



Focus Group Fertiliser efficiency in horticulture

Mini-paper - Knowledge exchange to support sustainable intensification of vegetable production in the open field

Participatory learning for knowledge exchange in field based vegetable production

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Introduction

An immediate and future challenge for Europe-wide and global agriculture is to supply safe and affordable food, in sufficient quantity, in the context of a growing world population; to provide healthy food that delivers multiple green credentials for consumers and addresses public health concerns, and to reduce its impact on the environment in a context of resource scarcity. To achieve such impact and progress then technological and social solutions must be sought and involves the collaborative efforts of farmers, advisors, researchers and the wider industry.

Horticulture production systems are dominated by open field seasonal intensive crops, which all have additive nutrient requirements to produce profitable marketable yield. How to effectively manage nutrient loss to the environment is a key management objective for vegetable growers and how to comply with the legislative requirements for e.g. nitrate loss requires effective communication from policy makers through to end users. This mini paper will examine the current knowledge exchange networks to inform practice that exist for growers, the challenge of communicating with large and small grower businesses and solutions for effective communication using modern participatory approaches for the industry.



Models for knowledge exchange

Knowledge or “know how” is key to develop successful, sustainable and profitable Horticulture businesses. Traditional models of knowledge exchange have been constructed around cereal crops within a state dominated system which has provided significant long-term financial support, business and environmental management advice to farmers (Figure 1).

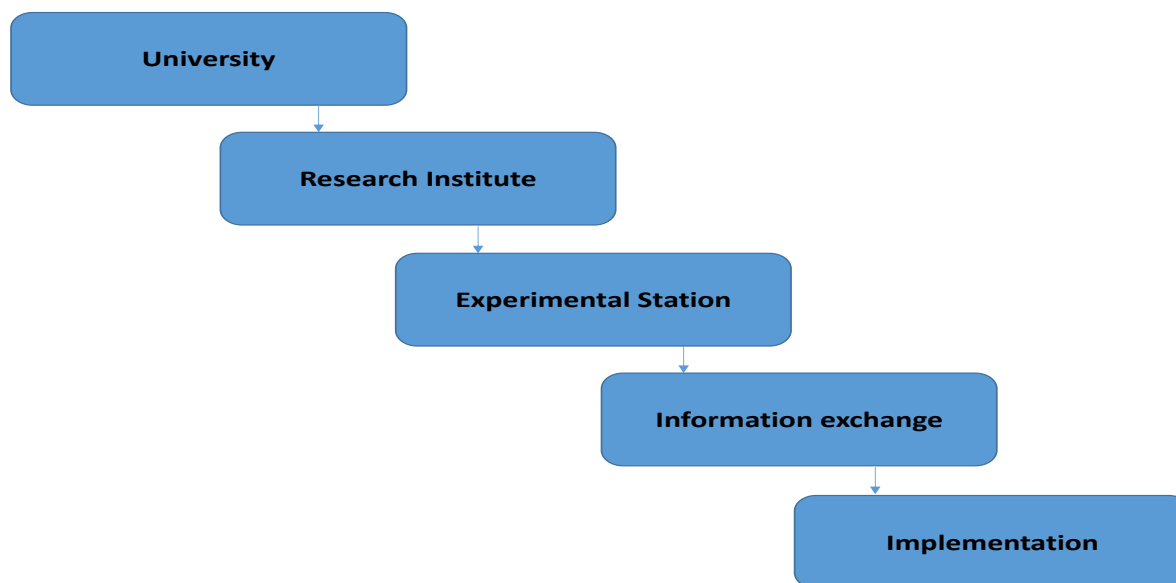


Figure 1 Traditional model of knowledge exchange, where knowledge flows from the academic community through to grower practice. Activities are broad and span from commercial gain through to environmental protection. The model was developed from the arable sector for primary producers and adopted for use by Horticulture; critical to the model functioning efficiently is the capacity to translate scientific findings to grower practice and requires specialist training in communication techniques. Knowledge sharing requires state or grower sourced funding to facilitate knowledge exchange activities. Early adopters of new approaches for the industry are powerful agents to drive change and create value from knowledge in the supply chain.

Reorganisation of extension services and in particular the privatisation into individual advisory companies across Europe has led to four major transformations in knowledge generated for application to practice for crop production activities (Labarthe and Laurent, 2013):

- i) Fewer investments by independent advisors in local experimentation and scientific monitoring,
- ii) Greater dependence on upstream industries which finance a large number of product testing trials,
- iii) Less organised control by farmers of applied research and less feedback through agricultural extension services,
- iv) A shift from a culture of joint management and secured public funding to one of calls for projects.

The transition from government funding to privatisation and the apparent lack of activity to bridge science and grower practice has exposed a funding gap for integrated advice. If it is to independently reach out to both smaller and larger farms, then some form of stable government sourced financial support is required. In areas of knowledge and grower activities that could be considered “cross

sector” e.g. soils, nutrients, energy, pesticides, the ability to exchange knowledge to benefit grower practice in privatised advisory networks has been significantly weakened. Whilst there has been a predominant shift to privatisation of the advisory network, this is far from ubiquitous, with some countries either maintaining a state dominated system or adopting a blend of private and state funded activities; all have different modes of delivery to the grower or farmer and grower.

Examples of advisory services across Europe and the USA

The complexity of the types of advice available include partial and impartial advisory approaches:

- The Danish Agricultural Advisory Service, is collectively farmer-owned and user-paid. One knowledge centre is the main supplier of professional knowledge, with advice offered by 31 independent local advisory centres.
- A fully privately supported model is offered in the Netherlands, where advice is provided by privatised consultancy companies, and by agribusiness co-operatives which give their own advice to growers.
- At the other end of the spectrum is Poland, which has a mostly state-run system. A central agricultural advisory system is supervised by the Ministry of Agriculture and Rural Development with 16 regional centres. In addition, there are: an advisory system created by local self-governments; systems created by private consultants and companies; an advisory system for forestry; and a separate advisory system within the farmers' organisation. Of 4856 advisers, only 200 are private.
- In Bulgaria **NAAS** (the National Agricultural Advisory Service) is state funded and is a department of the Ministry of Agriculture and Food and is a subsidiary body to the Minister of Agriculture and Food. Office provides consulting services to date information and technical assistance to farmers to implement efficient and competitive agriculture in Bulgaria. The main activity of **NAAS** is advising farmers working out of 27 offices which are distributed throughout throughout the country on a regional basis. **NAAS** also supports the transfer and application of scientific and practical achievements in the field of agriculture and thus to assist in the improvement of research translation to practice. NAAS also hosts a vocational training centre (VTC) whereby growers identify topics for discussion which are organised by NAAS as appropriate into seminars, demonstrations, lectures, discussions and thematic workshops. Detailed information is available on the website of the **NAAS**: www.naas.government.bg.
- In the UK the advisory service is fragmented and complex and advisors need to hold relevant professional nutrition and crop protection qualifications to advise grower businesses. There are several commercial agencies, together with the fertiliser producers providing consultancy. ADAS is the largest land based consultancy in the UK which provides a substantive 'applied research capability' to provide impartial quantitative scientific evidence to support implement on farm action to meet government and EU legislative requirements.
- In Germany, the federal states organise different research and advisory systems for agriculture and horticulture, ranging from public and state financed systems to private companies. An intermediate type of advisory system is the agricultural chambers, which is co-financed by land-based membership fees of the farmers, public funding as well as cost-recovery through fees for specific service and advisory contracts. Agricultural chambers are traditional organisations in Northrhine-Westfalia, Lower-Saxony and Schleswig-Holstein. Additionally, in some regions, collective farmer-owned advisory services exist, which commission applied research e.g. variety testing on site at grower holdings. Specific aspects of extension and advisory activities are usually funded publicly, such as monitoring and

administration functions or projects to stimulate socially desired innovation to minimise the potential impact of grower activities on the environment (Thomas, 2007).

- US land grant universities system is a key element of agricultural knowledge transfer in the US. Land grant status allows colleges to receive Federal funds in return for certain activities, which include agricultural advisory work. There is at least one land grant university in each State, and each has an agricultural advisory agency, although priorities will differ according to location. Some, but not all, activities are funded from the Federal budget, and land grant universities will work with the private sector on, for example, creating demonstrations. The land grant universities are just one part of the farm advice available: farmers "look to where the best information is for their question", which may be from a private seed manufacturer or "in some cases, farmers will band together and pay for a consultant." [Source: <http://www.publications.parliament.uk/pa/ld201012/ldselect/ldcom/171/17108.htm>]

Challenges for effective knowledge transfer for the vegetable production sector

In a diverse advisory landscape then the way for the grower to seek advice on a specific problem does appear complicated, and varies from country to country, with no clear route to "which approach is best" particularly for integrated advice which applies to the mitigation of nutrient and pesticide losses from field produced vegetable crops. An impact assessment carried out by the European Commission (EC) concurred with the findings of **AKIS** (Agricultural Knowledge and Innovation System): 'Currently new approaches take too long to reach the ground and that grower / farmers should be included from the start of the research process to inform improved practice.' The links for easy flow of information through to the end user have been fractured by changes in state funding policy. Despite the perceived and real difficulties in disseminating R&D outputs to grower practice, examples of effective integrated approaches addressing and solving grower focussed problems exist (Table 1).

Table 1 Case studies for participatory learning by all stakeholders through interaction between growers, scientists, consultants and policy makers.

Event	Objective	Actions
Diffuse pollution: Best practice programme for soft fruit in the South East region of the UK.	<i>To effectively communicate ground and surface water pollution risk and mitigation to the soft fruit industry in the SE region of the UK; this area of the UK has the conflicting pressures on water resources of a high population and favourable climatic conditions for food production.</i>	This work evaluated the potential of intensive Horticulture soft fruit 'table top' production systems to pollute ground and surface waters with nutrient and pesticide losses. The impact of the losses had not previously been quantified, so the work was novel and of significant interest to growers in meeting EU nutrient management legislative requirements; compliance is enforced by the UK Environment Agency. Using a combination of GIS and risk mapping combined with a detail knowledge of the range of commercial cropping systems then the areas of production that were most at risk of pollution were identified. To communicate the science and business impact then a series of workshops within South East England were delivered with four activity elements by talking to organised grower groups to cover; 1. Ground and surface water protection legislation; 2. The science of risk measurement; 3. Practical mitigation actions; 4. Farm demonstration, feedback and discussion with grower groups. This programme provides an example of multi-agency approach to assessing risk when formulating effective diffuse pollution mitigation strategies for immediate uptake by growers
Transition towards sustainable irrigation and fertigation strategies in the Netherlands.	<i>To develop networks of experts with growers to integrate knowledge to develop social, economic and environmentally sustainable crop production systems.</i>	A stakeholder network was developed in the Westland area comprising representative growers, polder boards, extension advisors, supply companies and local government which met bi-monthly to discuss strategies for irrigation and fertilisation use. Research gathered data and mapped emission routes and quantities of N leaching were measured. Using this approach, strategies for good and best practices were developed and implementation agreed by the selected participants. Further meetings discussed progress. By using a process of self-reflectance and peer group pressure, substantial improvements were made in the water and nutrient use efficiency. An important element which contributed to the effectiveness of this work was the scientific monitoring which provided soil, water and plant nutrient concentration data. This data was also used to construct predictive models which could be further used to identify and refine pollution mitigation strategies.
Demonstration of innovative fertilisation techniques and strategies to meet the manure action programme in Flanders.	<i>To demonstrate innovative fertilisation techniques to meet legislative nitrate losses for vegetable production areas in Flanders, including one-to-one targeted crop advice on farm</i>	At six different locations across Flanders, field trial platforms were carried out by the practical research centres for field based vegetable production. The trials carried out focussed on compliance with the nitrate directive. New techniques and strategies which could help the farmers to meet nitrate loss mitigation were demonstrated in the field. The trials provided answers for different fertilisation management techniques: Are the fertiliser application rates as set out in the action programme sufficiently high to grow high quality vegetables? How can we reduce the nitrate residue in the soil in autumn in intensive vegetable cropping systems (e.g. can catch crops have a significant role)? Grower group meetings were run alongside field site during demonstration days where presentations were given to provide additional information for farmers and advisors on the technical nature of the work. This provided additional insights into how the outputs from the work could be used for immediate uptake by growers. At these demonstration and information activities the Coordination Centre for Extension Services for Sustainable Fertilization (CVBB) advisors were also present. These advisor are funded by the Flemish Government. The advisors integrate the results of these trials in tailored advice on a farm and crop specific basis.

Any approach that attempts to deal with the environmental impact of intensively produced Horticulture crops, will require interactive, multi-actor and multi-agency approaches (Rahn, 2013). The communication between the parts of the 'system' will need to find a common language and clear messages (e.g. relevant to practice, information in a form that is familiar to the grower / farmer and that can assimilated easily for immediate uptake) imparted to growers so that cost effective actions can be taken by growers to address complex environmental issues, such as diffuse pollution of

fertiliser and pesticides. It is difficult to envisage a commercial funding stream which will support this 'grey area' of advice; as there is no tangible product to sell.

The main current types of knowledge exchange that are used to promote best practice can be ranked by order of impact as follows:

1. One to one advice.
2. Discussion groups and data sharing.
3. Structured workshop themed events.
4. Web site / summarised information.
5. Expert factsheets.
6. Trade press articles.
7. Sector specific conferences with a blend of business and R&D insights related to practice.
8. R&D scientific reports / scientific journal articles.

Peer group participation for a specific issue can be used to change grower behaviour in a constructive and interactive way (Table 1). Successful approaches are multi-activity / disciplinary and include practical implementation measures for immediate uptake by growers. A key message from these activities was that the most effective workshops were held at grower holdings as peer group pressure is an important part of the acceptance and need to change practice. An important question is how will this important work be funded and are current mechanisms of knowledge transfer 'fit for purpose'?

Possible future approaches for knowledge transfer and exchange within the EU

Effective knowledge transfer that will promote and support sustainable intensification of Horticulture production systems (Tilman et al., 2011), will require multiple approaches, with a range of skills sets. There must be an equitable distribution of strategic, applied science and application to current practice and the communication of clear messages for growers to improve the efficiency of production techniques and supply chains through to the consumer.

The Agri-Tech model: integrating private business interests in knowledge transfer and research

A new model that integrates knowledge is being part government funded in the UK as "Agri-Tech" catalyst projects, which are awarded in responsive mode, plus Agri-Tech Centres of Excellence (Figure 2). This idea is to integrate knowledge from the science, advisory and levy boards with 50% matched contribution from industry to facilitate knowledge exchange and drive increased productivity with environmental protection. In time, in the UK approach for Agri-Tech, government funding will cease and the Agri-Tech Centres will be entirely funded by industry. However, the funding of impartial advice and the expertise required to translate scientific findings to the wider industry (other than the industry partners of the centres) and the influence on grower practice remains uncertain.

In the Agri-Tech approach, the mechanism of knowledge transfer is bound by intellectual property as the businesses involved may have to provide up to 50% of the funds required to drive industrial research projects. The widespread uptake of innovation is business focussed and has therefore limited ability to be communicated to the benefit of the wider industry (e.g. growers); in fact there may be restrictions within the project partner agreements to restrict dissemination to the wider industry.

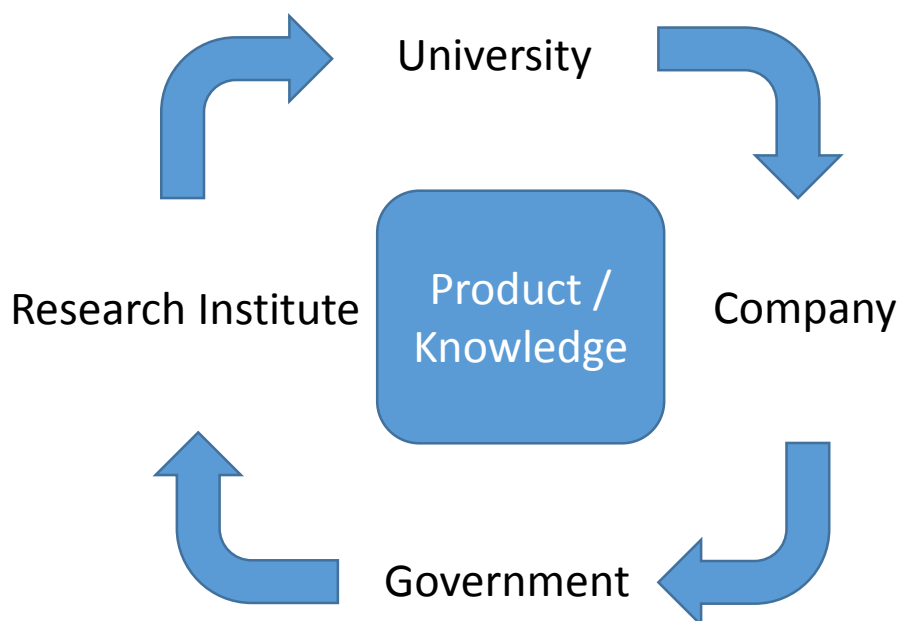


Figure 2 The Agri-Tech model [<http://www.agritechuk.org/strategy>] where product development or knowledge capture is business led and may only be used shared within a single company. Similar approaches exist in other MS, e.g. the Netherlands (Top sector policy).

Grower Groups

An important way that know how has been shared within horticulture is the 'grower group' where growers meet with advisors and scientists to discuss important industry issues (Table 1). In this way experience, knowledge of relevant R&D outputs and application can be integrated into a single event and is a strong example of participatory learning action. Participatory learning is also key to successful knowledge transfer, which involve practical grower engagement with quantitative R&D approaches, or increasingly direct grower participation in R&D projects e.g. UK HortLINK, Agri-Tech and Levy funded R&D by the Horticulture Development Company. Peer group participation and a shared understanding of the results or data from participatory R&D and their implication for practice remains a powerful mechanism upon which to facilitate behavioural change. There must exist within the group individuals who can translate the scientific findings to current grower practice and play an intermediate role between science and practice (Ekstrand, 2010; Ponzio et al., 2013). Multiple participants across the grower, research and advisory communities, locations and facilitates geographical spread and the potential involvement of smaller and larger growers at demonstration and communication events. A previous initiative in the UK, the 'LINK' programme, sought to encourage collaboration for industrially relevant research, a key output of which was knowledge transfer to the broad benefit of the Horticulture Industry. Pump priming for LINK came from the GINs (Defra funded Genetic Improvement Networks). These are pre-competitive strategic partnerships that foster innovation for the sector acting as an incubator and accelerator for new crop improvement ideas. The GINs have been instrumental in building a 'culture' of communication among industry, research and end-users working in wheat, oilseed rape, vegetable crops and pulses. These types of programme have been successful in identifying pre-competitive issues that could be used for knowledge transfer and also

encouraged the participation of smaller grower businesses and for the outputs to be widely disseminated.

Regional Operational Groups

The use of 'Operational Groups' where various types of actors participate to develop a common advance in primary production or for an entire supply chain may be an effective way to target a new type of grower led solution focused research and knowledge building. The catalyst for the identification for the need for Operational Groups has been through the European Innovation Partnership (EIP). A key output of the initiative has been to identify mechanisms for the effective information flow between research and practice. The groups must be grower led, and will require a strand of EU funding, but the nature of the work should be participatory and widely disseminated for immediate uptake by growers. The groups will bring together, applied and strategic researchers, advisors and KT experts. Furthermore, operational groups for example could be formulated in member states that deal with fertiliser recommendations, other focus groups could target recirculation systems, fertiliser fate and mitigation, resource use and so on for vegetable crops. A network of Focus groups that talk to their industry in each member state and on a regional basis, would be a powerful model for accelerated dissemination to practice and immediate uptake by growers within the EU (Figure 3).

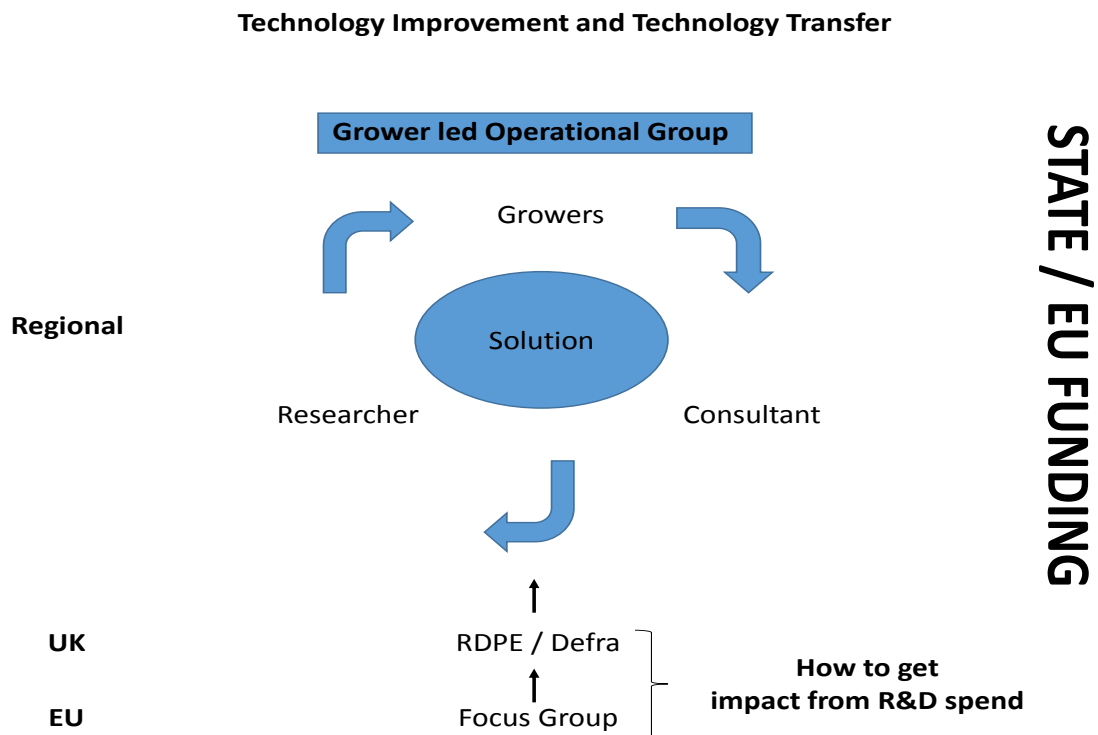


Figure 3 Regional operational grower led model for the UK, which is solution focussed and is route to impact for R&D spend and outputs. This approach will be inclusive to access small and large growers, to combine the latest technological developments with peer group knowledge transfer to drive solution focussed improvements in sustainable intensification of food production systems.

Summary

Advisory networks for growers that exist to improve practice, increase marketable yield, minimise waste and comply with environmental legislation have undergone radical change in the last 20 years. A modern open and impartial advisory network that will benefit all growers and that will effectively translate the latest scientific findings to grower practice is essential to realise sustainable intensification of field based vegetable production systems. Peer group participation with expert input from research scientists and consultants in the form of “Focus and Operational Groups” appear to be an effective way to impart the latest thinking to seek solutions to problems for immediate uptake into practice. The ability of these groups to link up on a regional and EU wide basis we envisage will provide a powerful model to maximise knowledge from the science and advisory base and accelerate solutions and advances for vegetable growers and farmers.

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