Weed control through seedling abrasion with an organic fertiliser

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Summary Many tools exist to control weeds in organic crops (van der Schans *et al.* 2006), and each has utility in specific situations. Nevertheless, surveys of organic farmers indicate that weed management often is second only to labour supply as their main bottleneck for success (Walz 2004). Consequently, new tactics for managing weeds are desirable.

Previous work demonstrated that grits derived from agricultural residues, such as maize cobs and walnut shells, could be used to control small broadleaf weed seedlings selectively in maize (Forcella 2009). These grits were propelled by air compressed at 500 kPa to effect the shredding and death of seedlings.

Unlike broadleaf weeds, the growing points of small grass seedlings are below the soil surface and are not expected to be damaged greatly by air-propelled grit. Consequently, the first of our objectives was to test the effects of abrasion on a typical annual grass weed, yellow bristle grass (*Setaria pumila* (Poir.) Roem. & Schult.).

Another bottleneck for organic crop production is soil nitrogen availability. Flexibility in supplying exact amounts in a timely manner is critical for growers. Approved organic fertilisers, such as corn gluten meal (CGM), which contains 10% N, may assist with such flexibility. Because CGM can be manufactured in the form of a grit (e.g. 'Avongold' from NZ Starch), it might serve also as a means of post-emergence weed control when propelled by compressed air. Testing this possibility was our second objective.

We performed a series of outdoor nursery experiments that examined the effects on yellow bristle grass of CGM grit expelled at (i) differing air pressures, (ii) distances from weed seedlings, (iii) 1 or 2 sec of abrasion, repeated three times, and (iv) seedlings growing proximally to maize plants.

Our proof-of-concept experiments showed that control of a summer annual grass, such as yellow bristle grass, is amenable to abrasion by grit during early seedling development (1- to 5-leaf stage). Abrasion effects were considerable at air pressures of 500 to 750 kPa compared to 250 kPa, and at distances of 30 cm compared to 60 cm. Furthermore, abrasion can be performed by post-emergence application of CGM, a substance already approved as an organically appropriate form of nitrogen fertiliser and pre-emergence herbicide (Card *et al.* 2009). Additionally, when CGM was applied to mixtures of yellow bristle grass and maize plants, which were at the 1- to 4-leaf stages, the crop plants were unharmed but the proximally growing bristle grass seedlings were reduced significantly, with 84–94% reduction in dry matter at 4 weeks after treatment. Lastly, monocultures of yellow bristle grass seedlings could recover from a single abrasion event and were controlled better with repeated exposures to grit. Thus, buried growing points of grasses permit some resilience to control by abrasion compared to broadleaf seedlings.

Simultaneous post-emergence weed control and fertiliser application could be beneficial for organic growers and others. Weed abrasion by air-propelled grit may be appropriate in high value row crops, such as organically managed vineyards, orchards, and soft fruit and vegetable production fields, or in urban areas, such as sidewalks, where city councils may have banned use of synthetic herbicides. In any case, much additional research will be needed before air-propelled grit can be recommended as a form of organic weed management, but the results summarised here are encouraging for the successful application of the technique.

REFERENCES

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