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ABSTRACTS OF PRESENTATIONS

Challenges for Crop Production: A Global Perspective

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The reasons underlying the 2007/08 global food “crisis” were many and include speculation, increased demand for grains, export bans on selected foodstuffs, inadequate grain stocks, higher oil prices, poor harvests and the use of crop lands for the production of biofuels. Together they have reawakened concerns about food security and its dependence on, and interactions with, energy and water securities.

Climate change also played a part in the “crisis” both directly because poor rainfall in south western and south eastern Australia reduced tradable wheat grain (especially to China) during 2007 and indirectly because actions to mitigate anticipated changes in climate through encouragement of biofuel production, while small globally in terms of the amount of land diverted from crop production to biofuel production, have had a disproportionate effect on reducing tradable grains from the USA.

A consequence of these global issues is that food security and food production are back on the political agenda of the UK. Crop production that minimises water pollution and greenhouse gas emissions, enhances local food brands and contributes to multi-functional outputs from land is the local manifestation of the global challenge.

This paper reviews the present knowledge of recorded impacts of climate change and variability on crop production, in order to estimate its contribution to the current situation. Many studies demonstrate increased regional temperatures over the last 40 years (often through greater increases in minimum rather than maximum temperatures) but effects on crop yields are mixed. Distinguishing climate effects from changes in yield resulting from improved crop management and genotypes is difficult but phenological changes affecting sowing, maturity and disease incidence are emerging. Anthropogenic factors appear to be a significant contributory factor to the observed decline in rainfall. Adaptation of crop production practices and other components of the food system contributing to food security in response to variable and changing climates have occurred, but those households without adequate livelihoods are most in danger of becoming food insecure. Overall, we conclude that changing climate is a small contributor to the current food crisis but cannot be ignored.

Soil quality and minimum tillage

Bruce Ball[1] and Blair McKenzie[2]
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The preservation of good soil structure is essential to maintain root penetration, uptake of nutrients by roots, soil water storage and flow and soil gas exchange. Maintenance of soil macroporosity is particularly important, especially in minimum tillage where ploughing to rectify compaction is not an option. A quick and simple field spade method of Visual Soil Structure Quality Assessment (VSSQA) is presented which requires little equipment or expertise to use. It involves digging out spadefuls of soil and comparing with a visual key. The structural quality can be used to determine any need to change crop or soil management. Scores ≤ 3 are considered acceptable. However, any areas and/or layers with consistently low scores (Sq4 or 5) may require improvement by tillage, drainage or different cropping. Such degraded soil is usually the result of compaction damage and is shown as pans, clods, smeared surfaces and smelly layers. Restoration of continuous macroporosity is then a priority. Some guidelines for improvement are given. Tillage to restore soil structure depends mainly on tensile soil failure and should only be done when the soil is dry enough to permit such failure. Guidelines for compaction prevention are also given. One possible method of control is to use controlled traffic where traffic is confined to permanent wheelways.

Minimum and no-tillage can increase the storage of carbon in soil organic matter (C sequestration). However, nitrous oxide emissions can also be greater under minimum and no-tillage. On wetter soils, these can wipe out the carbon-saving advantages of non-ploughing. Thus drier, coarser textured soils are more likely to save carbon and improve global warming potential. Such soils are also most suited economically to min till and to no-tillage and are the most suitable for successful non-ploughing.

Precision Farming and the potential to save costs

Tommy Clark
Kerchesters, Kelso
(Also works part time with Soil Essentials)

There is a substantial potential of precision farming techniques to save money and improve efficiency in crop production on most farms. With high input prices and precision farming hardware prices static the relative cost benefit ratio has never been better. The principles of agronomy within precision farming are no different to those in standard management, but the ability to manage within traditional boundaries can easily show a £50 per Ha increase in margin.
Techniques include zoned sampling for pH, P and K, in crop scanning for leaf area index and electromagnetic soil surveys. GPS Autosteer will reduce overlaps in turn allowing more accurate applications and reduced fuel usage. It also reduces the driving effort required by the operator, which in turn allows better concentration on other tasks and reduced fatigue.

The process of adopting precision farming can be daunting for the novice but there is plenty advice available and some funding from the Scottish Government.

Non Food Crop and Bioenergy Opportunities

Dr Elaine Booth,
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Non food crops can provide renewable, sustainable feedstocks for many market applications. There are also opportunities for bioenergy in the transport, electricity and heat sectors.

High Erucic Acid Rapeseed (HEAR) is an example of a currently grown crop with well developed agronomy for non food applications, in this case in the production of erucimide, a specialist slip agent used widely for polythene applications. A growing demand for biodegradable plastics will give further opportunities for crop starch from other crops well adapted to UK growing conditions; potato and cereals.

Fibre from hemp, a crop which has been shown to grow well in Scotland, can be used as a building material when mixed with lime, giving very good insulation properties and offering potential to lock up carbon for the life of the building. Further specialist opportunities may be developed in growing crops for pharmaceutical purposes, including opium poppy, which can be grown successfully in Scottish conditions and is processed in Scotland. Species native to Scotland also provide opportunities for non food use. These include bog myrtle which is now used in skin care and midge repellent products. Another native species, heath pea, or bitter vetch, has appetite suppressant properties and gives scope for development as a slimming aid.

The Scottish Government has particularly ambitious renewable energy targets, giving several opportunities for agriculture.

- Renewable energy for transport is currently limited to biodiesel and bioethanol and whilst it is predicted that much will be imported, the terms of the Renewable Transport Fuel Obligation requires an increasingly stringent environmental profile which may be difficult to achieve from some imports. It is anticipated that future biofuels will be derived from lignocellulose material, requiring biomass feedstocks.
- Biomass already has a role in renewable electricity generation, with the large electricity producers being required to use a growing proportion of purpose grown energy crops.
- Considerable targets for renewable heat have recently been announced and these offer particular possibilities for biomass crops. The main technology for increasing renewable heat is likely to be biomass based using distributed heat systems, improving the viability of biomass from the rural sector.

The agricultural and environmental implications of promoting biomass use in the UK are currently being assessed[1] and it is intended that this will help to guide development of the biomass area.

[1] SAC (2009). The potential impact on UK agriculture and environment of meeting renewable feedstock demand. Funded by National Non Food Crops Centre. *In preparation*.

Optimising your inputs in 2009

Dr Keith Dawson
SAC

There is no doubt that 2008 will remain long in the memory of Scottish Arable Farmers as the most difficult harvest and drilling campaign in the last fifty years. The winter crop hectarage has suffered massively from adverse drilling conditions caused by incessant rainfall. With grain prices falling back and fertiliser and fuel costs squeezing Scottish farmers are caught between a rock and a hard place. Soil problems are also evident in many fields with backward crops struggling in capped soils. Working capital requirements are increasing and the strength of the Euro will both be important factors. The threat of removal of crop protection products through misguided EU directives will be an increasing challenge to the whole industry and put more emphasis on varietal resistance.

The twin aims of maintaining and increasing productivity to feed the growing world population whilst protecting and enhancing the environment present a huge challenge to researchers, advisers and farmers. It will take all our efforts in partnership and an increase in systems based agricultural and environmental research funding to achieve these aims. Scotland is well placed to lead by example in this area

How can arable growers make the most of the current situation to maximise opportunities that arise and mitigate the challenges they face? There are a number of practical tools and approaches to make the most out of harvest 2009. The inputs we are targeting are seed, fuel, crop protection inputs, fertiliser and machinery. The major increases in costs have been with fuel and fertiliser but other areas can yield significant savings. In the seed area a few key areas are:

- Select a variety for the market
- Utilise new genetic material
- Consider blends and home saved seed – reduce variability
- Utilise seed testing diagnostics
- Use SAC Recommended Lists – prioritise character criteria to your own conditions
- Sow by plant number not weight!
- Select the right seed dressing.

Fertiliser costs have doubled in the last year, with only a part due to increase in energy costs. Lack of competition in the sector compared to crop protection is a cause for global concern. A number of areas to focus in on are:

- Soil analysis – full analysis every 3 – 5 years and **use it!**
- Adjust NPK applications according to soil status, crop requirement, previous crop and allow for any inorganic manures applied
- Adjust fully for organic manures – they are valuable at £15/t!

- Feed for potential –use response curves & Break Even Ratios
- Use best fertilisers eg urea and straights
- Use Precision Farming techniques – they work!

In the area of machinery and application the following opportunities are available:

- Poor N spreading only shows at +/-20%
- Calibrate regularly – rate and spread pattern
- Precision Farming – it works!!!!
- Poor spraying costs £££££
- Calibration – the right nozzles, replaced timeously
- Recreational Water Carriage – 250t of water saved on 500ha with 100/ha
- Operator training and certification.

In the area of crop protection, using wheat as a model there are a number of areas for optimisation:

- Opus and Proline remain choice for Septoria tritici. Generic epoxi - Cortez
- Use Proline or Tracker for eyespot-low risk in 2009
- Remove Bravo & use Prosaro with Tracker if rust risk on septoria susceptible variety
- Use low rate strobs Comet/Jenton to improve rust control
- Low mildew/rust risk in 2009-don't overspend
- Use Talius or Cyflamid for mildew- only if there!
- Avoid expensive blockbuster pre mixes.

Competition in this area will keep prices lower and needs to be leveraged. The strength of the Euro will have an impact, but is being absorbed by chemical manufacturers to a greater extent than fertiliser manufacturers!

In summary the way forward is to:

- Budget costs of production
- If you don't measure – you can't manage
- Get the best independent advice based on good research
- Marketing strategy related to costs of production
- Plan and take account of all input factors
- Attention to detail critical
- Think Twice – Spend Once!

Exploiting diversity in cereal production

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Diversity is important for cereal crops as it introduces stability, increases yield and reduces disease. This has been demonstrated in barley and wheat crops both for high quality end uses such as bread-making and malting, and for feed. We have also demonstrated its value in winter wheat for distilling where the yield and alcohol production gains are small, but stability is enhanced. Winter barley mixtures were grown in different types of 'patchy' distributions using a farm drill over three successive years to investigate practical, on-farm ways of sowing mixtures without the expense of pre-mixing grain. Mixtures of winter barley varieties were also trialled using five different soil cultivation techniques using varieties with different rooting characteristics. Mixtures gave yield increases and disease reduction in most of these treatments, demonstrating their practicality in a wide range of farming systems. We found that some varieties are adapted to high or low soil disturbance conditions whereas others performed similarly under both types of conditions. Choosing varieties either as monocultures or components of mixtures should be done as part of an integrated crop protection and agronomy approach aimed at optimising performance whilst reducing risk. Information from the RERAD-funded barley pathology work at SAC and SCRI which includes utilisation of resistance elicitors, disease tolerance and escape, is being developed into risk analysis tools for growers.