arrangements: SEAg, backed by the Institution of Engineers, Australia.

Local Contact: Glen Riethmuller, Agriculture WA, Drylands Research Institute, Merredin, Western Australia, 6415, AUSTRALIA.
Tel: ++ 61 8 90 81 3111
Fax: ++ 61 8 90 41 1138
E-mail: Riethmul@agric.wa.gov.au

Change of web site address

As part of our policy of continuous improvement, we have changed the address of our web site. It is now:
http://www.silsoe.cranfield.ac.uk/iagre/default.htm
Look us up when you are surfing by.

John Neville
Secretary

Membership movements

Mem No	*Name*	*From*	*To*
5396	S J **Bamford**	Lincoln	West Sussex
2417	P H **Baskerville**	Essex	Singapore
5718	J G **Bell**	Berkshire	Scotland
6622	D **Bentley**	Durham	Bedfordshire
6132	S R **Briggs**	Uganda	Bedfordshire
6620	S J **Brown**	Devon	Nottingham
6602	R W **Causer**	Essex	Surrey
2720	R P **Cherry**	Singapore	Essex
3382	H D **Cooper**	Belgium	Kent
6278	M P **Duggan**	Essex	West Sussex
5347	K M **Elliot**	Uganda	East Sussex
6202	S J **Gossage**	Malawi	Surrey
6323	V R **Hamilton**	Wiltshire	Dorset
2823	R P **Heath**	Devon	Wiltshire
4497	K **Hopkins**	Kenya	Zambia
6569	R **Jackson**	Lancashire	Hampshire
0908	I M **Johnson**	Bedfordshire	Cornwall
6643	P G **Kaumbutho**	Bedfordshire	Kenya
6201	D J **Killer**	Wales	Scotland
6293	M **McLeister**	Gloucestershire	Scotland
6636	C M **Moore**	Essex	North Yorkshire
2337	D K **Morris**	Devon	Northern Ireland
6515	Y **Persaud**	Bedfordshire	Guyana
6630	D **Price**	Bedfordshire	Scotland
6495	Md K U **Sarker**	Bedfordshire	Bangladesh
6085	D W **Seccombe**	Cambridgshire	Suffolk
2761	D J **Stokes**	West Midlands	Dorset
3657	D B **Williams**	Kyrghyzstan	Warwick
6465	C B **Wylam**	Oxfordshire	Buckinghamshire
6487	M D B **Young**	Oxfordshire	Tyne & Wear

Long service certificates

25 Years

Name	*Grade*	*Date of Anniversary*
Sidney Denis **Cartmel**	MIAgrE	19 Oct 1997
Christopher Charles **Rothery**	IEng, MIAgrE	19 Oct 1997
Francis Robert **Bibby**	IEng, MIAgrE	20 Oct 1997
Thomas Brian **Lucas**	MIAgrE	20 Oct 1997
Michael Paul **Douglass**	IEng, MIAgrE	20 Oct 1997
Alan Richard **Jones**	MIAgrE	20 Oct 1997

Engineering 'feel-good factor'

Mike Heath, Director General, Engineering Council

There was a lot of talk earlier in the year, particularly in the run-up to the general election, about the search for the elusive 'feel-good factor'. From the reports in the media and the comments made by politicians, one could have been forgiven for thinking it was a tangible object - like a pair of comfy slippers lost at the back of an over-stuffed cupboard - rather than a state of mind.

But there is no doubting its power to make the whole nation feel better about itself and I am convinced that I have detected a 'feel-good factor' coming over the engineering profession during the past few months. In this Year of Engineering Success, there are so many positive things happening in our profession to make us proud to be playing our part and we shouldn't be backward in 'talking-up' the good points.

Many of you, I know, are constantly on the look out for fresh ammunition with which to combat some of the myths that still persist about the engineering profession. So I am delighted to report that the publication of the Council's Survey of Professional Engineers and Technicians 1997 offers a wealth of new facts and figures to demolish the negative arguments of even the most sceptical.

Somehow, we got stuck with the mistaken view that professional engineers and technicians are poorly paid in relation to their colleagues in other professions. In the recent past, this has certainly not been the case and the new Survey bolsters the message with hard statistical evidence that I hope you will be eager to relay to the doubters and detractors.

The Survey, which is drawn from the responses of more than 10,000 professional engineers, is the most comprehensive and authoritative of its type and opens a window onto the current employment environment and working conditions of all three sections of the National Register - Chartered Engineers, Incorporated Engineers and Engineering Technicians.

I should explain that the Survey is independently conducted for the Council by Electoral Ballot Reform Services, who send questionnaires to one in seven randomly selected names from the National Register. They typically receive a response of more than 40% - an extremely high rate for any survey.

The value of the data is that it convincingly supports what many of us in the profession have always known and constantly maintained - that engineering is a good job, is well paid and offers excellent prospects. The conclusions provide us with an even stronger platform from which to convince the brightest and most creative young people that engineering can offer them not just a stimulating career but a rewarding future too.

We now have conclusive evidence that engineering is not only a well rewarded career but is also very secure - with unemployment rates low and falling - and that an engineering degree is one of the surest routes to business success and a seat on the Board. It is also heartening that the vast majority of respondents consider engineering to be an exciting and

stimulating career and one that they would recommend to others.

Frequency of the Survey has been increased to every two years, which enables trends to be tracked and valuable comparisons drawn. Notable findings this year are that salaries across all three grades are continuing to rise at a rate well above inflation. Over the past two years, average salaries for Chartered Engineers have gone up in real terms by 7.9% to £40,131; for Incorporated Engineers by 7.0% to £29,918; and by 13.7% for Engineering Technicians, whose average salary is now £26,311.

I am very conscious, from the responses of some people to our previous Surveys, that not every professional engineer earns as much as the average. But as engineers we understand the significance of averages and that bitter personal experiences, however regrettable, do not necessarily provide an accurate reflection of the national picture.

In reality, the average salaries published in the Survey are, if anything, likely to be on the conservative side because there is some evidence to suggest that the very highest earners do not to respond to survey questionnaires. An indication of the earnings potential in the profession, however, is revealed by the 23 Chartered Engineers whose annual earnings were £250,000 or more.

There is an equally positive message from Registered engineers on their employment status. In our 1995 Survey, we were able to show that unemployment among professional engineers was around 2%, which at that time was well below the rate among the general working population and in most other professions. The new Survey shows that the rate has now fallen still further and, at a rate of 1.4%, is probably at or below the 'churning' rate.

The rate of response means that the results are statistically sound. They are not Panglossian wish-fulfilment from a profession searching desperately for some good news. Far from it: the new findings merely confirm the results of the two previous Surveys, in 1995 and 1992, and equally positive trends are being flagged up. They support a wealth of anecdotal evidence that engineering is on the way up in terms of status and reward.

Personally, I regard the Survey as an accurate and crystal clear reflection of this dynamic profession's health and a fitting endorsement of all that we have claimed are its strengths in the Year of Engineering Success.

Letter to the Editor

Dear Sir,

Advertisement about REMAP (Autumn 1997 edition of *Landwards*)

It was after reading an article in another engineering journal about 1982 that led me to volunteer to put my miniscule expertise towards helping REMAP. It so happened that there was no panel in my area, so with the aid and encouragement from Ted Lane, the South East organiser, I set about creating East Sussex REMAP. Its full title then was Rehabilitation Engineering Movements Advisory Panel(s), but here we often affectionately refer to it as 'Retired Engineers Making Aids for People'!

Since formation, we have completed around 60 jobs each year. This, shared out between about 20 of us, does not take up too much time, and most of that is 'thinking time'. Most of the jobs (or cases as we call them) come in the 'low'.... or 'intermediate' technology category. None of us has a real workshop. My own, for example, is a disused coal bunker outside!

We have also found that the things we made in our early days can now be obtained from commercial companies, not that they have stolen our ideas, but clearly with an ageing population, they have found a market for such devices. In fact, we often check 'Boots' catalogue now to save us reinventing the wheel and in any case we do not try and reproduce 'on the cheap' commercial items. Having said that, we frequently find ourselves modifying a commercial item to suit an individual case.

So....any engineers out there wondering what to do with your "BC Skills" (Before Computers!), please get in touch, and come and join us. The address again is: Eur.Eng J J Wright, Hazeldene, Ightham, Sevenoaks, Kent TN15 9AD

Yours faithfully

J. Trevor Thompson, IEng AIAgrE
38 Woodpecker Drive, Hailsham,
East Sussex BN27 3ES.

News of *Members*

Charles Morse is now an Applications Engineer with Assembly Technology and Test at Buckingham. The owners of this company are D T Industries which bought out Lucas Assembly and Test Systems earlier this year.

J P O'Neill is taking an Agricultural Engineering course at Harper Adams College.

On receiving his 50 year membership certificate **Francis Coleman** said that he will continue his membership for as long as he is allowed. He also commented that the friends he made within the Institution when he joined, so long ago, remained close to him throughout their lives.

Henry Gunston, who has worked for the Institute of Hydrology since 1968, has gone to St Helena to report on catchment management in the upland area of that country. He let us know that **S.D. ("Dick") Minto**, who was for many years the senior agricultural engineer with the former East African Agriculture & Forestry Research Organisation - and who put Henry on track for his own degree at Silsoe and Institution membership - has been very poorly recently after a serious fall. He was well enough when he wrote to Henry in July, however, to note that whilst Henry had just completed his 25 years, Dick's own 50 years of Institution membership is not too far ahead!

Henry added a comment which perhaps reflects the thoughts of many members: "I THINK I like the new logo and am getting used to it. Certainly the old one did rather hark back to the waistcoat-and-watch-chain era of engineering...."

After 11 years with ADAS, **S J Bamford** joined Southern Science in April 1996 as a Principal Hydrologist with a remit to establish an office in Lincoln and to develop new business in the East Midlands and the North East. In July 1996, Scot-

tish Power bought the parent company Southern Water and, following a reorganisation, he was appointed Water Resources Planning Manager in January 1997. In August, he moved to Worthing where he was made Head of Water Resources and more recently he has become Head of Environment, Water Resources and Contaminated Land in the Southern Water Technology Group. The Department is responsible for the planning and delivery of the Southern Water capital programme with respect to Environmental, Water Resources and Contaminated Land issues. They are involved in the development of policy and strategy together with their implementation, covering such diverse subjects as demand management and resource development to waste management and environmental assessment. Whilst the group is focused on Southern Water's investment programme, they are also active in developing links with the agricultural community. Many surface water sources are shared with irrigation abstractors and so they are developing relations to enhance resource management for the benefit of all abstractors.

Seamus Maguire, who is studying Agricultural Engineering at Writtle College, has returned to his home country Northern Ireland to do his industrial placement year. He is working for Matbro in Dungannon, Co Tyrone as a CAD technical, research and development assistant. He says that, when he has finished his course at Writtle, he hopes to find employment in Northern Ireland.

After graduating from Silsoe, **David Williams** became a graduate trainee with a major tractor manufacturer but, on completion of his training, the company reduced its need for engineers.

He then worked for a succession of small companies but, in each case, found that the decline in the agricultural machinery manufacturing sector limited his tenure. Along the way, he has worked on the design and development of tractors and construction machinery, coal mining equipment, round balers and bale handlers, sugar cane harvesters and seed planting equipment. During this time, he worked for short periods in East and West Germany, Italy, Barbados, Kenya and Zambia. He then obtained a position with a machinery dealer, where he first worked in their fixed equipment and grain storage department and later managed the department. Some 5 years later, the company changed hands and the department, although profitable, was judged as not being 'part of the core business'.

At that time, David was approached by a consultancy company who required someone to survey all of the state owned grain stores in the Syrian Arab Republic. He took this assignment in 1991 and until 1996 carried out overseas consultancy work and grain storage work in the UK. David says that this balanced quite well, because both were seasonal and they appeared to mesh. During this period, he worked in the Kyrghyz Republic, Ukraine, Lithuania and Zambia, and also in the UK offices of several organisations. He was also asked to write a grain storage manual for the United Nations Food and Agriculture Organisation.

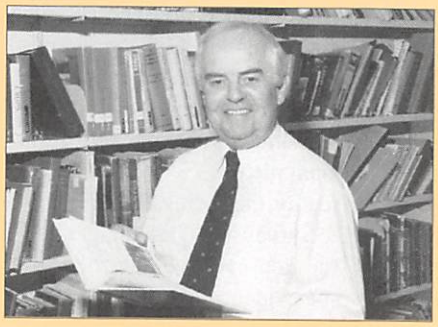
Most of David's work is obtained by personal contacts. David obtained work in Zambia through one chance encounter in the UK and another chance encounter in the Kyrghyz Republic led to an 18 month assignment in that country.

David was approached by an American company who needed an engineer with some procurement knowledge to join a small team which were to operate a credit line. The credit line is, in effect, a subsidised finance company. It was intended to assist private businesses to purchase either plant and machinery or advice services. It comprised a banker, a small business specialist, a procurement engineer and $15 million. Unfortunately, because of operational problems through rifts and arguments between the Kyrghyz Government and the World Bank, the scheme was not as successful as was intended. During the 18 months, they assessed some 90 formal applications and advised many more potential applicants from all sectors of the economy. David's function was to assess the application from a technical aspect, to make sure that the scheme was viable and, if approved, procure equipment from anywhere in the world since their function was to supply an equipment package and not cash.

David says that although on the face of it, there is less security than a 'proper' job, he personally finds the work far more rewarding and challenging than most salaried work and he considers that short or finite term assignments are more secure than arriving for work and finding that the company has been closed, which has happened to him on more than one occasion.

C T Nyongo is undertaking a two-year Masters programme in Water Management at the University of Dschang in Cameroon. He is specialising in Water Supply (and improving his French language), and would like to contact members of the Institution who are specialists in this area. His address is: University of Dschang, BP295, Dschang, West Province, Cameroon.

Bryan Morgan retired at the end of October 1997 after 34 years as Librarian of Silsoe College. For most of that time he was also the Honorary Librarian of the Institution of Agricultural Engineers, having joined in 1982 in the Companion grade.



The final year of Bryan's working life has been exceptionally busy since he has been overseeing the extension of the library, which has been nearly doubled in size. The work, which has included the refurbishment of the old section as well as the building of the new, has had to be carried out with minimum disruption to the availability of the service to students. That this programme has been successfully completed in time for the 1997-98 Academic Year says much for Bryan's organisational skills and patience and is a fitting climax to his career. I am sure that all those members whom he has helped over the years when they have visited the library will wish him a long and happy retirement.

The library will continue to provide access to Institution Members who wish to visit and books may be borrowed by special arrangement with the new Librarian Chris Napper, who is taking over from Bryan.

AAWC

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The future will be different

This submission by ***Geoffrey F D Wakeham****, is taken from material which is designed to stimulate discussion amongst students on the BEng course at Harper Adams Agricultural College, Newport, Shropshire TF10 8NB, and is open to comment from readers.*

Many companies, corporations and students spend hours producing long-term strategic plans based on some expected future. The bulk of the evidence indicates that, along with death, the only thing we can expect in the future is change. Without change, the onset of death is hastened. What we need is a strategy that encourages change and not one that puts us in a strait-jacket made for an unreal future.

Cranfield School of Management has found that the top 10% of UK engineering companies have introduced 62% of their product range in the past 5 years (Anon., 1996).

McKinsey and Company, as reported by Vestey (1992), claim that being six months late to market can reduce the gross profit potential by 33% *(Table 1)*.

Table 1 The cost of arriving late to market (and still on budget).

Lateness to market, month	6	5	4	3	2	1
Potential gross profit, % change	-33	-25	-18	-12	-7	-3
Potential gross profit by advancing 1 month, % change	+11.9	+9.3	+7.3	+5.7	+4.3	+3.1
Increase in annual gross profit, $k						
for revenues of $25M	+400	+350	+300	+250	+200	+150
for revenues of $100M	+1600	+1400	+1200	+1000	+800	+600

In agricultural engineering, with its highly seasonal markets, being 2 months late may be worse than being 1 year late.

The indications are that what is required is:

1. a commitment to introducing new products on a regular basis;
2. an organisational structure that significantly reduces the time between idea and product launch;
3. systems that evaluate the quality of the design before production commences and ensures any problems are corrected.

Item 1 suggests a clear commitment by top management that translates into providing the hardware and staff required to undertake the work. This will cost money.

Item 2 may require a total rethink on the way the development function is carried out. One of the more obvious requirements is to ensure that manufacture is considered at the earliest stages of design and the concepts of Concurrent Engineering are well known. One less favoured by management is to remove the process from 'the administrative nightmare of large, bureaucratic organisations' (Vesey, 1992). Structures need to be flexible and able to adjust to change. Change is the only sure prediction that can be made about the future. Small dedicated teams with clear goals and authority to act are the most likely to fit this scenario. Here, funding is unlikely to be significantly different from alternative structures. What is needed is a change of working attitudes.

The rapid introduction of new products on a regular basis is however only part of the requirement if design expenditure is to translate into improved overall performance. The third item listed of design evaluation will determine customer perception and hence long term customer loyalty.

This does not simply mean ensuring an adequate prototype testing programme but should include checking the design calculations against real data, checking the design against customer needs, and checking the robustness of the design in the manufacturing environment.

These processes cost money. The collection of valid data is neither easy nor cheap but, without it, the designer is working in the dark.

Field testing requires the construction of prototypes and can cost £50+ per hour of field work. By its very nature, field testing will give variable results from year to year and obtaining realistic conditions out of season is difficult. Obtaining 10 or even 5 years equivalent of realistic testing is almost impossible within an acceptable time.

Ways to reduce these costs and accelerate test time must be investigated. The use of test rigs is a common practice in some companies but, once again, costs can be high and results ambiguous.

Every effort should be made before cutting metal to ensure that the design will meet the customer's expectation with regard to total operating costs, function, reliability and overall life and that production systems will produce a minimum cost, consistent product that complies with the design specification.

This will ensure the minimum changes during testing and hence total test time and cost and also changes once the product is in the market place.

The designer should be working on the next generations of products, not fighting to correct past errors.

The future will be different. If we are to survive in it, we must be willing and able to adapt our practices and rapidly introduce new products that satisfy the customer's needs.

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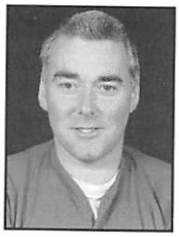
Farm and rural energy consumption in Scotland

Gwilym M Owen and Robert Graham



1. Introduction

Energy use and energy costs on farms and in rural areas vary considerably but both are likely to keep on rising in the foreseeable future, even though electricity supplies are to be deregulated in 1998. This upward trend is now opening up new opportunities to farmers and land owners for the installation of renewable energy equipment that should become economically viable for self use, and for selling to the grid or to adjacent group users.

In the Bruntland report as far back as 1987, renewable energy had been seen as a central part of sustainable development. Farms use relatively small amounts of energy compared with many other industries but, on the other hand, they are in a position to produce and use several different forms of energy. Before users can be give unbiased advice on the best option for their needs, detailed data of electricity usage are required so that strategies for matching supply and demand can be developed and applied. First, a survey of the energy consumption on 30 representative farms was carried out, followed by an analysis of the seasonal electricity demand on a further 27 farms through their electricity bills. Secondly, the electricity and diesel consumption on six farms selected from the first group was recorded at weekly intervals over a period of nine months to a year. Thirdly, an energy audit was carried out on a crofting community in the Highland Region.

The information gathered in these surveys will be used to analyse the financial viability of renewable energy installations using a systems model (Hunter &Morgan 1995).

Gwilym Owen MIAgrE is a Research Engineer recently retired from, and Robert Graham is an Information Technologist at, Resource Engineering Department, SAC, Bush Estate, Edinburgh EH26 0PH.

2. A farm energy survey

A farm energy survey on 30 farms in Scotland (Graham & Owen, 1994), showed that there was a wide variation in the annual consumption of energy, even on the same farm type and the range could not be accounted for by farm size alone. There was also a wide variation in the numbers and power rating of farm electrical equipment which means that peak loads would also vary. The results of the survey in *Table 1*, show the consumption of diesel and electricity during 1992-93; the amount of propane fuel used on five of the farms was also recorded. The description of each farm was summarised by type in accordance with EC farm topology, and by size, and coded for anonymity.

The electrical rating and function of every electric powered motor on each farm was also recorded so that load profiles could be better understood. The distribution of motor sizes showed clearly that electric motors up to 1 kW rating were by far the most common; only ten motors exceeded 10 kW and two exceeded 40 kW on the thirty farms surveyed. In other words, 90% of all electric motors were in the range 0.3 kW to 5 kW. Although some of the farms, such as dairy, general cropping and combinable cropping (*Table 1*), show a very high total electric load compared with a Least Favoured Area (LFA), mainly sheep farm or a low ground sheep and cattle farm, not all the electric motors would be in use at the same time. This suggests that it would be feasible to provide power to these electric motors from a small or medium sized alternative energy power source. Simple planning would allow demand to be spread during the day and night to keep the peak load as low as possible which in turn would significantly reduce the installation costs of an alternative power system. Excess power could be sold to the grid, sold to adjacent users or simply used to heat a hot water storage system that could then be used in the farm house for space heating or domestic use. For example, a farmer in the Scottish Borders installed a big bale fired boiler to heat three houses on the farm and to provide all the hot water needs of the farm. It would be a simple matter to heat a swimming pool or a hot house from the same system.

The average costs of electric power and fuel oil for the different farm types are given in *Figure 1*, showing that machinery fuel costs are significantly higher than electricity on all farm types except for dairy farms. Machine fuel and oil use is clearly greater on farms with a high arable input, followed by general dairy which includes arable and forage crops. Electricity needs were very similar for all farm types except general cropping and dairy.

The seasonal electricity demand on Scottish farms was further studied (Graham & Owen, 1996) through the annual electricity bills of a further 26 farms for the years 1992 to 1994. This analysis again showed that there was a wide variation in the annual average load between premises and a strong seasonal pattern in some cases. The cost of electricity also varied widely. For premises where the annual average consumption exceeded 20,000 kWh, the cost including the standing charge was below 7 p/kWh in most cases. At very low levels of consumption, the cost could rise to well above 10 p/kWh, and in one case as high as 118 p/kWh.

It is clear from the individual nature of each case that evaluating the possible use of renewable energy supplies would need to take existing premises demand,

Table 1 Farm type, farm size and fuel consumption over a one year period.

Farm number	*Farm type*	*Farm size, ha*	*Fuel used over one year*		
			Diesel, l	*Propane, l*	*Electricity, kWh*
23	LFA sheep	219	4,546		7,143
1P	LFA, mainly sheep	383	5,273		6,814
27	LFA sheep and cattle	114	8,000		20,000
29	LFA sheep and cattle	117	5,000		5,238
4	LFA sheep and cattle	243	38,281		10,286
11P	LFA sheep, chickens, pig, and cattle	121	4,546	49,016	128,571
12	LFA, horses	16	2,700	4,500	None
9	LFA with arable	546	35,578[4]		17,314
30	Lowground sheep and cattle	138	5,593		2,537
14	Combinable cropping	100	8,328	13,726	1,085
7	Combinable cropping	192	31,250	10,000	153,846
10P	Combinable cropping	291	13,778		15,618
17	Combinable cropping	314	44,250		26,057
22	Combinable cropping	584	111,875		91,886
21	Combinable cropping	632	118,335[4]	14,233	82,357
18	General cropping	190	75,312		78,571
20	General cropping	194	30,000		12,857
19	General cropping	206	119,836		332,814
26P	General cropping	243	53,000		63,828
13	General cropping	291	60,859		42,957
24	General cropping	465	89,835		269,557
6	Specialist - vegetable packing	-	86,625 95,246[2]		587,957
25	Specialist dairy	58	12,523		38,083
2P	Specialist dairy	152	16,218 13,230[1]		63,929
28P	Specialist dairy	201	65,671		74,842
16	General dairy	66	2,270		7,857
3	General dairy	133	27,125		56,257
15	General dairy	182	27,240 4,540[3]		53,428
5	General dairy	275	42,564		88,806
8	General dairy	971	117,187 55,547[3]		150,057

P Participants in load profile study
1 Heating (dairy wash)
2 Lorry diesel
3 Grain drier
4 Tractor and drier

NOTE: Diesel 12.8 p/l (Scottish Oils average)
Electricty 7 p/kWh (Scottish Power average)
Propane 15 p/l (Calor Gas Ltd average)

seasonal demand pattern, weekly demand pattern and unit cost into account. Therefore, the results of an evaluation would be very site specific and the most appropriate tool for making such evaluations would be a systems model.

3. A weekly energy consumption profile

A detailed, nine month, survey of the energy profile on six farms selected from the original group was carried out (Graham & Owen, 1995). Electricity and diesel consumption were recorded at approximately one week intervals for the whole farm and for some specific tasks such as drainage pumping, bruising and grain drying. Additional electricity meters and fuel flow meters were fitted as required. The results are given in *Table 2*, and selected profiles are given in *Figure 2*. The average energy used is given in kWh/h over the 9 month period of the survey and the total energy used on these same farms in the survey, *Table 1*, has been extracted for comparison. It is interesting to note that the electricity consumption in the chicken houses was twice as high during the day as against night use. This was probably due to the power consumption of the cooling fans during the summer months.

Extra meters were fitted on the general cropping farm, *Table 2*, to obtain a more detailed picture of the electricity used. This breakdown shows clearly how small some of the loads were when recorded separately.

The profile of the seasonal electricity demand on four of the farms is also given in *Figure 2*. The dairy farm shows a steady fall in consumption during the summer months as milk yield falls and rising to a peak in the winter when the price of milk is highest. The chicken farm on the other hand shows clearly the rise in consumption as each batch of chickens reach maturity, also the general affect of the increase in fan power can be seen over the summer months. The vegetable processing plant simply shuts down for much of July and August and the sheep farm hardly uses any electricity at all for most of the year. Most of the electricity was used for supplementary house heating on the sheep farm.

4. Rural energy study in Highland Region

4.1 A crofting township

A crofting township on the Isle of Skye

consisting of forty six houses, crofts and holiday homes, was selected as representative of a rural community suitable for an energy study (Graham *et al.*, 1995). The data was extracted from electricity, coal, oil and propane fuel bills covering the period from early 1993 to mid 1995 from twenty seven of the houses, *Table 3*. The profiles of variation in the average daily electricity consumption, kWh/day and coal, kg/day, was prepared for a number of the dwellings; examples are shown in *Figure 3*. These data are taken from the most complete set of quarterly bills. In a number of dwellings the electricity consumption was lower in the winter than in the summer because coal was used to heat the houses in the winter and electricity in the summer.

4.2 Farms in Highland Region, annual energy demand

Data on electricity and fuel costs were also analysed for a sample of farms in Highland Region. Energy demand was calculated using average prices of 8 p/kWh for electricity, 15 p/l for red diesel and 55 p/l for road diesel and then converting the amounts to common units of kWh. LFA sheep and cattle farms are predominant in the region, tables of the annual energy demand for the different farms are available on request from the authors. The cereal farms and the mixed farms each number about one tenth of the cattle and sheep farms; there are only forty two dairy farms in the region. Approximately, the gross energy demand per farm varies between averages of 100 MWh and 600 MWh across all farm types, the highest demand being on cereal farms. The

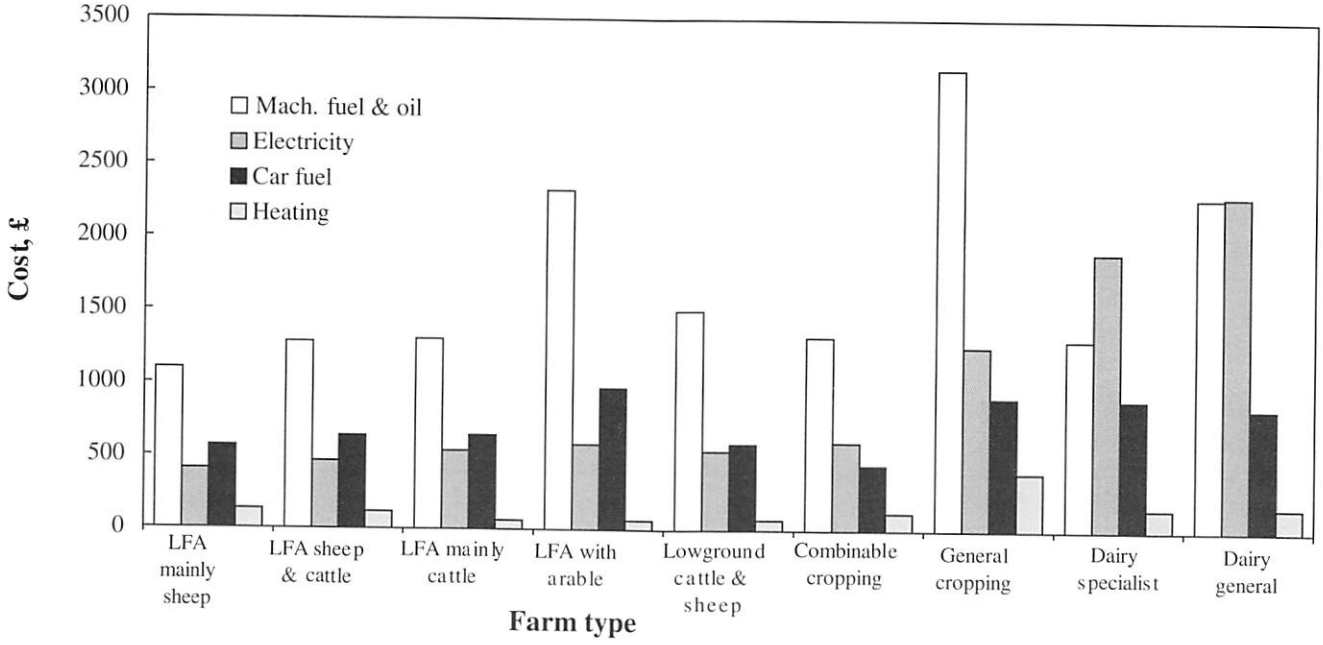


Fig. 1 Average annual energy costs.

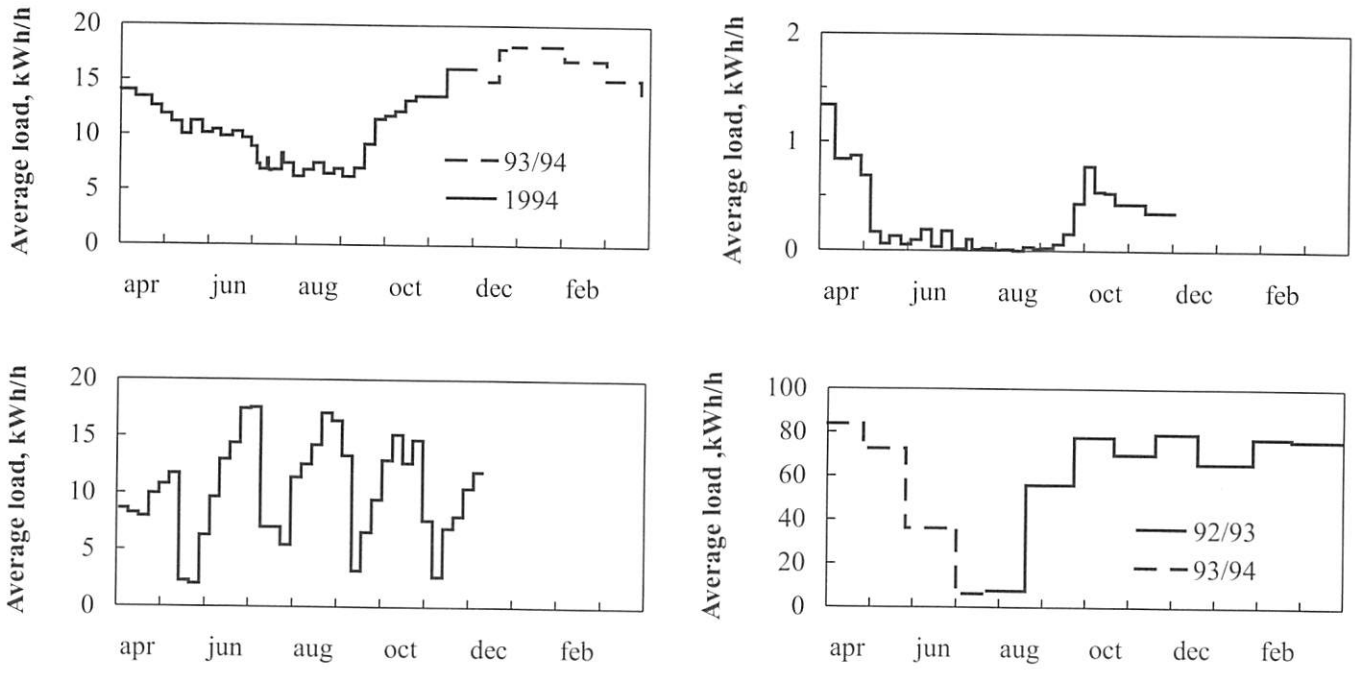


Fig. 2 Seasonal electricity demand data for four farms: dairy farm(top left); hill farm (top right); chicken farm (bottom left); vegetable processor (bottom right).

electricity demand per farm varies between averages of 5 MWh and 60 MWh.

5. Conclusions

The surveys give valuable information on the consumption and costs of energy used on a range of farms and rural areas in Scotland. This data can be used to evaluate the financial viability of all types of alternative energy production proposals on farms with the aid of a systems model which has been developed to assist in this decision making process. The data shows that many farms use modest amounts of electricity at any one time and that their needs could be provided by a much smaller alternative en-

Table 2 Energy consumption profiles for six selected farms of different types.

Farm type	*Size, ha*	*Survey period*	*Av energy use*		*Total energy use in 1993*	
			Elect, kW	*Diesel, l/h*	*Elect, kWh*	*Diesel, l*
LFA mainly sheep	382	Apr - Dec 94	0.3	0.5	6,814	5,273
LFA sheep, chicken, pigs, cattle	121	Apr - Dec 94	6.2 (day) 3.2 (night)	0.5	128,571	4,546
Combinable cropping	291	Apr - Nov 94	0.4	0.6	15,618	13,778
General cropping	242	Apr - Dec 97	4.7†	4.6	63,828	53,000
Specialist dairy	152	Dec 93 - Dec 94	12.5	2.5	63,929	29,491††
Specialist diary	201	Apr - Sept 94	5.6	3.9	74,842	65,671

† dairy - 3.5 kWh/h
drainage water - 0.4 kWh/h
bruiser - 0.1 kWh/h
drier - 0.5 kWh/h
conveyors and elevators - 0.2 kWh/h

†† 16,218 *l* - tractor diesel
13,273 *l* - heating and dairy work

Table 3 Annual energy demand from a Highland region.

Dwelling	*Annual cost, £*			*Energy consumption*					*Total energy, kWh*
	Electricity	*Coal [Wood]*	*Gas [Oil]*	*Electricity, kWh*	*Coal [Wood]*		*Gas [Oil]*		
					t	*kWh*	*l*	*kWh*	
2	542	275	-	7,153	2.5	20,208	-	-	27,361
4	680	666	-	8,500	5.2	42,033	-	-	50,533
6	229	345	-	2,595	3.0	24,250	-	-	26,845
7	972	675	-	12,150	6.0	48,500	-	-	60,650
8	752	499	-	14,958	3.9	31,525	-	-	46,483
13	457	576	-	5,731	4.5	36,375	-	-	42,106
14	995	666	-	20,962	5.2	42,033	-	-	62,995
17	520	530	-	6,500	4.2	33,950	-	-	40,450
22	945	444	-	18,893	3.5	28,292	-	-	47,185
26	480	1250	-	6,000	11.1	89,725	-	-	95,725
12	538	419 [50]	-	7,135	3.4 [1.7]	27,079 [8,350]	-	-	42,564
28	300	903 [60]	-	3,750	7.1 [2.0]	57,392 [10,000]	-	-	71,142
3	367	-	657	4,516	-	-	2,906	20,400	24,916
10	336	-	756	4,200	-	-	3,468	24,345	28,545
18	469	-	890	5,861	-	-	4,236	29,737	35,598
19	356	-	698	4,314	-	-	3,170	22,253	26,567
20	842	-	[491]	15,390	-	-	[3,000]	[32,490]	47,880
24	876	-	[330]	17,657	-	-	[2,000]	[21,660]	39,317
27	701	-	[533]	13,214	-	-	[3,200]	[34,656]	47,870
1	383	237	164	4,942	2.0	16,167	472	3,313	24,422
5	180	300	31	2,250	2.7	21,583	88	618	24,450
23	520	520 [70]	25	6,500	4.1 [2.3]	33,142 [11,500]	71	496	51,637
25	315	90	[310]	3,938	0.7	5658	[1,879]	[20,350]	29,946
9*	312	-	-	3,900	-	-	-	-	3,900
15H	402	-	-	7,964	-	-	-	-	7,964
16H	547	-	-	12,499	-	-	-	-	12,499
21H	260	-	-	3,250	-	-	-	-	3,250
							Average for holiday homes		**7,904**
							Average for permanent occupancy		**43,269**

ergy source than was first thought through good planning of energy use (Hunter, 1994).

The estimated energy resource available from farming is huge, dominated by wind energy at present but projected to be overtaken by energy crops in the future. The wind resource in the less-favoured areas of Scotland is so large that it presents a major opportunity for generating new income which can help sustain farming and rural communities in these areas.

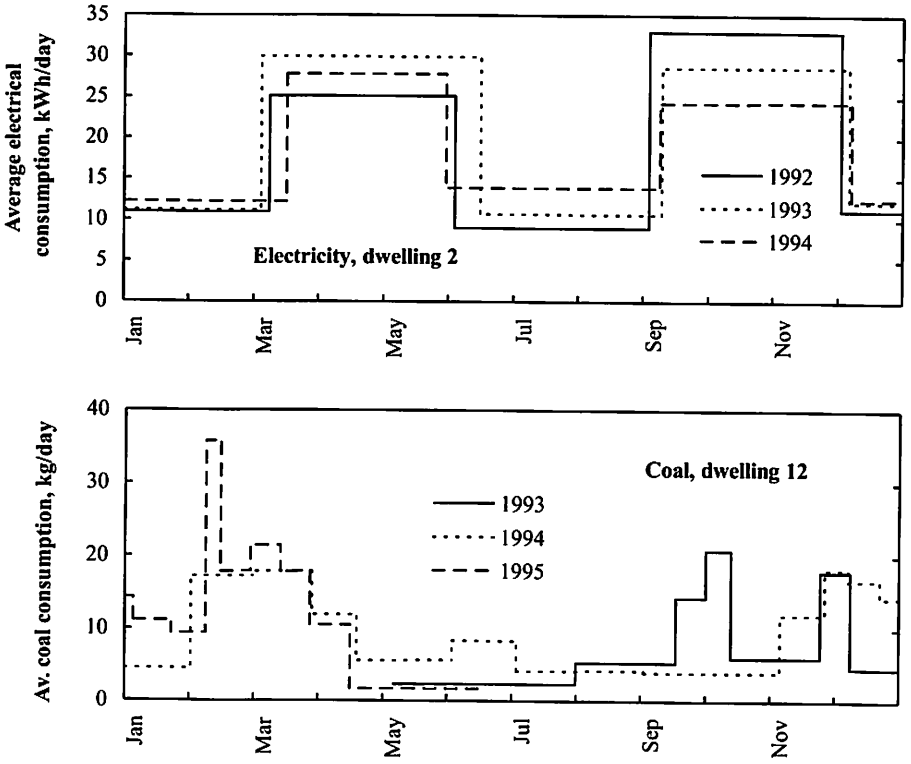


Fig. 3 Typical annual coal and electricity consumption.

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BTG licenses broiler harvester technology to JTT in Denmark

BTG plc has signed a licence agreement with JTT (Jydsk Transport Teknik ApS) for the rights to manufacture the broiler harvester in Denmark. The harvester is an innovative method of collecting birds for transportation that is more humane and gentler than traditional methods of catching birds.

The harvester was developed at the Silsoe Research Institute (SRI) with support from BTG. It uses soft, flexible rubber fingers to handle the birds. These fingers are attached to rotors on a slowly moving, arm which traverses from side to side at the front of a self-propelled machine. The fingers rotate on vertical axis drums and lift the birds gently from the floor on to a conveyor belt. The birds are then transported to the rear of the machine where they are placed in crates for transportation to the processing plant.

JTT is a leading Danish manufacturer of industrial conveyor belts and materials transport systems and, although it has previously been involved in the agricultural sector, poultry equipment constitutes a new activity for JTT. The company expects to launch a product into Europe during 1998.

SRI has involved farm animal welfare groups in analysing the results of tests with the broiler harvester which show that stress levels in the birds are significantly reduced by this method of catching. The birds show no visible anxiety at the approach of the harvester and make no attempt to run away from it.

Using the broiler harvester can result in significant cost savings for the farmer. There is less carcass downgrading due to bird damage, labour costs can be reduced as the harvester requires only three operators and it is fast, with an optimal catching speed of 6000 birds per hour compared to 1000 per hour by hand.

The harvester may also improve worker welfare by reducing, the risks of respiratory problems associated with dust and ammonia generated in chicken houses. Repetitive strain injury problems caused by lifting the birds may also be avoided. Legislation has been passed in Denmark relating to these issues.

JTT is the fourth licensee for the broiler harvester and joins Cattaruzzi International of Italy, American Calan of North America and AR Teknikka OY of Finland in manufacturing these machines.

Mapping in Cyberspace

Britain's national map maker, Ordnance Survey,, has launched its dynamic new look web site on the Internet.

Land-Line View is just one of the new highlights of the site, which can be accessed at **http://www.ordsvy.gov.uk/** Land-Line, is Ordnance Survey's flagship computer data product which maps the entire country at scales of up to 1:1250, or about 50 inches to one mile. It is so detailed that the shapes of individual houses and the lines of fences and hedges are shown - as are features as small as private garages and individual telephone boxes!

The sample of Land-Line mapping on the web - which can be manipulated on screen in a whole variety of ways - focuses on Tower Bridge and developments in the surrounding area of London. And for the first time, it is also possible for those with appropriate software to download other examples from Ordnance Survey's range of digital mapping, so that people can evaluate their versatility and potential use.

Ordnance Survey's Director General, Professor David Rhind, says: "Among the many other new features on the web site are an interactive guide to the National Grid - shown on all our maps - demonstrating how people can use it for effective navigation; a 'what's new' section, giving all our latest news; and details of our authorised agents, stockists and suppliers - along with location maps for our Superplan‰ Agents."

Among many other features on the site, which currently has around 1,000 pages of information, are:

- a fly-through video sequence of Cairn Gorm in Scotland and a 3-D drape of Helvellyn in the Lake District, both demonstrating spectacularly how Ordnance Survey's computerised height data can be used to bring maps to life;
- an index to the familiar pink-covered Landrange, map series covering the whole of Great Britain - making it easy to identify which local map a user might need for any area;
- a fun 'screen saver' which can be downloaded free of charge featuring many of Ordnance Survey's products with entertaining cartoon animation;
- extensive details of the history and work of Ordnance Survey from its foundation in 1791 to its latest developments and future plans;
- a complete listing of all Ordnance Survey products from paper maps through guide books and atlases to computer data.

Professor Rhind adds: "This launch is only the beginning of our new look web site. We listened to users about its predecessor and improved it; we welcome views on the new site and will act again accordingly. Our aim is to make it the best of its kind worldwide."

Government launches new guide to combat soil erosion

Countryside Minister Elliot Morley was at the National Agri-Environment Forum in November for the launch of a new booklet aimed at combating soil erosion. The booklet, focusing on farmers and other land managers, follows on from the 1996 report of the Royal Commission on Environmental Pollution on the Sustainable Use of Soil which encouraged farmers to seek advice on erosion control and minimise the loss of soil from their land.

Launching the booklet at the Agri-Environment Forum, Mr Morley said: "I am glad that farmers now have a new source of guidance in their efforts to control the problem of soil erosion. We are fortunate in this country that soil erosion is less of a problem than in other countries, but it is more widespread than commonly thought, and the consequences can be significant.

"Erosion can damage the environment, be a cause of public nuisance and affect farm profitability. Farmers have an incentive to manage their soils well as it is their most valuable asset. However, we must continue to ensure that those farmers with soils at risk of erosion have access to the most professional knowledge available in order that they are best prepared to deal with any potential problems. We also need to be vigilant to climate change, extreme weather conditions, and changes in land management practices which could exacerbate erosion in future.

"The Environment Agency, the National Farmers Union and the Country Landowners Association have greatly assisted in the preparation and development of this booklet, and I believe it is crucial that MAFF continues working together with these organisations to help farmers tackle erosion."

Soil erosion is a localised problem which can damage water quality through the transfer of pesticides and nutrients and freshwater fisheries through the deposition of sediment. It can also cause a public nuisance through the deposition of soil onto highways and can affect farm profitability through loss of productive topsoils.

The booklet complements the Code of Good Agricultural Practice for the Protection of Soil which is currently being revised for relaunch next year alongside the Water and Air Codes. MAFF has also commissioned ADAS to prepare a step by step guide to help farmers plan erosion control systematically. The pilots for this will be carried out over the winter in areas of England, to be selected, with soils at high risk of erosion by water.

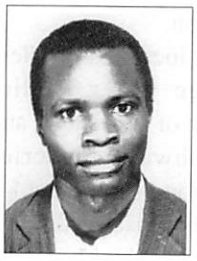
For copies of the booklet, contact: **MAFF Publications on 0645 556000.**

Mechanical properties of blue-gum timber

Stephen Ondimu and Lawrence O. Gumbe

The objective of the study reported in this paper was to evaluate the mechanical properties of *Eucalyptus Saligna*, otherwise commonly known as blue-gum timber, in structural sizes. Nine specimens of sizes 50.8 mm x 101.6 mm x 2000 mm were tested for bending strength, seventeen specimens of size 25.4 mm x 76.2 mm x 685.4 mm for tensile and fifteen specimens of size 50.8 mm x 101.6 mm x 304.8 mm for compressive strength.

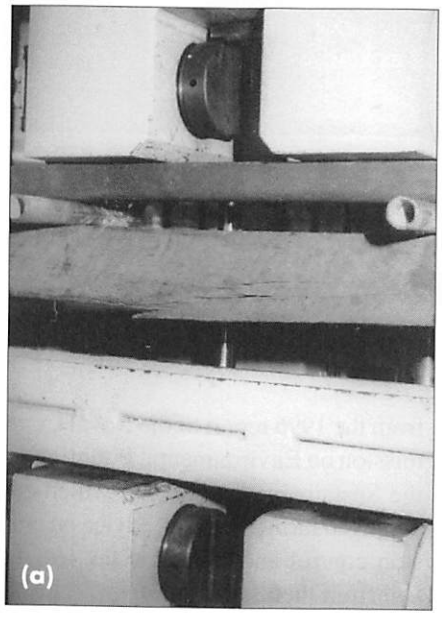
The results obtained showed that the properties evaluated were generally lower than those of small clear specimens. The average strengths at maximum frequency of occurrence were found to be: bending, 52 MPa; tensile, 57 MPa; and compressive, 32 MPa. These compared favourably with those of cypress (a common timber source) which were: bending strength, 68 MPa; tensile strength, not known; and compressive strength, 37.8 MPa (values for small clear specimens at 12% moisture content). It was concluded that blue-gum timber is a good structural material.

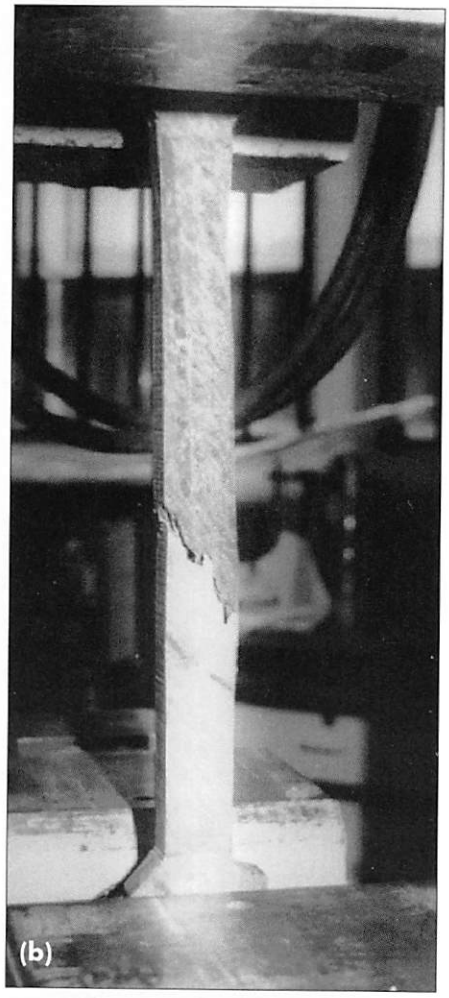


1. Introduction

Blue-gum, *Eucalyptus Saligna*, has become one of the predominant hardwood species in Kenya. This timber has not been evaluated mechanically for structural applications, consequently there has been little interest in the development of its timber products.

Boyd (1979) observed that most of the timber sold and used in farm houses is from softwoods. However, the rate at which these are being exploited in Kenya is quite alarming. The Daily Nation Newspaper (Ndichu, 1996) predicted that the country may suffer a serious timber shortage in the next ten years if the present trend of timber consumption continues. One way to avert such a crisis is to identify other sources of timber. *Eucalyptus Saligna* is a good candidate for





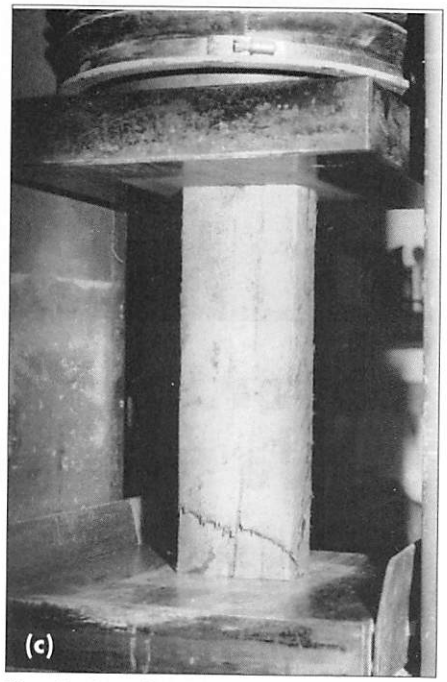


Fig. 1 Specimens under test for: (a) bending strength; (b) tensile strength; and (c) compressive strength.

Dr Lawrence Gumbe is Senior Lecturer and Stephen Ondimu is a former student, both at the Department of Agricultural Engineering, University of Nairobi, P.O.Box 30197, Nairobi, Kenya.

structural applications.

Even though timber from this species is quite common and is widely used for structural purposes, full data on its properties are not available. Campbell (1971) observed that *Eucalyptus Saligna* has been used mainly as poles and not a great deal in converted form in the construction industry, although there is no reason why this should be not be done. An understanding of its mechanical properties will enable more efficient and economic utilization and also will assist in the evaluation of the most effective secondary treatment to overcome its negative attributes so as to achieve a good quality product. The timber suffers from the drawback of being excessively water absorptive when exposed to the atmosphere. This knowledge is also helpful in design processes for manufactured wood products.

2. Objectives

The main objective of this study of *Eucalyptus Saligna* timber in structural sizes was to evaluate mechanical properties, namely:

1. bending strength;
2. tensile strength; and
3. compressive strength.

3. Literature review

Little work has been done on the properties of *Eucalyptus Saligna* timber. Campbell (1971) did some 24 tests on *Eucalyptus Saligna* poles from Uganda. He obtained a modulus of rupture of 1.14 MPa and modulus of elasticity of 2.59 MPa. Both values were obtained at 10% lower confidence limit. He concluded that *Eucalyptus Saligna* poles had a failure which was less abrupt and not so 'carroty' as that of Pine.

Recent work in this area has been done by Kagombe *et al.* (1994), who did tests on small clear specimens at an average moisture content of 12%. They obtained the compression and bending strengths as 52.2 MPa and 62.4 MPa, respectively. No work on tensile strengths has been done so far.

4. Materials and methods

Blue-gum timber of general structural grade was purchased from the University of Nairobi maintenance workshop. The tree was harvested from within the University of Nairobi grounds.

The test specimens were prepared, and the tests were carried out, according to the BS5820 (British Standards, 1979). Nine specimens of dimensions 50.8 mm x 101.6 mm x 2000 mm, seventeen specimens of sizes 25.4 mm x 76.2 mm x 685.8 mm and fifteen specimens of sizes 50.8 mm x 101.6 mm x 304.8 mm, were fabricated in the workshops at the Kenya Bureau of Standards. All visible defects were noted before any test. Specimens set up for bending, tensile and compressive tests are shown in *Figure 1.*

The bending strength was obtained from the formula:

$$f_b = F_{max}\, a/2W$$

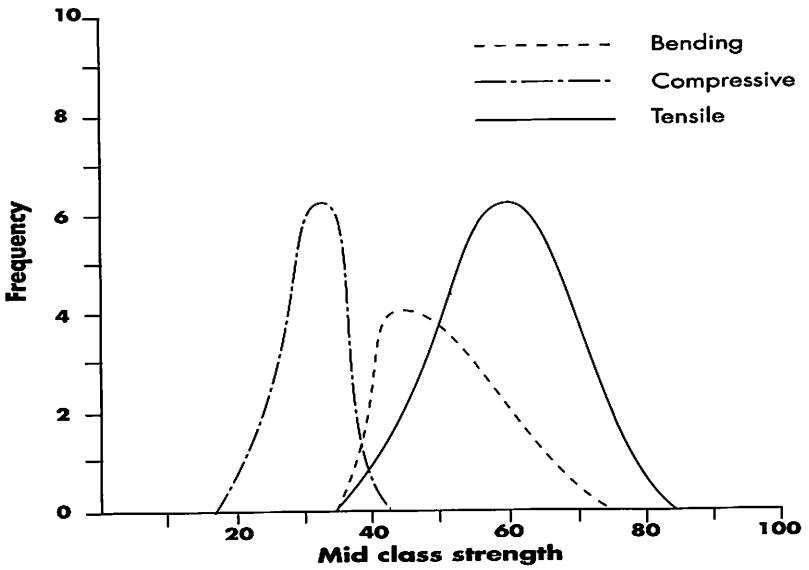


Fig. 2 Variation in frequency of occurrence with bending, tensile, and compressive strength.

Table 1 Values of bending strength for the test specimens.

Test no.	*Bending strength, MPa*	*Deviation from mean, %*
1	55.3	0.4
2	67.1	21.8
3	59.2	7.4
4	44.4	19.4
5	45.4	17.6
6	67.1	21.8
7	49.3	10.5
8	49.3	10.5
9	58.6	6.4
Mean	55.1	-

Table 2 Values of tensile strength for the test specimens.

Test no.	*Tensile strength, MPa*	*Deviation from mean, %*
1	51.1	17.3
2	45.2	26.9
3	68.0	6.2
4	60.3	2.4
5	51.2	17.1
6	52.6	14.9
7	53.4	13.6
8	64.8	4.9
9	67.5	9.2
10	56.1	9.2
11	60.1	2.8
12	56.8	8.1
13	73.0	18.1
14	51.5	16.7
15	74.5	20.6
16	56.9	7.9
17	107.4	73.8
Mean	68.1	-

Table 3 Values of compressive strength for the test specimens.

Test no.	*Compressive strength, MPa*	*Deviation from mean, %*
1	24.6	21.4
2	30.4	3.1
3	29.9	4.5
4	27.7	11.5
5	22.7	27.5
6	32.3	3.2
7	33.3	6.4
8	33.2	6.1
9	33.0	5.4
10	37.8	20.8
11	34.0	8.6
12	36.5	16.6
13	33.5	7.0
14	27.6	11.8
15	32.9	5.1
Mean	31.3	-

Table 4 Comparison of strengths with maximum frequency of occurence for structural elements of blue-gum with those for clear specimens.

Timber samples	*Strength, MPa*		
	Bending	*Tension*	*Compression*
Structural element	48	57	32
Clear specimen	62.4	-	52.2
Difference, %	23.1	-	38.7

where:

f_b = bending strength, Pa

F_{max} = maximum load, N

a = distance between an inner load point and the nearest support point, m

W = section modulus, m^3.

Table 5 Comparison of strengths with maximum frequency of occurence for small clear specimens of blue-gum with those of cypress and pine.

Timber samples	*Strength, MPa*	
	Bending	*Compression*
Blue-gum	62.4	52.2
Cypress	68	37.8
Pine	75.6	-

The section modulus was determined from the actual dimensions of the section, using the formula:

$W=I/y_{max}$

y_{max} = maximum height from the neutral axis to the extreme fibre in tension or compression, m

I = second moment of area, m^4.

The second moment of area was calculated from the equation:

$I=bh^3/12$

where b is the breadth of cross-section and h is the height of cross-section, m.

The tensile and compressive strengths were determined from the general formula:

$f = F_{max}/A$

Table 6 Summary of strength parameters for blue-gum.

Strength property	*Mean value, MPa*	*Value at max frequency, MPa*	*Standard deviation*	*Deviation from mean, %*
Bending	55.1	48	8.12	12.9
Tension	68.1	57	13.90	18.6
Compression	31.3	32	4.03	2.2

where: f is the strength, N/m^2; F_{max} is the maximum load, N; and A is the area of cross-section determined from its actual dimensions, m^2.

5. Results and discussion

Numerical values for the bending, tensile and compressive strengths determined for each specimen in the respective tests are presented in *Tables 1, 2 and 3.* The group frequencies of occurrence for the bending, tensile and compressive strengths are presented in *Figures 2, 3, and 4*, and are based on the number of test values falling into different strength intervals as represented by the midclass value of each interval. From these curves, the strengths with the maximum frequency of occurrence were taken to be the best representative of the three mechanical properties for the structural elements of *Eucalyptus Saligna* timber. A comparison between these values and those from small clear specimens are presented in *Table 4*, while the values compared with those of main timber sources i.e. cypress and pine are presented in *Table 5*. Mean values and standard deviations were also obtained for each property and are presented in *Table 6*. The curves of tensile and compressive strengths showed a normal distribution trend complying with tests carried out by Sunley (1956) whose study showed that the maximum frequency occurs near central strengths. The bending strength graph was skewed towards the left breaking the assumption of normal distribution.

6. Conclusions

At 28% moisture content, the strengths of *Eucalyptus Saligna* in structural sizes were found to be bending strength, 48 MPa, tensile strength, 57 MPa, and compressive strength, 32 MPa. These properties compared favourably with those of cypress (a common source of timber for structural purposes). The consumption of timber can therefore be diversified to exploit this timber source to avoid extreme exploitation of the two. Thus, *Eucalyptus Saligna* timber is a promising structural material. The strengths of structural elements are lower than those of small clear specimens. The tensile strength of timber was found to rank highest in value among the strength properties, followed by bending and compressive strengths.

Acknowledgements

The authors are grateful to the Dean's Committee, University of Nairobi, for funding the research work. The physical experiments were conducted at the Kenya Bureau of Standards, Nairobi, Kenya. The help of the Director and technicians of the Kenya Bureau of Standards is hereby acknowledged.

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Book reviews

Farmers for the Future

by Dan Looker

Publisher: Iowa State University Press

ISBN 0-8138-2383-8

Dan Looker is an agricultural journalist with his roots very much in rural America. He calls on both of these experiences in the writing of this book which considers the situation of young Americans who want to start out in productive agriculture.

In fact, a section from the introduction illustrates the author's aims: "For those bold young people who want to farm, this book is a first step towards a lifetime of learning about agriculture - and harvesting its true richness of self-reliance, a sense of place and community, and a love of the natural resources we have been given".

The work is divided into three sections:

i. Roots of Decline, Reasons for Renewal

ii. What's There to Help Young Farmers

iii. Farmers Helping Themselves

Each section is sub divided into chapters, each considering a facet of the problem (eg in the first section there are chapters on Boom & Bust, The Treadmill of Technology, etc). It is within these chapters that the journalist shows through. They are case studies taking real situations to illustrate the problem, then reporting on events and actions that have followed.

Perhaps I make the book sound like a series of well researched editorials 'strung together' to present the case for the future of farming. If so, good, because that is exactly what it is. Or perhaps more than that because it is not 'strung together' but thoughtfully built to present the issues and possible solutions. Yes, it is a very good piece of work.

Now, we have to ask whether it has relevance to the British experience. This is difficult to answer, but certainly my farming background was able to draw many parallels from the book. For certain, we can learn from the experiences considered.

For me it was a refreshingly honest approach to a major problem. An excellent book for any "young farmer" to read as he or she considers his or her future."

Machinery for Horticulture

by Brian Bell and Stewart Cousins

Publisher: Farming Press

ISBN 085236 369 9

Price £18.50 (hardback)

This is the second edition of this book which I first reviewed in 1992. At the time, I suggested that Brian Bell's experience of lecturing stood him in good stead when compiling an easy to follow, well prepared script. The fact that for this volume he has a co-author who is also a lecturer suggests the formula has worked and is repeated in this work. This is very much the case and produces a book which provides the reader with a sound basic knowledge of the range of tractors, machinery and equipment used in the horticultural industry. There are sections on tractors, self propelled machinery, cultivation, drilling and planting equipment, also crop equipment and harvesting machinery. Glasshouse, grass cutting and turf care equipment, together with machinery for estate and ground maintenance are also given considerable space.

The book finishes with a section dealing with horticultural workshops and sources of power. It must be pointed out that this is a basic text. Aimed very successfully at students and those intending to broaden their understanding of machinery for horticulture at a general operative and equipment selection level.

For them this text will prove invaluable, perhaps even a standard; important, as quality books in this discipline are few and far between.

MJH

Surveillance results show responsible use of pesticides

Surveillance results from 1996 show responsible use of pesticides for food production in the UK. The surveillance programme, carried out by the Working Party on Pesticide Residues (WPPR), covers the main food groups and also incorporates comprehensive diet studies to estimate overall human dietary exposure to pesticides.

Professor Ian Shaw, Chairman of the WPPR, said: "The WPPR's surveillance programme has been operating since 1977. Increasingly, we have seen evidence that where pesticide residues are present in the diet, they are virtually always at low, safe levels.

"From a variety of 3,400 samples of foodstuffs analysed last year, results demonstrate that 66 per cent showed no detectable residues, 34 per cent had residues below the maximum residue level (MRL), and less than one per cent were found to have levels above MRLs.

"As analytical techniques become more sensitive, we must expect to find more residues, albeit at very low levels. They have probably always been there, but it is only as techniques develop that they are being found.

"While the results show that consumers would not be at risk from the MRL exceedance, any findings of levels of pesticides above the MRL are investigated to ensure growers follow the rules set out to ensure that consumers can be confident in the safety of the food they buy."

The key findings of the 1996 report are as follows.

i. **Milk** - This report includes monitoring carried out following the findings in 1995 that 9 of the 216 samples of milk analysed exceeded the MRL for Lindane (gamma-HCH). The 1996 results indicated that, although there were some fluctuations of residue levels during the year, there were *no MRL exceedances*. The report also summarises the action that was taken to investigate possible causes of the 1995 residues.

ii. **Organophosphorus (OP) residues in carrots** - Following the monitoring results on variability of OP residues between individual carrots reported in the Working Party's 1994 and 1995 report, further monitoring (on imported carrots) has been included in the 1996 report. These results were first published in a Pesticides Safety Directorate briefing note in July 1996 and indicate a lower level and incidence of residues than that found in UK carrots; when calculated on a composite basis *only two of 22 samples contained residues and these were at levels well within the MRL.* Further monitoring is in progress to confirm the position.

iii. **UK winter lettuce** - Working Party surveillance has consistently revealed evidence of misuse of pesticides on UK winter lettuce in recent years. The 1996 report includes three winter lettuce surveys: retail surveillance; wholesale surveillance; and EU surveillance. Further evidence of misuse has been revealed but at a reduced level. Enforcement programmes to date have resulted in three successful prosecutions and seven warning letters. An enhanced enforcement programme is planned for 1997/98.

The results are found in the Working Party on Pesticide Residues Report for 1996 published recently, and available free of charge from MAFF. The report also contains a questionnaire seeking the views of readers on how the presentation of these important results can be further improved.

Farming community vote for Monetary Union

A top level conference entitled "Monetary Union is Inevitable" proved to be a resounding success at the National Agricultural Centre in Stoneleigh with a 'line-up' of heavyweight speakers including the ex-Governor of the Bank of England. Sponsored by Farming and Agricultural Finance Limited (FAF), and jointly organised by the Royal Agricultural Society of England (RASE) and the British Institute of Agricultural Consultants, the October event attracted a 100 strong audience which included landowners, farmers, farming consultants, solicitors and accountants.

Chairing the conference was FAF Group Managing Director Paul Mead who, at the end of the event, asked for a show of hands as to whether the audience was for or against joining the EMU. The result was an overwhelming 'yes' vote, a small number of abstentions and only three against. "There was a real sense of urgency among the speakers to join and it is up to each and every one of us to make our views known, lobby as necessary and preach to the unconverted", says Paul Mead.

"It's inevitable that monetary union is going to happen and business really needs to plan for this. We welcome the chancellor's statement (Monday 27 October) that the Government in principle favours economic monetary union and stresses the need for businesses to prepare for entry during the next Parliament."

Lord Kingsdown, better known as Robin Leigh Pemberton, told the conference: "Economic and political imperatives on Germany and France are strong enough to cause them to form an inner core EMU on time on January 1, 1999. The UK will not be ready to join then, but its general economic policies must converge with those of that union, leading in all probability to joining at a later date.

"In the intervening period, business in London and the UK will involve transactions in Euros. Failure in this respect or opposition to it could lead to adverse discrimination and increasing isolation, with serious effects on investment and employment," he added.

Lord Kingsdown went to on to say: "Europe needs to speak with one voice and on level terms with the United States; and to prepare for increasing competition from the Pacific rim. EMU will be the climax to all that Western Europe has achieved in the last 50 years in contrast to its history in the 50 years before that. Fragmented nationalism will not be an answer to the competitive world of the 21st century", he added.

Mr. David Jones, head of planning for Worcester-based Milk Marque told delegates that EMU was rather like a white knight. "In the dairy sector, the volatility

of sterling has been a key factor determining profitability of companies and farmers over the years."

He added that the recent strong pound had severely hit farmers. "The strengthening of the £ sterling since June 1 996 has had a direct impact on dairy support prices (intervention prices) and through these on the milk target price, bringing about a reduction of 20% in 12 months and taking prices back to the levels of five years ago."

David Jones concluded by saying that whilst EMU does not hold all the answers, with the UK a non-member in the short term, the result will be more trade distortion and uncertainty.

Denis Turner, Chief Economist for Midland Bank, summarised the key issues.

Arguments for joining EMU

- Lower transaction and hedging costs will help to boost cross border trade and economic integration.
- Interest rates are likely to be lower, and inflation kept under control contributing to a more stable environment.
- Participation will put the UK at the heart of Europe and help it determine the agenda.
- By staying outside, the UK risks losing inward investment.
- The EMU will underpin the European economic integration and help meet the challenge from Asia.

Arguments against joining EMU

- ♦ The UK has never had a monetary arrangement that has worked.
- ♦ The UK would lose monetary independence.
- ♦ The system implies social and political costs which would disadvantage UK industry.
- ♦ Economic policy will be determined by the needs of the strongest.
- ♦ The single market is working without a single currency.

Risks from UK's non-participation

* Higher foreign exchange transaction costs.
* Higher cost of managing exchange rate risk and/or potential loss of price competitiveness for those who do not protect themselves.
* If EMU is a success and the euro is strong, nominal and real interest rates in the UK are likely to be higher.
* The UK could become less attractive to foreign investors.

Insurance discounts for ATVs with Datatag

A revolutionary electronic tagging system is set to turn the rising tide of theft of All Terrain Vehicles (ATVs).

The market for ATVs is on the increase, but so are thefts; about 6000 are sold annually in the UK and about 1500 are stolen every year (NFU Mutual estimated UK figure for 1996, based on claims received). The dramatic increase in the theft of ATVs, from farms, parks, the Forestry Commission, etc, is posing a considerable problem. Insurers are facing heavy claims and some owners who have had their vehicles stolen repeatedly are deciding it is no longer worth replacing them.

NFU Mutual, which insures about 60% of all ATVs, first noticed a problem in 1992 when claims for stolen ATVs tripled. Theft escalated in 1993 and, in 1994, the company had to increase premiums significantly and introduce a £500 excess (reduced to £100 if the machine is locked away at night).

One very effective way of preventing theft and recovering stolen ATVs is offered by Datatag, a unique property marking system which has already proved remarkably successful in reducing motor cycle theft. NFU Mutual are so impressed with the property marking system that they have agreed to offer a 5% discount on insurance premiums on ATVs fitted and registered with Datatag. Special kits are now available for fitting by ATV dealers throughout the country.

Datatag was developed by multinational giants, Yamaha Motor and AEG Electronics, and is distributed by Hull-based security specialists, NPR Datatag Division. Originally designed to combat the problem of motor cycle theft, the marking system uses miniature passive transponders (tags) implanted within the property to be protected. The tags vary from as small as a grain of rice to the size of a credit card and have been designed to withstand vibration, electrical and magnetic interference and acid attack. The tags are almost impossible to find and cannot be removed without causing major damage to the property.

Each transponder carries a unique identification number which is logged in the central Datatag computer with details of the owner and the tagged property. The system acts as a deterrent because easily identifiable property is both dangerous to the thief and has only a minimum resale value. Tagged items display visible identification labels and warning signs. Scanning equipment and Video Text terminals, which enable 24 hour access to the Datatag computer, are supplied to Police and Customs free of charge, upon request.

Richard Miles, Senior Surveyor with NFU Mutual, comments: "Thieves are increasingly targeting the countryside and ATVs are high on their shopping list. All terrain vehicles are ten times more likely to be stolen from farms than tractors, Land Rovers or cars, so it is important that they are well protected. Fitting Datatag not only deters the majority of opportunist criminals, but also enables machines which are stolen to be traced."

Speaking about the Datatag initiative, Bryan Collen, farmer and Chairman of the NFU National Technical Services Committee, adds: "For many farmers, particularly in upland areas, the ATV has become an essential piece of equipment, integral to their day-to-day operations. The loss of such equipment can have a major impact on their businesses, both short and long term.

"The problem of ATV theft is significant and unfortunately continuing to show an increase, despite the efforts of owners to protect them. Anything that will effectively contribute to reducing or discouraging theft, or aiding recovery of stolen property, must be welcomed."

Special kits for a variety of property are now available. With the backing of Yamaha, one of the world's largest companies, and the extensive infrastructure created for the police, Datatag has proved to be one of the most effective weapons in the fight against property theft.

Contact: **NPR Datatag Division, 01482 222070.**

Claas chooses LandStar for precision farming systems

Leading German agricultural equipment manufacturer, Claas, has chosen LandStar Differential GPS systems from Racal Survey for installation aboard its top of the range combine harvesters. The LandStar units will provide the precise positioning necessary for farmers using the Claas' advanced precision farming system. This enables farmers to map crop yields and apply fertilisers only to those parts of a field needing them and to achieve significant cost savings as a result. It also helps to prevent environmental damage by reducing the run-off of chemicals from fertilised fields.

Farmers using Claas combine harvesters equipped with LandStar DGPS will be able to automatically plot their positions to within one metre anywhere in Europe, in any weather and at any time of the day or night. The new service now enables them to create yield maps with a precision that has not been possible before. Although Britain and Germany are the largest markets for precision farming systems, LandStar can also be used in many other parts of the world and offers significant advantages to a major equipment exporter such as Claas. The same LandStar unit can also provide one metre positioning throughout North America, southern Africa, Australia, New Zealand and Indonesia and the service has recently become available in South America and the Middle East.

Claas spokesman, Laurence Rooke, said that his company welcomed the launch of a new breed of communications satellite which has finally made precision farming a realistic proposition. "Claas has had some excellent yield mapping technology available since 1992," he said, "but we have been unable to launch it onto the market because the positioning services that the techniques need have not been reliable or accurate enough. The arrival of LandStar means that we are finally able to offer farmers a more efficient and cost effective way of working."

The new LandStar service is used to provide corrections to the signals received from the US operated Global Positioning System (GPS) satellites. Although GPS signals are freely available, the US governnent deliberately distorts them to make them unsuitable for non-military use. Uncorrected GPS signals can be inaccurate by up to 100 metres which, although adequate for general navigation, is quite unsuitable for precision farming.

Racal Survey has established a network of reference stations around the world which are able to measure the deliberate errors being applied to the GPS signals and to calculate the amount by which they must be corrected to restore their accuracy. These calculations are then transmitted to LandStar users via one of the new generation of communications satellites. These use powerful spot beams to relay the corrections down to users of precision farming systems whose yield maps can then be created with the necessary accuracy.

The strength of the spot beam transmissions is such that the LandStar correction signals can be received by farmers using only a small saucer-sized antenna. LandStar receivers can be bought as separate units and retro-fitted to a vehicle or they can be incorporated within a yield mapping system's hardware. The compact size of the complete LandStar unit also makes it suitable for use on smaller vehicles so that farmers can now save money by performing their own soil sampling projects and plotting their test locations with unparalleled accuracy.

Racal Survey is a world leader in the provision of precise positioning. It was the first company in the world to offer a commercial Differential GPS service and now provides a wide range of positioning and survey services to the demanding offshore oil and gas industry. It is part of the international Racal Electronics Group which has operations worldwide and annual turnover of more than £1 billion. Racal Survey has a global network of 23 business units that provide a complete range of integrated services including geophysical and geotechnical surveys, unmanned underwater vehicle manufacture and operation, high accuracy positioning, vessel and vehicle tracking and data management services. These are provided to land and offshore industries for oil and gas exploration and construction, telecommunications, surveying, mapping and agriculture.

Visit Racal on the World Wide Web at http://www.racal.com

Deere to acquire Dutch sprayer manufacturer

Deere & Company has reached an agreement to acquire the shares of the Dutch machinery company Douven. The agreement is subject to approval by the German anti-trust authorities. Terms of the transaction have not been disclosed.

Douven, based in Horst, Netherlands, is a leading European producer of high specification mounted, trailed and self-propelled sprayers, including orchard models. The company is also involved in the development of precision farming applications.

Douven will retain responsibility for product development and manufacturing, and will continue to provide products and service to its customers through its existing distribution network, under the Douven brand name. It employs 65 people, with sales this year worth in the region of US$8 million.

Deere & Company, with more than 34,000 employees worldwide, manufactures products in 11 countries and markets products in more than 160 countries. Annual net sales and revenues in 1996 exceeded US$11 billion worldwide. The organisation manufactures, distributes and finances a full range of equipment for agriculture, construction, forestry and public works, as well as a range of commercial and consumer equipment for sports and amenity turf applications.

Rich pickings from Cattron

Cattron (UK) Ltd has supplied Traymaster Ltd with a portable radio remote control (PRRC) system to safely control one of their machines

Remote control of a compost turner

which is used extensively within the mushroom industry.

Traymaster are specialists in the design, manufacture, installation and servicing of mechanical handling systems for the commercial production of mushrooms. The company has led the field in development and innovation in mushroom process mechanisation since its inception. As a result of this, Traymaster machines are used daily on mushroom farms throughout the world.

Their specification requirements were very precise: they required a radio transmitter and receiver with a range of 100 m or more. The receiver needed to be powered by a 24 volt DC supply from a diesel engine battery and housed in an IP65 enclosure, complete with a remote mounted antenna and 3 m lead. The transmitter had to be hand held, push button with a protective carry case and capable of operating for a minimum of 12 hours per day before needing to be recharged.

Durability was also an important factor in the specification requirements. The controller needed to be able to withstand harsh working environments with temperatures ranging from minus 5∞C up to 40∞C or more. In addition, all equipment needed to be supplied to current CE Standards, complete with operator's and maintenance manual.

The Cattron portable radio remote control system is used to control a compost turner which has been supplied to one of Traymaster's clients in Southern Ireland. The compost turner forms rows of compost which are regularly turned, giving a cross mix to break down the compost structure. The unit is a very slow moving piece of equipment which would normally have its own operator. With the portable radio remote controller, the unit can now be operated by the driver of a front end loader who is working close by. This substantially reduces the chance of accidents by allowing the operator to choose the safest vantage point to operate the compost turner. In addition, the system eliminates potentially dangerous communication problems which can arise in a noisy working environment such as this.

Cattron has operations in the USA, Canada, United Kingdom and South Africa and is supported by an extensive sales and distribution network throughout North & South America, Europe, Asia, Africa and Australia. With over 50 years service to industry, the company has become a world leader in the development, manufacture, and installation of radio and infrared portable remote control systems, RF data links, and related equipment. Its controls are suitable for all industries, from railroads to shipyards; mining to aerospace; steel to agriculture; military to amusement parks; material handling and much more.

Contact: **Nicola Moore, Cattron (UK) Ltd, Riverdene Industrial Estate, Molesey Road, Walton-on-Thames, Surrey KT12 4RY. Tel: 01932 247 511.**

The world's smallest tachometer

Graham & White Instruments announce the availability of the ALL NEW TM-4010 low cost, hand-held tachometer, which is claimed to be the world's smallest. This fully featured instrument offers contact or non-contact operation modes for the accurate measurement of both rotational and linear speeds, giving results on an easy-to-read, 6 digit LCD display.

In optical mode, the instrument operates by projecting a red light beam onto the target surface. Reflected light pulses from a strip of glass sphere tape on the target surface are monitored and converted, using an exclusive microprocessor chip, into a direct numerical reading in rpm or rev/s, both to a resolution of 0.1.

Contact mode also enables the user to measure rotational speed. In addition, linear speeds can be monitored in units of m/min, cm/sec, ft/min, inch/sec and yard/min.

User friendly features include 'On Target' and 'Low Battery' indicators, together with onboard memory for up to 8 individual measurements. Housed in a compact ABS case weighing only 140 g, power is derived from 3 AAA size batteries giving a life in excess of 12 months operation in normal use. Each instrument is supplied with batteries, carry case, all accessories, instructions, and a full 2 year warranty.

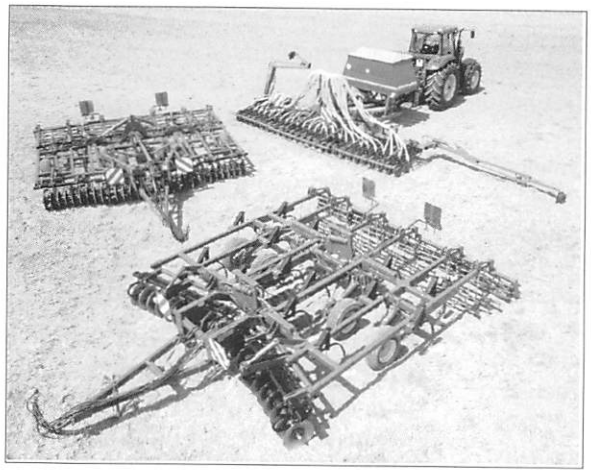
The TM-4010 is a robust, long life, general purpose instrument, ideal for all speed measurement problems commonly met throughout manufacturing, process, commerce, farming and maintenance industries.

Contact: **David White, Graham & White Instruments Ltd, 135 Hatfield Road, St Albans, AL1 4LZ. Tel: 01727 861110.**

New mulch tillage and seeding system

A completely new range of cultivation and seeding equipment for minimum or conventional tillage systems has been introduced by John Deere. Designed and built at Deere's European factory in Zweibrucken, Germany, the machines complement the existing tractor and harvester ranges, enabling the company to offer customers a full line of basic farm equipment. Full parts and service support will be available from the John Deere dealer network.

The range includes the 410A mulch tiller, the 420A mulch finisher and the 740A mulch drill, which incorporates the company's well proven seeding units produced in the USA. All three trailed machines will fit individually into tillage and seeding systems currently in use throughout Europe, but can also offer a complete system solution for cost-effective crop production on large arable farms.



New mulch drill and tillage range.

Long-term trends across Europe are towards larger farms and more contractors using higher power tractors pulling wider implements, including non-powered combination tillage implements working to shallow depths. The John Deere mulch tillage system is designed for farmers who wish to reduce their unit costs of production, and maximise profit. They can be used in situations where conventional ploughing and secondary cultivations may be considered too expensive, and continuous no-till systems unsuitable in terms of crop establishment and weed build-up. The machines offer high workrates, reducing the number of field passes and therefore minimising soil erosion, and are effective at mixing and incorporating straw residues, fertilisers and manures.

410A mulch tiller

The 410A mulch tiller is a versatile combination tool for stubble breaking and primary tillage at depths of 5 to 15 cm, behind higher power tractors from 112 to 195 kW. It is available in working widths of 4.6, 5.3 and 6 m, folding to 2.9 or 3 m for transport depending on model. It features rows of disc gangs and spring suspended sweep tines on a heavy-duty frame for effective incorporation of residues, directly after the combine.

The front disc gang works at a 14∞ angle at 23 cm spacings, and is optionally hydraulically adjustable on the move, according to soil conditions. Three rows of sweep tines have an 81 cm underframe clearance, and a 25 cm trip height with a trip force of 295 kg for reliable protection from stones and other obstacles.

The 41 cm wide sweeps are set at 35 cm spacings with a 6 cm overlap and shallow angle to optimise the flow of residues through the implement. The single point depth setting is fast and convenient, with large gauge wheels within the frame f o r accurate depth measurement.

Prices of the new John Deere 410A mulch tiller are £25,707 for the 4.6 m, £28,255 for the 5.3 m, and £29,972 for the 6 m version.

420A mulch finisher

The 420A mulch finisher is designed for secondary tillage and seedbed preparation to depths of between 4 and 12 cm, or primary stubble tillage under good conditions. Working widths are 5.7 and 7.1 m, folding to 3 m for transport. The mulch finisher uses a different frame arrangement of discs and sweep tines, and requires the same size tractors as the mulch tiller.

It features an 8∞ front disc gang angle at 18 cm spacings, while the four rows of sweep tines have a lower 61 cm underframe clearance, and the same 25 cm trip height with a trip force of 61 kg. The narrower 26 cm wide sweeps are set at 23 cm spacings with a 3 cm overlap.

A robust, flexible spike tooth harrow and suspended roller at the rear of both the 410A and 420A provide a good, even finish, and implement brakes and road warning lights are standard. The flexwing frame design enables the implements to follow ground contours on uneven land.

Prices of the new John Deere 420A mulch finisher are £27,289 for the 5.7 m model, and £29,832 for the 7.1 m version.

740A mulch drill

With the 740A mulch drill and the 750A no-till drill, John Deere now has two machines to cover the range of drilling systems from conventional to zero tillage. The 740A mulch drill comes in working widths of 6 and 8 m, with respective hopper capacities of 2300 or 3500 litres - the latter being the industry's largest - and a common transport width of 3 m.

Use of the mulch drill can save farmers time and free up larger tractors for other, heavier work, compared with conventional primary plus secondary tillage and drilling systems. It features an active hydraulic system and John Deere's patented double disc openers. The drill can be used with lower power tractors from 75 and 90 kW for high output drilling at working speeds of 8 to 14 km/h in minimum tillage conditions, such as those left by the John Deere mulch tiller and finisher, as well as in more conventionally prepared seedbeds.

Row spacing is 15 cm on the 6 m model, which has 40 openers, while the 8 m version offers a slightly wider 15.3 cm spacing with 52 openers, staggered for better residue flow through the machine.

The double disc openers are made from cast aluminium and feature 1.25 cm offset blades to cut the seed slot, with large dimension rubber press wheels. A simple hand-operated depth setting provides working depths of 1.2 to 7 cm, and there is adjustable hydraulic down-pressure of up to 45 kg on each opener, giving total independent depth control.

Floating flex-wings on the 8 m model adapt to uneven surfaces, and employ two gauge wheels for extra stability. The drill

uses the same field-proven Accord air seeding system as the John Deere no-till drill, and again implement brakes and road warning lights are standard.

Prices of the new John Deere 740A mulch drill are £31,515 for the 6 m model, and £36,000 for the 8 m version.

Contact: **David Whitworth, John Deere Ltd, Langar, Nottingham, NG13 9HT. Tel: 01949 860491.**

Sisis Ecospray

The Sisis Ecospray has been designed to minimise 'drift' and can therefore be used in adverse weather conditions. The Ecospray may be towed or fully mounted behind the Sisis 321, trucksters, pickups, etc.

Each of the five fully floating units has a mesh shroud which is scientifically designed to allow the correct amount of air flow to reduce drift to a minimum, whilst maintaining droplet size. Each unit has three nozzles fitted with bubble jets which give the correct spray pattern across the full width of the sprayer. The

bubble jets give a hollow droplet which bursts to give a more uniform droplet size which also reduces drift and improves leaf contact.

The diaphragm pump may be driven directly on the PTO or by PTO shaft. The tank is 320 litres capacity. Ball monitors show that all nozzles are operating correctly. A hand lance, clean water tank and dirty clothes locker are fitted as standard.

The spraying width is 4.03 m and the units fold for transport between sites.

Contact: **Lynn Hilton, SISIS EQUIPMENT (Macclesfield) Ltd, Hurdsfield, Macclesfield, Cheshire, SK10 2LZ Tel: 01625 503030.**

Electric seed drill drive (ESA) with DGPS

For the pneumatic seed drills DA, DL, DT, DV, DF, DG and DP, Kverneland Accord offers a new electric drive of the metering device under the abbreviation, ESA

The system ESA offers the farmer the possibility to adjust the applied seed quantities according to yield and soil maps (cultivation according to partial field requirements) by the DGPS (differential, global positioning system). The data transfer from or to the PC is done by a chip card.

The ESA system, however, can also be used without the DGPS.

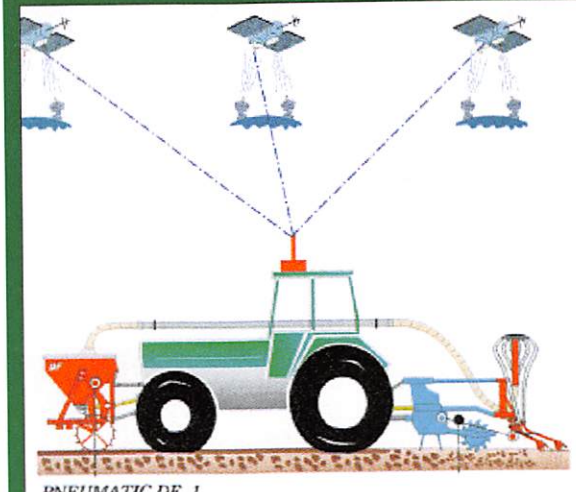
The metering devices are driven by 12 volt motors and are controlled by the in-cab computer. Data for different seeds and various calibration test results can be stored in the memory. Additional seed quantities can be increased or reduced via computer in proportional steps according to the partial field requirements. Standard equipment includes metering device shut-off which in the case of twin hopper machines, operates as a half-width shut-off device.

The in-cab computer controls all important functions such as fan revolution min/max, metering device, drive wheel, hopper, speed and the central seed flow. To ensure smooth operation and comfort, all functions are constantly monitored by the adjustable LCD display. Any malfunctions are indicated to the operator by an acoustic signal.

A special new feature is incorporated into the software of the ESA. Featured as 'Continue sowing' this action allows for the early start of the metering device which is particularly important when sowing right into the corner of awkward shaped fields. Delivery of seed can be activated prior to the machine moving forward.

The in-cab computer has an integrated control system to check all sensors and functions.

Contact: **Ferrag Ltd, PO Box 90, Haydock Lane, Haydock Industrial Estate, St Helens, Merseyside WA11 9UU. Tel: 01942 272777.**



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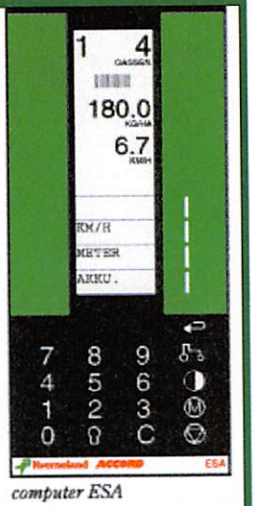

computer ESA

Institution of Agricultural Engineers

National Conference • AGM Annual Luncheon • Awards Ceremony

Tuesday, 12 May 1998, at Silsoe College, Silsoe, Bedford registration from 08.45

A celebration on the 60th anniversary of the founding of the I AgrE in 1938

The conference will focus on the challenge to Agricultural Engineeers in a changing and increasingly competitive environment, with its implications for the knowledge and skills needed for the future. Authoritative speakers from agriculture, the engineering industry, food retailing, research and economics will present their views.

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Guest Speakers

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Vice President Operations, New Holland North America, Immediate Past President, ASAE

Martin B Van Zwanenberg
Divisional Director, Marks & Spencer plc

Dr Michael Murphy
Department of Land Economy, University of Cambridge

Ambassador Bo Kjellen
Ministry of the Environment, Stockholm, Sweden

Dr Michael Kelly
Building Design Unit, Scottish Agricultural College
Past Chairman, Rural Design and Building Association

Prof. Francis Sevila
University of Montpelier, France
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