THE INVOLVEMENT OF *FUSARIUM*, AUTOTOXINS AND HERBICIDE RESIDUES IN THE ASPARAGUS (*Asparagus officinalis* L.) REPLANT PROBLEM.

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Abstract.

In temperate climates, asparagus reaches peak production five to eight years after planting and thereafter yield declines until production is no longer economically viable, normally between years 12 to 15. In many of the asparagus producing areas of the world the availability of land suitable for asparagus production is limited, therefore, replanting of old asparagus beds is undertaken. Replanted asparagus often has poor establishment and a short commercial life compared with planting on sites that have no history of asparagus production.

In this research, field trials indicated that replanted stands will yield 20% to 30% less marketable asparagus than those on similar sites with no previous asparagus cropping history. Pre-planting treatments with the fungicides thiabendazole and/or metalaxyl did not alleviate the problem but may improve establishment in replant sites. Treatment of plants or field soils with *Trichoderma viride* did not improve establishment or plant performance in old asparagus soils. The replant problem was common to all asparagus cultivars evaluated with the most vigorous varieties in a replant site also performing best in virgin soils.

Plants that died out in replant soil field trials exhibited symptoms typical of *Fusarium* spp. infections and isolations confirmed the involvement of both *F. oxysporum* and *F. moniliforme* in the early decline of replanted asparagus stands.

Greenhouse studies confirmed the importance of *Fusarium* inoculum level in inciting disease in asparagus plants. As inoculum levels increased the disease levels on roots and crowns of developing seedlings also increased and the plant vigour decreased. A Root Necrosis Potential bioassay which measured the infectivity of *Fusarium* propagules in field soils proved to be useful in separating soils with a previous history of asparagus production from virgin soils.

Residual herbicides commonly used in asparagus production significantly reduced asparagus seedling growth at levels likely to be found after several years of asparagus cropping demonstrating the importance of planning for the removal of an old asparagus planting some years before the crop is terminated.

Evaluation of soil with and without asparagus cropping history showed that an abiotic cause to the replant problem may also be important.

The presence of autotoxic material in asparagus storage roots was confirmed in laboratory experiments and the toxic material reduced growth of asparagus. Bioassays using pre-germinated asparagus seed on blotting paper demonstrated that the toxin was water soluble and heat stable. The toxins were present in roots of all ages and all asparagus cultivars tested. All asparagus cultivars tested were inhibited by the toxin. A range of other plant species were shown to be suppressed by asparagus storage root extract and some species were unaffected.

The level of toxicity in replant soils at two sites was monitored over a twelve month period using a lettuce seed, paper bioassay procedure. The toxin levels found in asparagus soils after the termination of the asparagus crop by cultivation was probably only high enough to directly inhibit replanted asparagus for a short time (up to five or six months) after terminating the crop. Autotoxins are likely to be present in old asparagus soils for many years following the termination of the asparagus crop and their importance in the replant problem is most likely to be as a result of an interaction with the pathogenic *Fusarium* spp. present.

Fusarium appeared to be the main factor involved in the replant problem and inoculum levels of pathogenic *Fusarium* spp. in soils are likely to be high for many years after asparagus cropping has ceased. In most cases the asparagus replant problem is therefore a replant disease that is likely to persist for many years.

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