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ORGANIC SEED TREATMENTS TESTED IN BARLEY PRODUCTION

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BACKGROUND

Reduced crop establishment is a growing concern on organic farms, which can lead to higher weed pressure as well as reduced yields and farm income. Poor establishment can result from the use of lower-quality seed, slow or hindered crop seed germination, or inappropriate soil management practices that lead to elevated weed or disease pressures. These occurrences can affect both the quality of harvest and weed seed presence years into the future.

A variety of organic-approved seed treatments are commercially available, claiming to offer developmental advantages to germinating crop seeds and young plants and to promote healthier and higher-yielding crops. In such cases, treated crop seeds may grow faster and with fewer limitations, gaining an advantage over competing weeds and pathogens. The treatments may reduce disease-causing organisms, or facilitate growth-supporting factors such as beneficial microbes and their promoting plant interactions. Such strengthened or accelerated crop growth will likely improve establishment earlier in the season.

OACC technicians Paula Schofield and Lloyd Rector, sowing barley plots (D. Kerr)

Seed treatments may be loosely-categorized by function as antimicrobial, biostimulatory or nutrient-enriching, although some may play multiple roles due to their complex biological formulations or activities. In general, seed treatments function by either stimulating the germination process itself or by providing the germinating seed with a micro-environment that is beneficial for growth (fewer pathogens, with more nutrients available). Historically, seed treatments have usually taken the form of fungicides. Today, however, legume inoculants have become commonplace and more seed treatments are being sought and discovered with the goal of promoting healthy soil ecology.

The objective of this research was to evaluate seven types of organic commercial seed treatments in terms of their effects on seedling vigour, crop establishment and yield in barley.

WHAT WAS DONE

The selected OMRI-approved seed treatments included: ASL™ TP (Acadian Seaplants Ltd.), Biodynamic Preparation 504 (Josephine Porter Institute), CB-QGG™ (EcoChem), HeadsUp® (HeadsUp® Plant Protectants, Inc.), MycoApply® (Mycorrhizal Applications, Inc.), NanoGro™ (Agro Nanotechnology Corp.), and SuperBio® SoilBuilder (Advanced Microbial Solutions, LLC).

Treated common no.1 barley seed was subjected to two different vigour tests in a growth chamber to assess seed treatment effects relative to an untreated control. Cold tests evaluated the percentage germination under simulated cold-seedbed conditions and seedling growth tests measured average shoot length after seven days' germination.

The same treated barley seed was also sown in field-plot experiments at three sites in late May of 2007. At each site, plots were sown in four replicates at a rate of 350 seeds m^{-2}, with pre-and post-emergent tine weeding. Within the first few weeks, early growth of the barley plots was assessed in terms of crop establishment and seedling vigour (height, dry mass). At maturity, grain was harvested, dried and cleaned. Grain data recorded included yield, test-weight and 1000-kernel weight.

WHAT HAPPENED

Both the cold test and seedling growth test were repeated and each trial used two different samples of barley seed. In the two cold test trials, ASL™ TP and HeadsUp® occasionally appeared to reduce the germination rate of certain seed samples relative to the untreated control. In the seedling growth test one trial indicated no differences among any of the treatments while the other trial indicated that both ASL™ TP and CB-QGG™ could reduce the average shoot length of seedlings.

Cold test samples, during incubation at 10°C (D. Kerr)

ASL™ TP was also shown to decrease germination. The ASL™ TP seaplant extract was used at full strength during these lab experiments; since then, a dilution has been recommended to avoid inhibition effects due to seed toxicity.

In the field-plot experiments, crop establishment was only affected at one site by MycoApply® which resulted in a reduction of establishment relative to the untreated control. Altering or influencing the microbial population around a seed could have either favourable or unfavourable consequences, depending on the activity of introduced microbes as well as their interaction with other organisms in the surrounding soil.

Neither of the two seedling vigour indices – dry mass nor seedling height – was affected by any of the seed treatments relative to the control, at any of the three sites. Such observations of seedling vigour can offer early indications of future crop performance, but there are other growth factors that will not show up at this developmental stage. The same results were observed for harvested grain yield, test weight and 1000-kernel weight as none of the seed treatments had any effect on them relative to the control. It should be noted that the relatively late spring planting could have compromised potential seed treatment effects otherwise seen under early-spring planting conditions.

Seedling growth test samples, following incubation for 7 days (D. Kerr)

Any such differences were not observed in the cold test, however, where they would have been expected to show up if they existed. While the lack of significant effects at three different sites is compelling, it is worth noting that unfavourable growing conditions such as soilborne disease pressure can vary from year to year, and under low-stress conditions treated seed may fare no better than untreated seed. Ideally, seed treatment evaluations would be conducted over at least two seasons.

Table 1. Descriptions of selected seed treatments

Treatment Name	Category	Active Ingredient(s)	Disease Control
ASL™ TP	Biostimulant; non-biological	Seaplant extract of (*Ascophyllum nodosum* L. Le Jolis)	Unspecified, unknown
Biodynamic Prep. 504	Biostimulant; non-biological	Composted stinging nettle (*Urtica dioica* L.)	Unspecified, unknown
CB-QGG™	Biostimulant; biological	Nutrients, stimulants, enzymes, vitamins	Unspecified, unknown
HeadsUp®	Systemic acquired resistance agent; non-biological	Plant biochemical extract from quinoa (*Chenopodium quinoa* Willd)	Broad-spectrum, unspecified
MycoApply®	Disease control; biological	Beneficial microbes (*Glomus* spp., *Trichoderma* spp.)	Unspecified, unknown
NanoGro™	Biostimulant; plant immune system booster	Sugar pellets treated with ethanol and trace nutrients	Broad-spectrum, unspecified
SuperBio® SoilBuilder	Nutrient-enhancer; biological	Beneficial microbes and byproducts (*Bacillus* spp., *Cyanobacteria*, *Actinomycetes*)	Unspecified, unknown

Young barley seedlings at the two-leaf stage (D. Kerr)

Variability among identically-treated seed, following seedling growth test incubation (D.Kerr)

THE BOTTOM LINE...

Results were inconsistent among lab experiments, and no seed treatment could be declared as offering a clear advantage over untreated seed in terms of improved performance - based on cold germination and seedling growth tests. Field tests further supported this, as none of the seed treatments evaluated increased crop establishment, in-field vigour, yield, test-weight, or 1000-kernel weight.

Many seed treatments are likely species- or environment-specific, in that they may only offer beneficial effects to certain crops or under certain growth conditions. While the seven seed treatments selected for this study did not offer any advantage to treated barley seed in the lab and field trials described here, they may be beneficial for other crops or in other situations. On the whole, organic seed treatments may still have important roles to play in organic cropping systems and should be investigated on an individual basis and using different crop species for proper evaluation.

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Graduate student Donald Kerr, explaining his barley seed treatment plots during OACC's Field Day (K. Seckar)

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