THE FUTURE OF WEED RESEARCH
HGCA, London, 19 November 2008

The idea for this one day meeting was stimulated by a growing concern about the decline in funding for weed research and concomitant decline in numbers of weed scientists in the UK, despite the many weed-related issues of economic and environmental importance that still exist, and the continuing (some would argue, expanding) need for integrated, sustainable approaches to weed management. The aim of meeting was therefore to consider future needs for weed research and training of weed specialists from the points of view of industry, funding bodies and research organisations.

The meeting was held at the HGCA headquarters in London, and the meeting room was filled to overflowing, showing that there is no shortage of interest in the subject, even if funding is declining!

The first session dealt with the current situation. Steve Moss from Rothamsted reported the results of a survey he had carried out into the age distribution of European Weed Research Society members in the UK. He reported that the average age was 54. Sixty five percent of members were over 50 years old, and only one was under 30. There was concern that if this is indicative of the age-profile of weed scientists in general, expertise will be lost as the older generation retires, which will not be replaced by younger recruits to the discipline.

James Clarke (ADAS) gave a presentation on current research in England & Wales. He identified four main areas, herbicide options including minor crops, herbicide resistance management, problem weeds and enhancing biodiversity. He pointed out that most of these were geared towards providing immediate solutions to current problems, and that there were few projects on basic biology.

Current research in Scotland was described by Peter Ianetta of SCRI. In contrast to the situation in England, there is a strong strategic programme of research with a balance between ecological and economic impacts. Peter emphasised objectives of identifying traits that encourage crop-weed co-existence and optimisation of productivity and biological diversity with minimum inputs. Key areas of research included Seed banks, genetic diversity, germination, dormancy, persistence, impact of crop competition, tillage, and fertilisers.

Bob Froud-Williams from the University of Reading spoke about the status of weed science in University education. Weed science is declining as a taught discipline in UK universities. As elsewhere in the world, there is an increasing emphasis on environmental issues and invasive alien species. Educational provision is greater at post-graduate level, especially in terms of Masters degrees.

In the discussion, it was noted that work on 'wild plants' was more readily funded than work on 'weeds'. Weed science as a discipline is disjointed, with a dichotomy between those who work on weed ecology and those who work on weed control.

The second session aimed to capture views on future requirements for research. Julian Hasler of the NFU presented the farmers' viewpoint. He emphasized that farmers want weed-free fields and expect a 'magic bullet' to achieve this. In general, they find integrated control and resistance management too complex. Agronomists are obliged to use insurance approach to ensure that weeds are minimised, in order to protect their livelihoods. There is currently a disconnect between weed research and farmers' requirements, e.g. farmers do not make use of crop competition or management of resistance to aid weed control.

Agronomists' viewpoints were presented by Jim Orson of TAG for the south and Mark Balingall of SAC for the north. Jim supported the view expressed by Julian; farmers will break all cultural rules and still expect the agronomist to keep the crop clean. However this will become increasingly difficult as products are lost, with few new ones being developed, and resistance problems increase, particularly to ALS herbicides. Farmers will have to lower their expectations in future, as a weed-free crop may become an unaffordable luxury. Water contamination is also an issue. He considered that the revision of EU 91/414 could render production uneconomic. Likewise Mark drew attention to the loss of active ingredients, particularly in the context of grass-weed control, notably annual meadow grass and bromes. Lack of active ingredients for grass and potatoes were also concerns. Longer term research needs include the impact of climate change, improved knowledge of dormancy, adapting to EU directives, and the use of GM and non-selective weed control options.

Anne Thompson (Dow AgroSciences), speaking on behalf of industry, reiterated the problems arising from loss of ai's through revision of EU 91/414, and the lack of new modes of action. She pointed out that 75% of global market is taken up by only six modes of action, and the last significant new mode of action was introduced in the 1980s. There are few new products in pipeline. There is a 'discovery dilemma': a long residual life, good soil mobility and activity in soil are desirable for weed control but a short residual life, low water solubility and high soil absorbtion are desirable environmentally, hence it is very difficult to find new ai's that perform well in both areas. Until new modes of action are developed, it is important to make best use of what is available and retain products

wherever possible.

Approaches to non-chemical weed control were outlined by Gareth Davies of the HDRA. Organic weed control is aimed at prevention. There is little funded research, and a 'DIY' approach is taken with an emphasis on information exchange through discussion groups. Rotations are integral to the system, which is pro-active and practically orientated towards prevention of weed build-up. There is a need for more information to be available to growers in a readily accessible form.

Djami Djeddour from CABI UK described recent developments in biological control of weeds. She emphasized that modern approaches are much safer than previously due to stringent controls, and risks are fully assessed before release. She described several promising developments for control of non-natives, the most advanced of which is a specific control agent for Japanese knotweed which is currently awaiting Government approval for release.

Non-natives are a particular problem in aquatic weed control, as outlined by Jonathan Newman of CEH. He explained that the productivity and survivorship of these is increasing due to greater eutrophication and warmer winters respectively. As a consequence there was an increased flood risk and implications for amenity and biodiversity. Tighter regulations and product withdrawals mean that here would be no herbicides left for submerged weeds from 2009. Mechanical is currently the main alternative but is environmentally damaging. There are biological, environmental and physical control options but these need further development. Invasive aliens were discussed by Ken Davies (SAC Edinburgh) in the context of climate change and changing cropping practices. Ken highlighted the increased occurrence of *Amaranthus* species and spring-germinating grass-weeds. Further consideration was also given to the problems caused by invasives in riparian and other non-crop situations, particularly Japanese knotweed, Himalayan balsam and giant hogweed. Climate change may encourage other species that are only locally a problem to spread further afield in the future, and control options are limited, difficult to use and often only partially effective.

The conservation interest and requirements of arable flora were considered by Kate Still of Plantlife, who identified gaps in our knowledge concerning the rare arable flora, notably the ecological response to environmental factors. In particular, more information is needed on seed longevity. Better management prescriptions are also needed for uncropped margins, the best agri-environment option for conserving rare arable plants. She emphasized the need to conserve 'natural' populations rather than rely on introductions, hence it was important to identify & target priority sites and historic landscapes

The roles of weeds in the agricultural ecosystem were discussed by Nigel Boatman from FERA. Weeds provide a food resource for other organisms and have a role in the functioning of the agro-ecosystem, hence a balance needs to be achieved between the need to minimise impacts on crop production and the maintenance of a healthy ecosystem. Many invertebrates dependent on weeds, also farmland birds depend on weeds directly (seeds) and indirectly (hosts for chick-food insects). Farmers favour agri-environment options that do not impinge on the cropped area but these need active management to be effective for species characteristic of arable land.

The third session examined the way forward. On behalf of CRD, Ingrid Den Hoed outlined the regulatory role of CRD in the context of herbicide registration and the need to address the risk of herbicide resistance. In common with previous speakers, she expressed concern as to the ability to manage resistance development with fewer active substances following re-registration requirements after revision of EU Regulation 91/414.

Graham Jellis of the HGCA addressed the research needs of farmers and growers. In a survey by the HGCA, weed management came sixth out of the top ten issues for research. Currently, weed control projects represent 5% of the HGCA budget. Priority areas are preparing for the future, minimising impact, and improved farmland biodiversity'

Finally, Cathy Knott (Independent consultant) considered research needs for minor crops. She reminded delegates that horticulture represented 22% of UK production value, however there is no Government funding for research into minor uses of herbicides. The UK spends less than any other European country in this respect. Failure to control weeds as a result of herbicide losses could render some crops uneconomic to produce. She considered that future research needs were a gap analysis, baseline survey data of weed floras in horticultural crops, cost-effective reliable and novel non-chemical approaches, bio-technology traits for herbicide tolerance and control of invasive aliens in relation to climate change.

Discussion

After the presentations there was a lively discussion of the issues raised during the talks. Key general points included the implications for knowledge transfer of the disjointed nature of weed research and the relative isolation of many research groups, the lack of underpinning research (except in Scotland), the problems arising from the reduced availability of a.i.'s as herbicides are lost and not replaced through new developments, and the fact that farmers may have to accept that fields cannot be kept weed free with herbicides. A new 'post-herbicide' paradigm including cultural and physical controls may be needed.

Several areas for development were identified. Knowledge transfer could be more effective, though levy bodies etc play a valuable role. In particular, loss of an integrated research/extension system in England and Wales has reduced effectiveness. Weed research should broaden its horizons to include plant molecular biology, ecophysiology and genetics. Considering weeds as 'wild plants' which are part of the agro-ecosystem will broaden the potential research and funding base. It was noted that invasive non-natives could provide a vehicle for underpinning research, as funding for work on these is often easier to acquire. New technology developments, including mechanical and physical control, and targeting of control measures, need further work to achieve their potential. The development of weed-suppressive crops also deserves more attention. The role of modelling caused some controversy, but it was concluded that it can be a useful tool provided the expectations are realistic. There was also a call for greater use of participative approaches as in organic weed control programmes, with the farmer as a full participant

The future of education in weed science was also a topic that raised considerable interest. One delegate questioned the ethics of promoting careers in weed science if jobs are not available. It was suggested that broader curricula would give more flexibility. The concept of weeds as 'wild plants' could be used to introduce weed science into the plant science curriculum. Agricultural systems could be used as examples to study plant population dynamics. Students need to be aware of implications of declining herbicide availability and effectiveness, and the need for new approaches/ methodologies for weed management. Outside the formal education system, it was suggested that EWRS could be more pro-active in awareness raising among farmers and advisers.

Improvement of interactions, both within the weed science profession and between weed scientists and others was a topic of concern. It was suggested that the UK Weed Liaison Group might broaden its base to cover plants within agro-ecosystems in a more general and holistic manner, and that a change of name to reflect this might be considered. Such a move could encourage broader membership and thus increase interactions among those working in weed-related disciplines which do not necessarily conform to traditional weed control-driven approaches. A possible approach might be to frame the remit of the group in terms of vegetation management rather than weed control. This could include positive management for conservation as well as negative (control), recognising role of weeds in agro-ecosystem and seeking to achieve the optimum balance.

Overall, the conference was successful in bringing together representatives of most of the organisations concerned with weed science in the UK and other interested parties, and the issues important to the future of weed research were thoroughly aired. The only disappointing element was the fact that three of the major funding organisations, Defra, BBSRC and Natural England, were not represented, despite being invited to give presentations. This fact alone encapsulates the major problem faced by weed science, particularly in England, i.e. a marked lack of interest from those who provide funding for research.

It is intended that all abstracts and presentations will be mounted on the AAB website along with a fuller summary of the discussion.

Nigel Boatman, March 2009