ENVIRONMENT, SOCIAL AND ECONOMIC ASPECTS OF SUSTAINABLE FOOD SUPPLY, WITH SPECIAL REFERENCE TO PEST MANAGEMENT.

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Introduction

How do pesticides fit in with the wider debate about "more sustainable" agriculture? Pesticide use over the next few years may change in ways that reflect emerging debates about agriculture, science and sustainability.

"Sustainable" means carrying on in ways that do not jeopardise future generations to grow their food" (based on Brundtland definition – Our Common Future UN Report 1988). Major questions are being raised as to whether we can go on doing what we are – however successful it may be for delivering cheap food.

The **Public Sector Food Procurement Initiative** (www.defra.gov.uk/farm/policy/sustain/procurement/index) defined sustainability in food and farming as "systems of production, processing, marketing, distribution, and catering which meet the following five broad aims to:

- 1. Raise production and process standards
- 2. Increase tenders from small and local producers
- 3. Increase consumption of healthy and nutritious food
- 4. Reduce adverse environmental impacts of production and supply
- 5. Increase capacity of small and local suppliers to meet demand."

There are many definitions of sustainable food (www.sustainablefood.com/what), however my definition is simply: "food which is healthier for people and the planet". This addresses two major issues: a) what the WHO calls the "double burden" of a billion people obese, while nearly as many go hungry, b) major environmental concerns, such as, climate change, fossil fuel use and land & water use. Let us concentrate on the environmental aspects for the moment.

Environmental:

Reflecting the concerns about toxicity, the impacts on ecosystems and human health of pesticide use in the UK is costed at £300m (www.food.gov.uk). The bulk of that figure is accounted for by the environmental cost. The financial cost arising from policies to deal with the externalities (e.g. drinking water treatment) amounts to a further £130 M per annum. Hence, the total external cost of pesticide use in the UK is in the range of £430 M per annum (www.food.gov.uk).

At present, the main questions regarding pesticides use are about toxicity – to people and the environment. In future, questions regarding pesticide sustainability will have more to do with bigger environmental issues – environmental, social and economic concerns.

Along with everything else, pesticides will be measured for their carbon footprint.

And how do they fare? Globally, pesticide production releases 72 million tonnes of Greenhouse Gases (GHGs – a mixture of gases, mainly CO_2). Compare this with fertiliser production at 410 mt and the release of nitrous oxides from fertilised soils at 2122 mt of Co_2e (www.greenpeace.org). (This 'CO_2 Equivalent' translates the NOx into CO_2). In other words, fertilisers contribute over 25 × more to climate change than pesticides do.

New Pesticide Intitiatives

1. The forthcoming EU Directive "Sustainable Use of Pesticides" will present a range of challenges and opportunities for growers, suppliers and all in the food chain (www.pesticides.gov.uk). The Directive moves beyond existing regulatory systems, which rely on top down systems where pesticide users must follow what is on the label. Now, there is more responsibility throughout the chain to look for alternatives/substitutes, and apply IPM/Organic principles. The aim is to use pesticides more cleverly and to reduce their environmental impact in ways which make for more prolonged life of each pesticide. This is partly a matter of making pesticides with reduced environmental impacts. However, the Directive clearly wants users to look for alternatives that will drive towards the use of safer pesticides – and probably less pesticide. Users will also be trained in organic and IPM methods.

This Directive reflects a move away from strict regulatory approach that stops the worst – possible toxic exposures, to encouraging people and organisations to towards 'best practice'. This could fit with developments in the private sector.

2. Several UK retailers now require procedures that go beyond minimal regulation, particularly regarding elimination of pesticide residues. The reason for this is stated as 'that is what consumers want'. Sainsbury's want to be "residue free" (at least for insecticides and herbicides) within a few years; M&S claim to have banned 60 pesticides (although I was unable to find out

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which); Co-operative Retail uses a "hazard trigger" to ban over 100 pesticides; and even Lydl claims to have quality and reduced residues. These will all require new methods to measure and monitor. This change between 'law' and 'practice' in pesticide control reflects how manufacturers and retailers have longer time horizon than any government – and are keen to become more "sustainable".

System standards will develop in significance and proliferate for all sorts of issues – from 'ethical' to 'carbon'. The widely adopted pesticide standards system is GlobalGap (www.globalgap.org). The most comprehensive principles for various crops are from Sustainable Agriculture Initiative (SAI), a food industry platform promoting a more sustainable agriculture (www.saiplatform.org).

There is a plethora of Retailer Assurance schemes, including M&S's "Farm to Fork" & Tesco's "Nature's Choice". There is a greater need for many people in the supplier chains to have greater learning and skills in order to deliver these systems. It is not difficult to see how in future chemical manufacturers will need to sell not just their product, but also a value added service of how to deal with these systems.

Farm Models

Pesticides are part of a wider whole farm approach that takes in land use, labour, other chemicals, and machinery. The management process connects all, so changes to any element will affect the others.

The dominate way of thinking about agriculture in the last 50 years is called "productionist", as it concentrates on the production process – how to produce food as cheaply and efficiently as possible.

However, new ways of thinking about future agricultural science and technology are developing, and two different models are emerging. There is the "Life Science" approach that sees how science-based products can satisfy consumers better. (For "Productionist" read "Model T Ford", for "Life Science read "Toyota Prius"). The other model is "Public health-ecological" (Citroen 2CV) approach which seeks more preventative methods which see the great diversity in land as an asset rather than a problem. (For more see, 'Food Prices and the death of the Productionist Model' and the original book 'Food Wars').

A new intergovernmental panel, called IIASTD, has involved 30 countries and 400 participants in addressing the role of agricultural science: "The International Assessment of Agricultural Science and Technology for Development (IAASTD) coincides with the widespread realisation that despite significant scientific and technological achievements in our ability to increase agricultural productivity, we have been less attentive to some of the unintended social and ecological consequences of our achievements (www.agassessment.org)." Another recent Conference determined strategies to cope with the impacts of global environmental change on food systems and to assess the environmental and socio-economic consequences of adaptive responses aimed at improving food security (www.gecafs.org) Here are some of the issues they all address, presented as an Assessment of Environmental, Social and Economic impacts for the whole 'UK farm'.

Environmental

Energy Use: The *energy ratio* is equal to the food energy that is eaten, divided by the energy taken to present the food. This ratio was about 100 for traditional pre-industrial societies. It is now less than 1, as fossil fuel use has increased. It requires 10 – 30 calories for every beef calorie. Fruit and vegetable cultivation in the UK has an output/input ratio is between 2 and 0.1 – which means 1 calorie of food energy is produced for ten calories of energy input. This rises to 500 calories for one food calorie for winter glasshouse vegetables. The Food system is almost completely dependent on crude oil – a finite resource that will soon peak in production – for this energy input.

Water: Water as an environmental constraint is going to rise in the future. A typical meat-eating, milk guzzling, westerner consumes as much as a hundred times their own weight in water every day" (Pearce). It takes over 1000 cups of water to make the coffee for your one cup. It takes 2-5,000 litres of water to grow each kilogram of rice. Water that is tied up in growing and manufacturing products is called "virtual water". About 10% of all the water used in raising crops goes into the international 'virtual water' trade. It moves large volumes of water over colossal distances. Water equivalent to '20 Niles' is being moved around the world each year. It is estimated that annually, the UK "imports" 189 million cubic metre of African water as a result of the import of green beans. This is enough to provide 10 million Kenyans with drinking water (www.bdafrica.com).

Carbon Footprint: Climate change is the big issue, and agriculture's contribution is now under scrutiny. According to the UN, agriculture contributes about 20% of all Global Warming Potential (GWP) emissions globally (Stern Report), with the UK about half that – the rest being made up in the food chain (for details see Food Climate Research Network and, if you want to look at 'carbon counting' statistics in more detail, see my site www.carboncounter.info). Yet agriculture is not part of the (EU) Emissions Trading Scheme, which asks and expects every other area of business to do their bit to reduce emissions. The main source of agricultural GWP gases that we hear about is methane from animals (accounting for nearly 33% of agriculture's emissions). However…

Nitrogen Fertiliser: Nitrogen fertilisers give rise to various nitrous oxides, which are a major contributor to Greenhouse Gases (GHGs). "Reactive nitrogen" has 300 × more potential for Global Warming (GWP) than carbon dioxide (www.sustainablefood). According to the Stern Report, fertilisers account for 38% of the total agriculture GHGs. Added to this are the emissions created while making the nitrogen fertilisers through the energy intensive Haber process. This adds up to about 2-3 × all the UK (internal & external flight) aviation emissions.

Footprint on Land: The Ecological footprint (EF) measures the land used directly (about half – both here and round the world), half to energy consumption & pollution assimilation. This gives an estimate of the **total impact** on the environment. In the UK, food production translated into this geography, takes over 5.0 times the area of Britain – which is over a quarter of the total footprint of all our activities is due to food production (www.york.ac.uk).

Biodiversity: 75% of European food product diversity has been lost since 1900 (www.slowfood.org.uk). 30,000 vegetable varieties have become extinct in the last century, and one more is lost every six hours. The National Fruit Collection (Brogdale) houses 4000 varieties, yet only about a third of fruit sold in supermarkets are grown in UK, who sell about eight varieties. The Convention on Biodiversity (CBD) has a 2010 Target to "*achieve a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth*."

Social

The "social" elements of sustainable development usually refer to conditions of people in less developed countries – as without improvements to their social well-being it is hard to see how anything can be sustainable. The first brand to develop awareness of producer conditions is "Fair Trade". This sets out standards – that workers are paid at least their country's minimum wage. Because this often does not provide a 'living' wage, to cover basic needs, including food, shelter, education and health care for their families, the Fairtrade Foundation tries to ensure a better deal for disadvantaged and marginalised third world producers. They work directly with small farmer producers, and as part of their principles, try and reduce pesticide usage (PAN).

Food and farm wages are notoriously low. That is why there has to be a Wages Board in this country to ensure basic rates of pay. It is not just the producers who suffer, but many in the supply chains, including workers who are pickers, packers, and processors. For them, the concept of 'Ethical Trade' has been developed where retailers, trade unions and NGOs work together to try to enforce the UN International Labour Organisation Conventions, that cover H&S/Labour relations, Freedom of association and Child Labour.

Health and Safety on UK farms is poor. The Curry Report, largely seen as the "sustainable bible for UK farming" noted that farming is the most dangerous workplace in Britain. You are more likely to be killed at work on a farm (8 per 100,000) than any other UK workplace (e.g. Construction 3.7 per 100.100) (www.hse.org.uk). Within any risk assessment of the UK farm this is the priority. Second is the high incidence of musculo-skeletel disorders (MSDs) – about 80% farmers/farmworkers can expect to suffer from MSD at some point – far higher than the industrial average. Pesticide accidents and poisonings are very few and far between.

Economic

Markets

This double burden demonstrates that we cannot continue "leaving it to the market". When food production goes up, what happens? Prices plummet. CAP tried to deal with the conundrum, but this resulted in wine lakes and butter mountains, not to mention grubbing up many orchards and dumping cheap food on the rest of the world. But it has clearly given up on trying to manipulate the market.

Subsidies

Do subsidies contribute to sustainability? Where do they go? While sugar received massive subsidies up to 2005 for "Non farm" payments (export payments now stopped), more healthy foods like fruit & vegetables never received many subsidies (www.farmsubsidy.org). Subsidies from 2012 may well be geared to more sustainable systems, that take in carbon sequestration, healthier food and safer production. (www.sustainablefood.com/fecncap.html)

Spending

Numerous studies have examined consumer willingness-to-pay (WTP) in other countries for fresh produce or agricultural commodities produced using reduced or no pesticides – assuming that there is still plenty of food available. In general, results have shown that consumer WTP is modest, with most premiums falling in the 5-10% range. The UK consumer WTP is likely to be lower although there may still be the potential to add value to retail products. Even at a one per cent premium this would indicate a market benefit from the policy amounting to £8m annually (Cranfield & Magnusson, 2003). Clearly all these calculations are being overtaken by rising food prices, so that a lot more money may be coming into the system.

Costs

Other external costs are attracting concerns. Gordon Brown's Strategy Unit "is examining current and emerging trends in the production and consumption of food, the key drivers of those trends and the implications for the wider economy, society and the environment". This is the first such policy initiative since the war and reflects new political focus on food production and consumption. It estimates that over 70,000 early deaths could be avoided each year if we all ate our recommended "5 a day". He is also concerned about the lack of "food security" – we have only a few days supply in UK (www.cabinetoffice.gov.uk).

Possible Pesticide Issues

Clearly, pesticide concerns will be part of this overall picture. However, there are several particular issues with regard to pesticides and sustainability.

1. In relation to future resources. Pesticide manufacture is dependent upon fossil fuel, particularly oil. As oil production peaks within the next few years, questions

will be raised about the use of that oil. I would prefer to see it used to make pesticides than being set light to. But will that view prevail?

2. Resistance is going to be a big issue – With increasing resistance, how can it be delayed/dealt with. Clearly there is a role for Genetically Modified crops (GM) here, but can technology alone keep the pests at bay, or do we need a lot more land-based skills?

3. And what is the role of pesticides in relation to decreased use of nitrogen fertilisers? What is the likelihood of more – or fewer – pests when nitrogen use declines? As it must.

We could do with much more government research, like when I was young, to look at these types of issues. There is a case that the government should spend much more on IPM and GM. For now however, which of those three paradigms do you think can deliver what will be needed?

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