COLLOQUIUM OF ORGANIC RESEARCHERS

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By Hugh Raven, Director, Soil Association Scotland

It's a great pleasure to have been asked to speak today, and on a subject that – while I can claim no expertise – has occupied my thoughts intermittently over the last 25 years.

I did at one stage seriously consider whether your profession was the one I wished to follow. I attended agricultural college in the late 1970s, and while my family had a farm, it seemed unlikely I would be the one asked to manage it. So I thought if I were to pursue a career in agriculture, either writing about it or researching how to improve it seemed very real career opportunities.

I took a different route, for a variety of reasons – most of them not germane to our subject today. But it is true to say that much of what I saw then had the effect of turning me away from agricultural research.

I first went to college shortly after the 1979 change of government, and some here will recall the incoming minister – Peter Walker – exalting the UK's farmers to ever greater levels of production.

I had looked for a college at which I could study organic agriculture – unsuccessfully, as the only place I could find was a small place in Sussex, which I didn't think would fulfil the other needs typical of a male teenager.

At Harper Adams, which I therefore chose, there was with one honourable exception no interest whatever among the 80-odd staff in organic production. The college bursar, a

well-respected figure, openly derided it as “muck and magic”. That was typical of the time and of the place.

The quality of much that was taught was highly dubious. During my sandwich year, I looked after a herd of free-range pigs on fertile but heavy land in the English county of Buckinghamshire. I could not fail to note that the sows derived a significant proportion of their nutritional needs from grazing the rye grass on which they were folded. From memory, I think we concluded that a breeding sow could obtain about a third of her nutritional needs from grazing over the course of the production cycle.

So I was surprised to be told by our lecturer in pig husbandry that this was physiologically impossible. Monogastric animals are incapable of digesting cellulose, we were informed, so all the nutritional needs of the domestic pig – whether kept indoors or out – had to be met by supplementary feed. To have written anything else in an examination would have been to court failure.

We learned agronomy and modern techniques in pest and parasite control that relied very heavily on poisons. One such chemical – I recall its name as Temik – was so toxic, we were told by our lecturer with a quiver of excitement, that a single speck would be a fatal to a human being. It was incorporated in soil, to control nematodes in potatoes.

At the time the college was involved in a range of agricultural research, including a project investigating the effects of feeding various unusual substances to cattle. I don’t think they included ruminant derived protein – an experiment conducted elsewhere with an ultimate price tag of over £4 billion. But I do remember considerable interest in the effects on growth rates of feeding beef

cattle the dust scraped from the inside of power station chimneys.

These are random recollections from a typical agricultural education a quarter of a century ago. To me they represent the perversion – almost the corruption, although I don't think that is quite an accurate term – of what should be one of the noblest professions.

And I find it very heartening that the priorities have changed so much in the intervening years as to fill a hall such as this to debate what is, I believe, genuinely the public interest in agricultural research.

I have been asked to think about what would be my priorities for that research community. I'd like to outline four areas that I think each deserves far greater attention than they have received so far.

1. Land use and climate change

It is surprising and somewhat alarming how little understood are the implications of land use change, including agriculture, for greenhouse gas emissions. To give an example, we are at the very early stages of understanding the implications of changes in forest management, and particularly the processes which determine the balance between CO_2 and CH_4 emissions from the decay of wood. By the same token, our understanding of the carbon cycle in agriculture is rudimentary.

a) With respect to soil carbon - soils are hugely significant as a store, as a sink and as a source of carbon. This subject is of particular importance here in Scotland, where our deep upland peats contain some two-thirds of the UK's entire soil-borne carbon reserves. The UK has around 15% of the world's blanket peat.[1]

Work from the Macaulay Land Use Research Institute[2] has estimated that nearly a sixth of Scotland's land surface is overlain by deep peat soils. This represents about 5000 tonnes of carbon stored per hectare, or about 10 times the equivalent stored in the mineral soils . Taken together, the carbon stored in the peaty soils of Scotland is about 170 times more than stored in all the vegetation of Scotland.

But our understanding of what causes the further deposition of carbon, and conversely the release of carbon from changes in soil conditions – for example

[1] Parliamentary Office of Science and Technology, Postnote no 265, July 2006, London
[2] Review of the Contribution to Climate Change of Organic Soils Under Different Land Uses, - Chapman, Towers, Williams, Coull and Paterson. Macaulay Land Use Research Institute, Aberdeen, 2001

through changes in hydrography, burning, and changes in vegetative cover – is still very undeveloped.

We know that the tillage associated with conventional arable production tends to reduce carbon levels and has the potential to shed many hundreds of tonnes of carbon per hectare. Conversely, organic arable practices that incorporate crop residues and other by-products have the potential significantly to increase soil carbon on a sustainable basis. These known facts have yet to feed through into changes in arable practice – and doubtless there are many research projects that could be initiated trying to achieve precisely this purpose.

Conclusions of the work at the Macaulay include the need for more accurate assessments of the distribution of soil-borne carbon, and improved data collection on land use changes, to allow assessments of the scale of this elephant in the room.

b) Nitrous Oxide.
There is good evidence – including in an influential paper published in Science several years ago[3] – that the release of nitrous oxide, a greenhouse gas with 200 times the global warming potential of carbon dioxide, is the largest contribution of agriculture to climate change. Many in the organic movement cite research indicating that conventional farming practice is responsible for much larger unit area emissions of nitrous oxide than organic husbandry. Recently that conclusion has been called into question, and it seems that variations in organic techniques, application and spreading practices, etc, themselves have a huge impact on the level of nitrous oxide emissions. The imperative of better understanding

[3] Greenhouse gases in intensive agriculture: contributions of individual gases to the radiative forcing of the atmosphere. Robertson, Paul, and Harwood, Science Vol 289, 15 September 2000

these processes surely merits this being a major priority for the organic research community.

c) Energy use in agriculture.
It seems extraordinary that one still sees numerous references to work by Leech in the late 1970s, conducted after the first oil shock, on energy input-output ratios in food production. Surely this will ultimately be one of the key determinants of sustainability – yet it's hardly mentioned in public discourse. Again the organic movement thinks it has a good story to tell, and there is some evidence to back this up – including a MAFF research project from 2000 that concluded "Organically grown crops require around 50% of the energy input per unit area than do conventional crops, largely because of lower, or zero, fertiliser and pesticide energy inputs."[4] If I were a young researcher looking for a specialism, I think this is where I would alight.

[4] Energy Use in Organic Farming Systems, ADAS Terrington, MAFF Research Report OF0182, 2000

2. Horticulture

It is a commonplace of the debate on health and well-being in Scotland that increased consumption of fruit and vegetables is essential. The NHS's review of the Scottish Diet Action Plan, published a week ago today, reported that in the ten years since that plan was first published the "daily consumption of fruit and vegetables remains at around 246 grams a day whereas the target was to achieve a minimum of 400 grams per person per day."[5] We also know that the transport intensity of many fresh fruit and vegetables consumed in this country is completely unsustainable.

So Scotland needs to eat more fruit and vegetables and become more self-sufficient in those that can be grown here. So we need a far better understanding of what will thrive in our climatic and soil conditions, the most appropriate husbandry techniques under different growing conditions, and how to integrate such crops with other agricultural and horticultural operations. I know Audrey Litterick and colleagues at SAC here in Scotland, has been working on precisely this question – but the magnitude and importance of this subject merits considerable extra effort in support of their work.

[5] Review of the Scottish Diet Action Plan: Progress and Impacts 1996 – 2006, Lang, Dowler and Hunter, NHS Health Scotland, 2006

3. Future production in Scotland's hills

With the move to the single farm payment, we are already seeing a radical reduction in livestock production in the hills and uplands. Figures released recently showed a decline of around 400,000 in the number of sheep in the Scottish Highlands in recent years.

Yet we also know that many of the land uses which the public has consistently shown it is prepared to pay to support – such as the extensive livestock production systems that have had such an important role in shaping our landscapes – are currently under serious threat.

Production systems which maintain and enhance soil carbon levels, that can be integrated with the public's taste for increasing woodland coverage, that enhance – or at least don't diminish – the capacity of farmland to buffer catchments from drought and flood conditions, and that produce animal fats with beneficial health-giving properties, are all legitimate areas for further research.

Scotland's upland communities need much clearer leadership on how to use their most important natural resource – land.

4. Aquaculture

Finally, pursuing the theme of beneficial fats, it is also worth mentioning the global move of the aquaculture industry – particularly farmed salmon - away from the use of fish oils. Vegetable oils are increasingly substituting fish oils, as more sustainable and less contaminated alternatives.

Historically aquaculture has accounted for the large majority of global fish oil consumption. As fish oil supplies come under increasing pressure (and the FAO projects that demand will outstrip supply at the end of this decade), and as alarm at the human health implications of PCB and dioxin contamination of marine oils increases, demand for vegetable oils to feed fish is growing very rapidly.

Those of us involved in developing organic aquaculture would like to investigate this seriously – but the shortage of organically-grown vegetable oils with appropriate nutritional profiles for feeding to fish is a serious constraint. When I, and colleagues in the Soil Association looked into this last year, we identified one UK organic farmer with a serious commitment to organic oil seed production. He has since emigrated.

There is a growing and potentially highly lucrative market niche here, but a great deal more research needs to be done on the practicalities.

Conclusion

I recognise that these priorities strongly reflect the conditions and pressures existing here in Scotland. At a global level, these may be of passing or even incidental importance. Soil and water conservation, drought resistance, nitrogen fixing, integrated cropping, management techniques to withstand pest and disease problems, etc – doubtless all of these are far more significant to the future capacity of humanity to feed itself.

For all my negative comments earlier about UK historic research priorities, we can at least in the UK count ourselves lucky that our agricultural ecosystems are robust and more or less reliable. That comparative luxury does not apply elsewhere.

These random thoughts from an amateur risk underestimating the importance of your profession. Though it may not be apparent from what I've said, I recognise and salute that.

But I cannot put it better myself than Colin Tudge, whose profoundly wise and important book *So Shall We Reap* points out the eternal verity that no task is more important for humanity than feeding itself sustainably. As he says,

"If the world took its lead from good farmers and good cooks, and if science were content to serve those traditional crafts, humanity would have nothing at all to worry about. It's only the economists and politicians who are screwing things up – they, and the scientists who have so complaisantly flocked to their cause."

I hope we can be confident that his stricture does not apply to those here. For that – for you, and for your work – we should be very grateful.