

THE PERFORMANCE OF GLYPHOSATE AFFECTED BARLEY SEED

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Summary: The laboratory germination of barley seed from crops sprayed preharvest with glyphosate improved when tested in compost rather than paper towelling. However, field emergence and establishment were more closely related to the results of paper towelling germination tests than germination tests in compost.

INTRODUCTION

The use of glyphosate preharvest in barley crops has increased by 275% in the last three seasons and this has been accompanied by an increase in the number of samples showing reduced germinations with negatively geotropic seedlings. The reduction in germination is greatest in paper towelling medium. Germination in potting compost increases the germination of glyphosate affected samples and reduces the levels of glyphosate-induced abnormalities (McLaren and Don, 2002).

The aim of this study was to investigate the performance of glyphosate affected barley seed.

MATERIALS AND METHODS

Six plots of Derkado barley were sown in 2000 at Gogarbank Farm, Edinburgh. Individual plots were sprayed with glyphosate (Roundup® Biactive™) at different ear moisture contents. Plots were sprayed respectively at 50%, 40%, 30%, 25%, 20% ear moisture contents and just before harvest. Plots were harvested using a Wintersteiger Nursery Master plot combine and samples for laboratory and field tests were obtained using a Boerner divider (Anon., 1999). Four x 100 seeds were tested for germination using paper towelling and a proprietary potting compost (Levingtons) and seedling assessments were made according to International Seed Testing Association (ISTA) Rules (Anon., 1999).

Samples of seed from the 6 plots were resown at a rate of 350 seeds/m² in 10 x 1 metre plots at Gogarbank Farm, Edinburgh in April 2001. Within each plot, 5 x 1 metre rows were marked at random with coloured tallies. Emergence counts were carried out in each of the marked rows, 3 weeks after sowing. Final plant counts were completed, by pulling up the plants, in the same marked rows immediately before harvest.

RESULTS

When crops were sprayed with glyphosate at different ear moisture contents the germinations of the resultant seed is generally lower in paper towelling than compost (Table 1). The mean germination in paper towelling was 83.33%, whereas the mean germination in compost was 89.5%. With the exception of seed from the preharvest plot, all the germination tests contained seedlings displaying glyphosate-induced abnormalities. Symptoms included negative geotropism of the roots, stunted growth and absence of root hairs (Plate 1).

Table 1
The effect of glyphosate application at different ear moisture contents on germination of resultant seed

% Ear Moisture	% Paper Towelling Germination	% Compost Germination
50	81	79
40	85	91
30	71	88
25	87	92
20	83	90
Preharvest	93	97
Mean	83.33	89.5



Plate 1.



Plate 2.

Plate 1 and 2. Seedlings showing glyphosate-induced abnormalities in paper towelling (Plate 1) and compost (Plate 2) germination tests (normal seedlings for comparison are on the left of each plate)

The relationship between germination, emergence and plant establishment of the harvested seed, when resown in 2001, is shown in Figures 1 and 2.

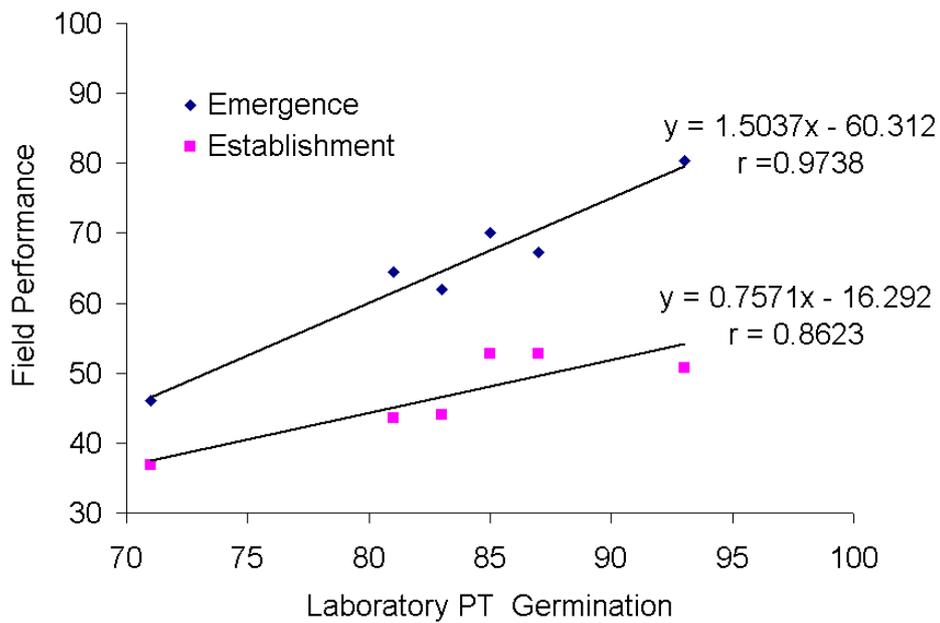


Figure 1. The relationship between laboratory paper towelling germination and field emergence and plant establishment

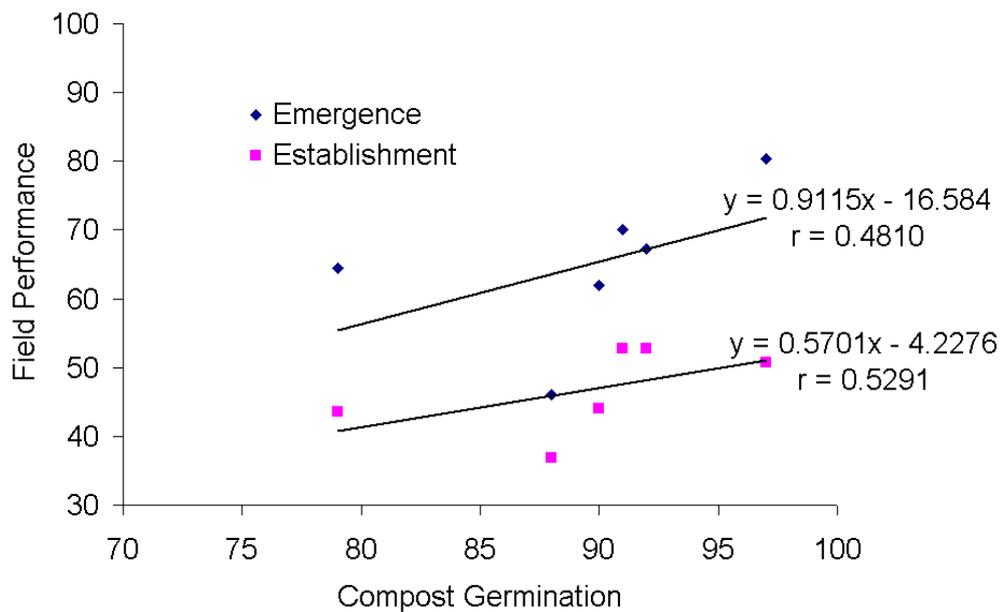


Figure 2. The relationship between laboratory compost germination and field emergence and plant establishment

A significant relationship was obtained ($p < 0.05$) between paper towelling germination and both emergence and plant establishment (Figure 1). The relationship between compost germination and both emergence and plant establishment was not significant ($p > 0.05$) (Figure 2).

DISCUSSION

The results of this study clearly demonstrate that glyphosate has a detrimental effect on the germination of seed from crops treated preharvest with glyphosate. The reduction in germination in seed from such crops can be minimised if the seed is tested in compost rather than paper towelling.

Field performance of seed is affected by a wide range of factors (Anon., 1995) and the field performance of glyphosate affected seeds is lower than would be anticipated from laboratory germination tests. It would appear that the paper towelling germination result of glyphosate affected seed, although lower than the compost result, gives a better indication of emergence and establishment in the field.

Future work will concentrate on an examination of the other factors that affect the field performance of glyphosate affected seed.

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