

Seeing

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Lodge* on the
benefits of dye
markers in spraying
operations.

So, you have a weed problem and you've decided there's no sensible alternative to weeding with herbicides. You've chosen your product based upon its efficacy, crop tolerance, operator and environmental safety. You've selected your applicator and made all your assessments. In this case, you decide on a directed spray of glyphosate. You need to avoid contact with crop trees, avoid operator contamination and make sure your spot size is at least 1m in diameter. All often easier said than done.

Dye markers might be able to help here. The principle behind using them is that you add a coloured dye to your diluted pesticide mix. Dyes enable you to see where you have sprayed, so that you don't overdose, contact crop trees or kill non-target vegetation. They also make any fault in nozzles or dripping applicators very visible and help to reduce and eliminate operator contamination. The disadvantages of dyes are that they can reduce pesticide efficacy, can be difficult to handle

(staining clothing and skin), can be costly and make your pesticide application very visible to all and sundry who pass by. A lurid fluorescent red coating to trees and vegetation will probably attract comment!

So, ideally, a dye would:

- be cheap
- be safe to operators and the environment
- not change pesticide efficacy
- be visible when spraying, and for a few days afterwards.

Forest Research (the Forestry Commission Research Agency) has set up several small trials over the last few years to try to identify a suitable dye. Our first step was to investigate ready-made commercially available dyes. Most of these dyes are designed to be used in places like golf courses (often to spruce up the colour of grass so it looks good on TV), but there are products specifically formulated for use with pesticides. Whilst we found several dyes that gave reasonable visibility, most of them were too expensive to be used with dilute sprays at medium volume (200 l/ha) at the concentrations needed to be visible. Some of them are visible, and economic when used for instance for stump treatments or in weed wipers, where total volume rates are very low, or a high amount of the dilute spray is put onto a small area.

DYE PROPERTIES

Our next step was to look at other sources of dyes that might be cheaper. There are thousands of dyes used in textile, cosmetic and food manufacture. Initially we rejected dyes not soluble in water. Then we examined several that we thought would show up well on different vegetation and site types. Colour is important - green dye will not show up well on green foliage. Peoples' perception of dye colour also changes as it dries - a red dye on green foliage appears brown as it dries.

SAFETY

Next we looked at safety. The Pesticides Safety Directorate advises that dyes as markers are not covered



1: Dye colour appears to change as it dries. Here a 2% solution of Dysol Turquoise that has dried appears scarlet on green vegetation, but stains dead material a very visible blue.

2: At concentration rates that are economic to use, dyes may not be visible enough for supervisory purposes. However, in this case, a 2% solution of Dysol Turquoise is clearly visible when wet to the operator on this restock site. Nozzle performance also shows up clearly.

Red (or Blue)



3: A 2% solution of Dysol Turquoise clearly visible when used as a top up spray.

4: A 1% solution of Brilliant Crocein MOO clearly visible when used as a top up spray.

5: A 2% solution of Dysol Turquoise moderately visible when dry on young grass.

6: A 1% solution of Brilliant Crocein MOO Turquoise moderately visible when dry on young grass.

by the Control of Pesticide Regulations. If users intend to add marker dyes to pesticides, they are entitled to do so provided that the statutory conditions of approval of the pesticide product are complied with. Where the Control Of Substances Hazardous to Health Regulations (COSHH) apply, the user must also ensure that the COSHH assessment takes account of the use of the dye and that any control measures identified as being necessary are implemented.

We decided to restrict ourselves to dyes used in cosmetics or food, on the basis that they have already been tested by EC expert committees for toxicological safety, and the Pesticides Safety Directorate use them as safe to use when formulating pesticides. This meant we had to reject Rhodamine B, a promising candidate up to this point.

SIGHTING TRIAL

Then we took our new list of dyes and tried spraying them at different dilutions at a volume rate of 200 l/ha on various site types to see how visible they were, as we had with the commercially available dyes. We concentrated on two dyes - Brilliant Crocein MOO, a red dye, and Dysol Turquoise, a blue dye already used in mixture with urea for stump treatment applications.

Dysol Turquoise at 2% of final spray volume (1% dry dye), was highly visible when wet and immediately after drying. After 48 hours, it was still well visible on bare ground or woody debris, but had started to fade on vegetation. On the restock site, after three days it was fading, and after a period of seven days with 5.6mm of rainfall had faded completely. On young grass, it took 18 days and 50mm of rainfall to completely fade.

Brilliant Crocein MOO was again highly visible when wet, but only moderately visible when dry on the restock site and had completely faded within seven days on both sites (same rainfall pattern). The red dye was particularly visible on bare ground and dead material. However, red dyes are not as visible if you are red/green colour-blind, as

are around 20% of the male population.

When used as a top-up spray (2 x 10ml sprays, same dilution rates for dyes), against the stems of transplants, both dyes were highly visible, wet and dry, but had faded within 14 days and 86 mm of rainfall.

EFFICACY

We tried mixing the dyes with various pesticides to see if they had any effect on efficacy. The dyes had no perceptible effect on propyzamide or permethrin at 1% (Crocein MOO) or 2% (Liquid Dysol Turquoise) solutions. Both dyes reduced the effect of Asulam but only when the herbicide was used at rates of less than 3 l/ha. Both dyes reduced the activity of glyphosate on couch grass by up to 70%. However, in field trials with higher rates of glyphosate (5 l/ha) there was no reduction in efficacy. This suggests that if relatively resistant weeds are treated, or spray distribution is poor, or low rates of glyphosate are used, dyes may significantly reduce the effect of glyphosate and possibly other foliar acting herbicides.

HANDLING

Dysol Turquoise is ready formulated and marketed as a liquid dye, so it is much easier to handle than powder formulations. Brilliant Crocein MOO is only currently available in small quantities as a powder dye, although if large-scale demand develops bulk manufacturers might be persuaded to produce large quantities at significantly reduced prices.

SUMMARY OF RECOMMENDATIONS

- Dye markers can help reduce operator contamination, crop damage through overdosing and drift, and help reduce damage to non-target vegetation. Dye markers can therefore help reduce overall herbicide input through better targeting.

- If dye appears to be on the inside of protective clothing, this may indicate a fault. Test by applying water to the outside of the clothing, with a paper towel held on the inside to show up any penetration of liquid.

- Some herbicides are distinctively coloured and already show up adequately when sprayed, so don't need a dye marker to be added, e.g. Stomp (pendimethalin) and some Nomix products.

- If the pesticide product label recommends the use of a particular dye for a particular application type, use it.

- When no dye is recommended, for herbicide sprays at low/medium volume where the use of a dye would be advantageous, consider using a 2% solution of Liquid Dysol Turquoise ANX50.

- Do not use dyes where glyphosate is applied at low rates on difficult to kill weeds.

- Visibility and persistence of dyes will depend on individual perception, and on vegetation type and climatic conditions. A 2% solution of Dysol Turquoise will be clearly visible when wet and dry, but subsequent visibility will vary. For this reason, it is of most value for the operator, and is probably unsuitable for follow-up supervisory purposes.

- For top-up sprays, use a 2% solution of Liquid Dysol Turquoise.

- Only permethrin, glyphosate, asulam and propyzamide have been subject to small-scale trials to examine effects on efficacy. Users must test small areas to gain experience before engaging on a large-scale programme using this dye. Replacements for permethrin have not yet been tested, but given the lack of effect in the permethrin trials, it is quite possible that the pesticide efficacy will be not be reduced.

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Table1: DETAILS OF DYES

Common name	Colour index name	Colour index number	Price/kg	Recommended rate	Cost/ha for top-up permethrin spray	Cost/ha for low volume (50 l/ha) herbicide spray	Cost/ha for medium volume (200 l/ha) herbicide spray	Supplier address	Comments
Dysol Turquoise ANX50 Liquid	Acid Blue 9 (50% solution)	C142090	£17	2% of final spray volume (i.e. 1% Acid Blue 9)	£8.50	£17	£88	Hays Colours Ltd, High Level Way off Queens Road, Halifax HX1 4PS (tel: 01484 842266)	Liquid dye, also used with urea for stump treatment. Easy to handle
Brilliant Crocein MOO	Acid Red 73	C127290	£224 volume	1% of final spray	£56 £1.40*	£112 £1.65*	£448 £10.60*	Aldrich, The Old Brickyard New Road, Gillingham, Dorset SP8 4XT (tel: 0800 717181)	Powder dye, more difficult to hand. Price is that quoted by specialist scientific suppliers. Enquiries indicate the lower prices marked with an asterisk would be available for bulk imports from dye manufacturers.