# ALLELOPATHIC GROWTH STIMULATION OF WILD OATS IN CONTINUOUS WHEAT MONOCULTURE

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*Abstract.* Wheat and wild oats have occurred as admixtures since cereals were first domesticated and remain so to-day, despite man's efforts over hundreds, possibly thousands of years, to eradicate the weed from the crop (1). Weedy *Avena* spp. possess many intrinsic characteristics which assist their proliferation (1). Significant among these, but previously unrecognised, may be adaptive mechanisms which enable the buried seeds to respond to changes in soil biochemistry associated with the different stages of a wheat cropping cycle, and the stimulation of wild oat germination and growth by the presence of wheat crop residues.

The results of a field experiment in which wheat was sown in March, April, May, June and July showed that twice as many wild oats (*Avena sterilis* ssp. *ludoviciana* ) emerged in plots sown to wheat in May than in plots cultivated in May but in which wheat was not sown. That is, a combination of falling soil temperatures, soil disturbance and the presence of germinating wheat stimulated wild oat germination in comparison with the effects of the first two factors alone. Very few wild oats emerged during the winter period in plots which had been sown to wheat in March, although this time of sowing resulted in frost damage to the crop, and thus could not be recommended as a viable strategy for wild oat control. In subsequent glasshouse tests, the rate of *A. sterilis* germination was shown to be increased by the presence of germinating wheat seeds. The presence of established wheat plants however, or of rhizosphere leachates from wheat plants, appeared to induce a state of secondary dormancy in wild oat seeds, and germination was significantly inhibited.

Wild oat seedlings which emerge into an already established cereal crop have a reduced survival rate and low seed production (1). If germination were delayed until the commencement of the next wheat cropping phase however, the reproductive potential of the wild oat plants would be enhanced. The enforcement of wild oat seed dormancy by the proximity of actively growing wheat roots may therefore serve to prevent depletion of the soil seed reservoir in circumstances unfavourable to the weed. There is evidence to support the operation of such a mechanism in the field (5).

The post-emergent growth of wild oats (a mixture of *A. sterilis* and *A. fatua* ) was found to be increased by a factor of 10 and seed-production by a factor of 42, in the presence of wheat crop residues under field conditions (4). Glasshouse tests revealed that the amendment of soil with the water leachates from wheat stubble (i.e. no physical presence of stubble) stimulated the rate and the percentage of *A. sterilis* germination and the rate of post-emergent growth (3). When wheat and *A. sterilis* were grown together, the addition of 0.5% w/w finely milled wheat stubble to the soil (equivalent to 5 t/ha stubble incorporated to a depth of 10 cm in the field) increased the seed production of the wild oats by 66%, but had no effect on the seed production of wheat.

It seems reasonable to deduce from the above that the germination, post-emergent growth and seed production of wild oats would be selectively stimulated in the second and subsequent years of continuous wheat monoculture, by the decomposing residues of the previous wheat crop. This effect would not be manifested if wheat were grown in rotation with crop species which have an inhibitory effect on wild oats (2). The regulation of wild oat germination by allelochemicals from living wheat plants, in combination with the stimulatory effects of wheat crop residues, may confer significant advantages to wild oats in continuous wheat systems.

## REFERENCES

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