# THE ANNUAL BCPC WEED REVIEW 2017

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The 54th annual BCPC Weed Review "*Alternatives for weed control: picking the winners*" took place at Rothamsted on 9th November 2017, comprising an audience of over 90 invited delegates.

In his chairman's introduction, Joe Martin, Agriculture and Horticulture Development Board (AHDB) stated that this review was focussing on alternative options for weed control. Prior to this there was a short synopsis of the weather in 2016/17 compared to the 30-year mean (1981–2010) by Peter Lutman based on the national weather data from the Meteorological Office website. This was then used to explain the outcome of cropping practices and weed control in the last year. Overall, weather conditions were warm with a lack of substantial rainfall throughout the year. This led to favourable conditions for the sowing of autumn cereals and later sowing of crops, but with adequate rainfall to ensure good efficacy from pre-emergence herbicides for black-grass (*Alopecurus myosuroides*) control. Dry conditions in early 2017 provided a challenge for sowing spring crops. Rain in June and July was too late to prevent some drought-driven yield loss in early yielding crops. Continued unsettled weather into August this year interfered with harvesting however, national yield estimates suggest a better year compared to 2015/16.

Ingrid den Hoed, Chemicals Regulation Division (CRD) provided a 'regulator's perspective' on future options for weed control. In setting the scene, we were reminded of depressing statistics on the loss of available active ingredients with a decrease from 900 to 400 during the 10 years since 2000. From 2009 to 2017, the numbers have remained similar, essentially due to biopesticide approvals. There was an explanation of the impact of the implementation of the EU Regulation (EC) No 1107/2009 on approval status of under-threat herbicides for the UK. For predictive purposes, the Health and Safety Executive (HSE) has developed a risk factor database for under pressure active ingredients used in major UK crops with the objective to help predict the likelihood of future approval in re-registration processes. Thirty five active ingredients of high importance to the UK appear to be under risk. Their names were not provided partly, due to confidentiality issues but also to avoid publically pre-judging future re-registration processes. Advances in technology have the potential to reduce the risk with active ingredients or use them in different ways, e.g. more effective low drift nozzles. Targeted and spot application technologies would reduce the overall environmental burden; however, changes in the regulatory framework are necessary because to date, this is based on an overall hectare basis. In response to a question of regulation of targeted application, it was stated that regulations were still being considered and that there is also the issue of how to ensure compliance for such technologies. UAVs (drones) and fully autonomous application vehicles provide weed control options but still require regulatory consideration/approval. It was concluded that we can expect a further loss/restriction of use of current active ingredients in the future. EU Regulation (EC) No 1107/2009 is under review but it is unlikely to reduce regulations and reduce the loss of active ingredients. It was stated that an integrated approach for future weed management using chemical weed control, new application technologies plus cultural practice was the way forward, but uncertainty exists on future regulation processes, in part due to the EU exit.

An arable perspective was presented by Christine Lilly from Frontier, who reviewed its long-term rotational project focussing on reducing black-grass populations in arable crops. This project started in 2010 and has looked at rotations, cultivations and drilling dates on a heavy clay soil at Staunton in Nottinghamshire, where black-grass control had historically been poor. The field was split into 10 un-replicated blocks in which a range of cultivation strategies and cropping were employed together with normal herbicide applications. Spring cropping provided the lowest numbers of black-grass heads and resulted in the best yield and financial margin. A winter wheat/fallow rotation also reduced head numbers but with an obvious financial penalty during the uncropped year. Based on the findings to date, 'all is not lost' as changing rotations, cultivations and drilling dates, clearly can reduce blackgrass populations in soils such as those found at Staunton, although they may not be applicable for other soils/areas.

A horticultural perspective was presented by Andy Richardson from the Allium and Brassica Centre. Horticultural crops have a heavy reliance on older herbicides to achieve effective weed control, and many of these face challenges in re-registration approvals. Even for those active ingredients that would successfully pass all the regulatory studies and risk assessments, the cost of doing so may not be cost effective for the agrochemical manufacturers. As a result there has been a significant loss of herbicides in the past 15 years for horticulture. Machinery with targeted herbicide application with glyphosate prior to crop closure is an option, although not widely used due to the cost of application, the need for operator training plus the uncertainty with glyphosate regulatory approval. There is the potential to switch and accept alternative non-chemical approaches for weed management such as mechanical weeding between and within the crop rows with vision guidance to minimise crop damage. This has been used for high value crops but is limited to 4–5 weeks after crop emergence. Alternative non-chemical options such as thermal control with propane, as used in organic production were considered under-exploited to date for horticulture, whereas hot water/steam/foam applications for post-emergence weed control have been trialled, but energy costs will be too high for horticultural uses. The use of electric weeding provides


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potential for post-emergence weed control (see Eberius this issue) although may be limited because of cost and health and safety considerations. Robotics including vision guidance for spot applications of herbicide may have potential, although it is not considered to be commercially viable for horticultural use. During questions it was mentioned that the previous crop can itself become the weed problem issue in the next rotation. It was highlighted that prevention via more effective management of its removal during, or immediately after harvest should become part of the control method.

Six posters covering post-graduate research were presented during the lunch break and the opportunity was given for four of the PhD students to present a short summary of their posters. Investigating and improving our understanding of weed resistance mechanisms was the topic of all six posters and I hope that this may lead to the improved control of resistant weeds and more sustainable use of the limited herbicides that are still available for the UK farmers and growers.

The afternoon session started with Al Mason from LanGuard presenting the amenity perspective. The Thanet Weed project was set up to examine the feasibility of alternative weed control in an urban hard surface environment. LanGuard was the contractor tasked with completing the 5-year project which comprised a comparison of non-chemical, chemical and integrated treatment types considering cost effectiveness, carbon footprint and whole life cycle environmental impacts. The non-chemical options included mechanical brushing, heat, via propane burner and hot water with optical sensing. The latter was considered too expensive as was the use of a hot foam treatment. All non-chemical methods had issues particularly in far longer treatment time and were up to 8-fold more expensive than the chemical option of two glyphosate applications. An integrated approach with one herbicide application with mechanical weed control, was 2-fold more expensive. The experiences gained from this project resulted in the publication of guidance for the UK Amenity Sector.

The review was completed by a debating session with six short presentations covering alternatives for new approaches including their technology, sustainability, economics extension/viability in broad acre crops.

John Reade (Harper Adams University) gave an enthusiastic sales pitch for robotics, including low energy lasers and drones. The technologies are already developed for other uses and it was stated that it is just a question applying to agriculture.

Alistair Murdoch (University of Reading) presented the 'Eyespot Project' a leaf-specific droplet applicator depositing 1–2 µl droplets of glyphosate. Manual applications of droplets in cabbages and leeks resulted in 90% and 74% reductions in glyphosate use, respectively. This technology requires the herbicide to be translocated so it would not be an effective strategy for contact herbicides or those with a limited translocation profile.

Andrew Diprose (Ubiqutek) presented electric weeding options. There is a €1.3 million EU project investigating its use in cereals, vegetables and fruit giving hope that this alternative may have some future potential.

Chris Lunn (Garford), covered machinery with camera guidance to recognise weed and crop, for mechanical weed control, herbicide spot application or herbicide wipes for tall weeds.

John Pawsey (Organic Farmer) covered the weed management options for organic agriculture and horticulture, including rotational design, cultivation, drilling dates, crop competition and spacing coupled to mechanical weeding.

Nick Tillet (Tillet and Hague Technology) presented engineering options including technology for inter-row cultivation and band spraying, for which over 900 machines have been manufactured and sold. Vision-guided options for spot herbicide application machinery have been shown to work with respect to efficacy but are not cost effective to date.

The review was completed with a Q and A session with the six presenters.

I left the review, as with previous years with real concern for future weed management options in agriculture and horticulture. There is a lack of viable options for weed control, due to the absence of the development of new active ingredients; the withdrawal of old ones due to regulatory or commercial viability issues; plus increasing resistance to the few remaining approved herbicides. Non-chemical options do exist, and some included in this review do have potential but, at best, they would need to be integrated with the use of herbicides, or only have potential in niche or very high-value crops. Some of the alternatives such as targeted and spot application have yet to come under regulatory consideration and whilst such applications clearly reduce the overall environmental burden, will regulations remain conservative? How would treatment of 10% of the area in one field and 50% in another be regulated? During the debate the impact on earthworms due to mechanical weeding was raised. This reminded me that earthworm toxicity testing is a requirement for all agrochemicals and can lead to restrictions if toxicity is observed. Mechanical weeding would clearly physically disrupt earthworm populations near the soil surface, as indeed would any soil disruption associated with cultivation and planting. I am not advocating that risk assessment on earthworms should be conducted for mechanical weeding or cultivation practices but question why we have to conduct a risk assessment on any chemical that we apply to the same soil. Perhaps one approach, which may be wishful thinking, is that we reduce the need for in-field risk assessment for the chemicals we use within the crop and treat the agricultural field more as a production site. This may stop the continued decline in active ingredients and even bring some old ones back.

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