

VIEWPOINT

ISSUES IN UK AGRICULTURAL RESEARCH, DEVELOPMENT AND EXTENSION: DO WE NEED A NEW VISION TO MEET TODAY'S CHALLENGES?

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The public funding of agricultural research, development and extension in the United Kingdom has declined significantly since the mid-1980s with successive governments taking the view that production research and associated knowledge transfer should largely be left to the private sector. Hence, there has been a move towards creating rules and procedures that allow the intellectual capital built up by the likes of plant breeders and agrochemical developers to be protected through patents, plant breeders rights and other mechanisms to protect intellectual property (IP). Extension services have also largely been left to the private sector. But does this model of private sector research and knowledge transfer always work? What about 'far-to-market' technologies which are not immediately commercialisable? What about those technologies which are for the general good of agricultural advancement, but will never show a commercial return? Here I argue there is a strong case for the Government to take a much bolder lead in shaping the medium term UK agricultural research agenda.

The Global Context

The world population continues to grow at an alarming rate. By 2050 there will be 40% more people in the world than there are today: in excess of 9 billion compared to 6.5 billion today, with the growth rate currently running at 211,090 people every day (77 million people per year) (United Nations 2004, CIA, 2007). This in itself is not the real issue: what is critical is that agricultural productivity is failing to keep pace. In 1950, grain production was 250 kg/person/year. In 1984 its historical peak was 339 kg/person/year. Today it stands at less than 308 kg/person/year (Brown, 2005). After nearly tripling from 1950 to 1996, the grain harvest has stayed reasonably flat for about a decade, and in the last few years production has fallen well short of consumption leading to a critical erosion of world stocks. During the last half of the twentieth century the world's farmers more than doubled the productivity of their lands, raising grain yield from 1.1 tonnes per hectare in 1950 to 2.7 tonnes per hectare in 2000. This rise was driven by genetic advances (increasing the proportion of the plant's photosynthetic product going to the seed), agronomic improvements (expanding irrigation, using more fertiliser and controlling fungal diseases, insect pests and weeds) and synergies between the two. Never before has there been an advance remotely approaching this one – we are not guaranteed another.

Population and productivity gains are not the only challenges. According to the Consultative Group on International Agricultural Research (CGIAR) "rising food prices, concern over global climate change, the energy crisis and

new interest in the potential of biofuels have ushered in a new era of challenge and opportunity for agriculture and natural resource management."

According to the *World Development Report 2008* (World Bank, 2008), investment in agriculture research has "paid off handsomely," delivering an average rate of return of 43 percent in 700 development projects evaluated in developing countries. CGIAR maintains that strong programs of relevant and effective agricultural research must be at the top of the international development agenda, if the Millennium Development Goals of halving hunger and poverty by 2015 are to be met and if these gains are to be expanded in the decades to come.

The UK Position

Thirtle *et al* (2004) analysed the total factor productivity (TFP) growth in UK agriculture, from 1953-2000. They showed that prior to 1984 TFP grew at 1.68% per annum and after that date at only 0.26%. Furthermore, they noted that International comparisons showed that the UK had fallen far behind the leading EU countries. They noted that this real decline could be explained mainly by **cuts in Research & Development Expenditure** and the **demise of public extension**.

There are a number of issues arising from this analysis:

Lack of **Emphasis on the Production Agriculture Research Agenda** – the current DEFRA Public Service Agreements (PSA's) are focused on:

- securing a healthy natural environment for today and the future
- Leading the global effort to avoid dangerous climate change (DEFRA, 2008a).

There is no reference to food production there. Despite the fact that food security does now seem to be a more strategic issue with recent reviews by both the Cabinet Office (2008) and DEFRA itself (DEFRA 2008b), the overarching departmental objectives (and thus its research priorities) do not appear to have caught up.

Levels of Expenditure.

Not only has the emphasis of DEFRA's research expenditure changed, so the amount of money has declined. According to Leaver (2008) until the mid-1980's when the government began withdrawing its support for agricultural R&D, the UK was in the 'high-level technology club' of nations (with USA, France, Netherlands, Belgium and Denmark) as measured by Total Factor Productivity (TFP) indices. Thereafter, growth in productivity in the UK fell considerably relative to the other five. UK public sector R&D in agricultural research peaked in 1983 and by 1989 was 12.5% lower. Leaver also notes that there are also indications that those in the 'low-level growth of technology club' (Ireland, Italy, Germany, Greece, Luxembourg) are now beginning to overtake the UK.

Decline of Applied Research.

In addition to the decline in agricultural R & D expenditure, Leaver (2008) notes that Government policies for R&D (across all sectors) have focused on producing world-class basic scientific research in universities and research institutes, but the successes here have been at the expense of applied R&D aimed at improving industry productivity and competitiveness. He concludes that the impact on agricultural R&D has been a major erosion of research infrastructure and expertise in both universities and research institutes. A vacuum has been created between basic scientific research and practice. This vacuum has not only reduced the ability of new science to be translated successfully into practice, it has also stifled innovation at the applied level.

Andrews (2008) goes further arguing that part of the problem is the way research is funded in the UK. She notes that researchers are rarely financed as part of the project to communicate their results, often restricted through IPR because of the need for private funding for research. As funding channels become more scarce, she argues that researchers are all fighting for funding from a smaller and smaller cake. The relevance of this research to the farmer and to industry therefore becomes dependant solely upon the contributor's priorities which may or may not consider the farmers needs.

Coupled with this, she also notes that fewer and fewer agricultural students in the UK are moving into applied scientific research, especially in the crop and livestock sectors. Human health, genomics and pharmaceutical research attracts students away from applied research due to the greater funding available.

A Lack of Knowledge Transfer / Agricultural Extension.

Agricultural Extension in the UK was formally organised by Central Government in the period following World War II in 1946 as the National Agricultural Advisory Service (NAAS), which later became the Agricultural Development and Advisory Service (ADAS) in 1972 (Needham, 1998). According to Garforth (2004) by the mid-1980s the status of ADAS was deemed unsustainable, for two reasons:

Firstly UK farms were producing far too much food and the escalating cost of price support led government to question whether taxpayers should continue to foot the bill for technical and business advice to farmers. The strategic imperative that followed World War II had receded - farmers rather than the nation at large were the beneficiaries of the service, therefore, farmers should pay;

Secondly, the government of the day was committed to reducing the scale of government activity. It took the view that government should only be involved in providing those goods and services which the private sector is not willing to provide; and services for which government remains responsible should, where possible, be contracted out to the private sector.

Privatization did not happen overnight. Before the final sell-off, ADAS moved first from providing a free service to recovering an increasing proportion of its costs from clients (from 1986), then to an Agency outside of, but still answerable to, the Ministry (from 1992). In 1997 the Government

finally offered ADAS for sale through a tendering process, and sold it to a management team buy-out with venture capital backing. The government retained the elements relating to the provision of advice on matters relating to the public interest, including animal welfare, environmental protection and conservation. These parts of ADAS were retained within the public sector as the Farming and Rural Conservation Agency (FRCA) which later became the Rural Development Service (RDS) and then Natural England (NE).

Whilst private sector provision of both technical and business advice has flourished (and it would be wrong to use public money to compete with this advice as there is no evidence of a market failure), there does remain a market failure in terms of commercializing some of the applied research undertaken in academia or research institutes and getting it into industry

Loss of a key number of **Applied Research Institutes** as agricultural activity is 'consolidated' within the wider biological sciences agenda, which was exacerbated by the Agricultural and Food Research Council (AFRC) being subsumed into the Biotechnology and Biological Sciences Research Council (BBSRC) in 1994. The casualties over the last twenty five years or so include Letcombe Laboratory (1985); National Institute for Research in Dairying (1986); Weed Research Organisation (1986); Hill Farming Research Organisation (1987); Plant Breeding Institute (1987); Grassland Research Institute (1992); Long Ashton Research Station (2003); Silsoe Research Institute (2006) and the Hannah Research Institute (2007). The Institute of Grassland and Environmental Research (IGER) has just been subsumed by the University of Aberystwyth. This leaves just six independent agri-food research institutes in the UK: Babraham Institute (BI - Cambridge); Institute for Animal Health (IAH - Compton and Pirbright); Institute of Food Research (IFR - Norwich); John Innes Centre (JIC - Norwich); Roslin (RI - Edinburgh) and Rothamsted Research (Harpenden).

Decline of the **Role of Agriculture in the Higher Education (HE) Sector** – Long term decline in the sector has led to loss of both teaching and research capacity in the HE sector with the demise of institutions such as Seale-Hayne and Wye and the phasing out of agricultural courses at other Universities including Edinburgh and Aberdeen.

Action Needed for the Future

A new R&D vision to 2050 needs to have the following components: Greater emphasis by DEFRA on the **production agriculture agenda** which must complement the wider environment and climate change objectives of DEFRA. New policy documents now appear to recognise the strategic importance of food production, but the research objectives of the department need to catch up.

A proper assessment of the market failures within agricultural research, development and extension. Public money must never be used to support initiatives or projects which compete with private sector activity but there are clearly market failures in the applied research area. Government should

engage in a constructive dialogue with private sector research providers and identify areas of 'public good' research which are currently not funded.

A greater emphasis on applied R&D within appropriate University departments and research institutes, together with appropriate incentives to encourage more application of pure science research to industry needs.

More recognition for academia to engage in knowledge transfer and in industry engagement – the existing Research Assessment Exercise (RAE) is largely one-dimensional being based on the ranking of papers produced in relevant Journals. This has tended to favour pure science (and economics) research rather than its application to industry solutions.

Greater investment in agricultural training and education, including more postgraduate taught and PhD places in applied agricultural research.

A stronger partnership needed between DEFRA, the new industry levy board (AHDB), academia and industry to maximise the benefits available from agricultural R&D. Andrews (2008) notes that a structure needs to be established "to fill the gap between farmers, extension and research to provide a framework of "translators" – we don't necessarily just need more extension!" She argues this would be best achieved by building a 'translation service' into the new levy board strategic plan but that it must not re-invent the wheel or cause duplication, wasting more industry money and frustrating farmers even further.

Conclusion

Agriculture stands uniquely positioned to help combat many of the challenges we face today, both at national and global levels including food, fibre and energy production and wider sustainable development. The output of global agriculture needs to double, or possibly treble, in a little over forty years to meet the demands of changing food consumption and bioenergy. The private sector will continue to play a vital role in 'near-to-market' research and development, but a much greater emphasis on 'blue sky' and 'far-to-market' applied R&D is essential to ensure that technologies for the greater industry good are not discarded. Greater emphasis of knowledge transfer and commercialisation of applied research outcomes for industry is also of fundamental importance to the success of the UK agricultural industry.

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