Technical Note TN626

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Black-grass: Managing the Risk under Scottish Conditions.

Summary

- **This technical note covers the current Black-grass situation in Scotland. It presents a picture, where through climate change, populations could become similar to those in parts of England.**
- **Through a better understanding of recognition and control strategies, maintaining rotations that include spring cropping and avoidance of herbicide resistance there is no reason why black-grass should remain at low populations.**
- **This note looks at the biology of black-grass and economic importance with sections on cultural and chemical control.**

Biology of Black Grass

Black-grass, Alopecurus myosuroides, also known as slender foxtail, is an annual grass with upright round slender stems, with few nodes and fine hairless leaves. It can grow in tufts or single plants depending on how competitive the crop. A ligule is present and is finely toothed 2->5mm long. Black-grass produces a green then dark purple flower head from May to August with multiple single flower spikelets producing 80–150 seeds/head (Moss S R). Seeds are generally dormant when shed but length of dormancy is very dependant on weather and soil conditions at maturity. Hot dry weather will reduce dormancy, cold and damp weather will increase it. About 80% of seed will germinate in the autumn if allowed to remain in the top 5cm of soil, which has important implications for cultural control and the potential cost of herbicide control measures. It does not emerge from greater than 5cm depth, but can remain in the seed bank for up to three years, occasionally more. A small proportion of black-grass can germinate in the spring if autumn treatments are ineffective.

Economic importance

Black-grass largely affects the intensive arable areas of south and eastern England, growing best on heavy moisture retentative clay soils. However in recent years black-grass has spread north and west into Staffordshire, Northumberland and into South and East Scotland; mostly the Lothian's and Fife. In 2008 there was a report in the Angus region which was identified as a seed contamination. In Scotland, which has a history of spring cropping and grass in the rotation, black-grass is mostly confined to small patches of single plants, rather than tufts, and is generally at roguable populations, or can be patch treated. However this may change with the impacts of climate change. It is possible that the spread north has in part been stimulated by warmer and wetter winters. Climatic models indicate a future of warmer drier summers, wetter autumns and warmer winters in Scotland, a climate similar to southern England. If this was combined with an increase in winter cereals then it is possible problem weeds such as black-grass, but also bromes, will increase, particularly on the heavier soils. However if , as models show, that parts of eastern Scotland and England become very dry by 2050 then black-grass levels might actually decrease and be replaced by weeds such as loose silky-bent (*Apera spica-vent*) and rye-brome (*Bromus secalinus*).

Photo: Rothamsted Research

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In England black-grass has become of major economic importance with the increase in winter cropping of cereals, in particular winter wheat, short rotations, the popularity of reduced cultivations (min till) and importantly the reliance on herbicides and the increase in herbicide-resistant strains of black-grass. A survey in 1989 showed 38% of the total wheat area in England had black-grass (Whitehead R & White HC., 1989), which even when treated can give a 4% yield loss, or 58% loss if untreated. More recently in 2006 a survey by Bayer CropScience of a sample of a 1000 cereal growers in England showed that 83% had a problem of black- grass on their farms.

The spend on black-grass herbicides programmes in winter cereals can be considerable. In a worst case scenario it can amount to £75 to £100/ha. In Scotland black-grass has not reached the worst case levels of eastern England although the exact level in Scotland is not known for certain due to poor recognition of the weed and ad-hoc reporting of incidence and severity of the problem. If black-grass is confirmed then it is important to map the weed, if in patches, or identify the field for control measures. For effective control a combination of cultural and chemical measures should be instigated:-

Control of Black-grass

1. **Cultural control measures** – Effective control of black-grass needs to incorporate a mix of cultural techniques and herbicide control. The over reliance on fire brigade herbicides, with poor cultural control, has been a major factor in the widespread development of herbicide resistance in England. Herbicide resistant black-grass has been detected on 2000 farms in 32 counties in England, (HGCA information 03, summer 2008).

- **Ploughing** can significantly reduce black- grass populations, or if in a minimal tillage regime ploughing every three or four years. This is good practice to control other grass weeds such as annual meadow- grass and bromes. Ploughing exposes seeds to predation as well as burying seed below a level from which they can germinate. Recent work has shown that ploughing can reduce black grass level populations by 67%, (Cook et al 2008). Where reduced tillage regimes are employed even rotational ploughing can significantly reduce black-grass levels. Rotational ploughing allows seed to be buried for two or more years, greatly reducing the viability of the seed bank.

- **Delayed drilling and use of stale seed beds**. Lightly cultivating seed beds allows germination of seed which can subsequently be burned off with glyphosate prior to drilling. This technique relies on there being adequate moisture in the seed bed and low germination of the black-grass seed. On the down side an extra cultivation can reduce soil moisture as well as potentially losing valuable drilling time and good weather windows in September and early October. Delays in drilling are especially risky on heavier soils, which are in themselves more at risk from black-grass. Any delay to drilling in Scotland can be risky where good drilling days in the autumn can be at a premium; this has been particularly evident in recent years. Delayed drilling also tends to produce less competitive crops less able to with stand the winter and also less competitive to black-grass!

- **Rotations and spring cropping**. The majority of black-grass germinates in the autumn and can be encouraged to do so by lightly cultivating stubbles in the autumn and delaying ploughing until the late winter or early spring. In Scotland the relative importance of spring cropping and grass breaks from winter cereals allows a reduction of viability of black-grass seed in the seed bank. Continuous wheat should be avoided in black-grass situations as this encourages black-grass populations and exposes the populations to the same herbicide chemistry increasing the potential for resistance.

Incorporating alternative winter crops in the rotation can help. For example black-grass can be treated in winter rape with propyzamide or carbetamide. Resistance to these herbicides has not developed.

Black-grass can emerge in early sown spring crops, but populations are much lower. However, if seen, the weed should be treated with herbicide if possible or rogued-out. For example Axial can be used in spring barley to control black grass or graminicides such as Laser in early potatoes. Nothing is available for oats!

2. Chemical control of black-grass in winter cereals

The use of cultural control measures alone is unlikely to give 100% control of black-grass but will reduce the incidence and severity where adopted. However not all cultural control methods are attractive to growers, increasing the reliance on herbicides. As already mentioned, pressure of autumn drilling makes stale seed beds unattractive and ploughing can be slow and costly and has a high carbon foot print compared to minimum tillage!

An effective herbicide programme should start with a residual herbicide applied pre-emergence or at full crop emergence, peri-emergence, of the crop. (See table 1 for options).To be effective this should be applied to a moist clod free seed bed with minimal crop residues. In Scotland where most growers are normally only targeting annual meadow grass the application rates for black-grass are **double** the meadow grass rates. Pre/peri-emergence herbicides are based around flufenacet (in mixture with pendimethalin or diflufenican), prosulfocarb (Defy), pendimethalin (as a straight or co-formulation) and tri-allate (Avadex). It is important to start a programme with a residual herbicide to prevent the build up of resistance to foliar applied black-grass herbicides.

A residual herbicide should be followed up with post–emergence contact herbicide when emerged black-grass is at 2-3 leaves although current thinking is earlier if possible. This can be either in the autumn or early spring. In Scotland it is more likely to be a spring application but it is important not to let the black-grass tiller and is should be actively growing. If autumn applied the contact herbicide must be mixed with a further residual herbicide as an anti-resistance strategy and to prevent further flushes. It is not absolutely necessary to mix a spring applied herbicide with a residual if further flushes are not anticipated, but it may be good practice as an anti-resistance strategy.

Post emergence herbicides are based around mesosulfuron (sold in mixture with iodosulfuron as Atlantis and Pacifica and should always be applied with the adjuvant Biopower), flupyrsulfuron (Lexus SX), pinoxaden (Axial)

or clodinafop-propargyl (Topik). It should be noted that mesosulfuron, flupyrsulfuron and clodinafop-propargyl are only recommended on winter wheat. Pinoxaden can be used on both Spring Barley and Winter Barley but not on Winter Wheat. Of the post emergence products Atlantis is the most effective but wide- spread use in England and in some cases misuse, has lead to resistant populations increasing.

Resistance to Black-grass herbicides.

More information on resistance to black-grass herbicides can be found on the WRAG, (Weed Resistance Action Group) web site *www.pestcides.gov.rags*. There is little evidence to show that black–grass populations in Scotland have developed the same resistance to fop, (clodinafop), dim, (cycloxydim) and den,(pinoxyden) herbicides, (Topik, Grasp, Axial) and the sulphonylurea herbicides, Atlantis and Lexus as in England, although continued use of these products in the future will put them under pressure.

Photo: Rothamsted Research

Table 1. Herbicide Options for Black Grass Control. (Assumes sensitive strains of black-grass)

Pre-emergence		
Active Ingredient	**Product**	**Label Crops**
Prosulfocarb	Defy	WW & WB
Flufenacet + Diflufenican	Liberator	WW & WB
Flufenacet + Diflufenican	Crystal	WW & WB
Pendimethalin	Various	WW & WB
Triallate	Avadex	WW & WB
Post emergence		
Flupyrsulphuron	Lexus SX	WW
Mesosulphuron-methyl + iodosulfuron-methyl	Atlantis + Biopower Pacifica + Biopower	WW
Pinoxaden	Axial	WB & SB
Clodinafop-propargly	Topic	WW
Chlorotoluron	Various	WW & WB Check variety

References

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HGCA Information Sheet 03. *Herbicide-resistant black-grass: managing the risk with fewer options*

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