Integrating *Xanthomonas campestris* PAR5 with Chemicals for Control of Annual Bluegrass

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The perennial subspecies of annual bluegrass is a common contaminant of bentgrass greens and fairways. Currently, the most effective control of this weed is through hand removal. Bacterial bio-herbicides, such as *Xanthomonas campestris* pv. *poa*, have been proposed as a means to selectively remove weed species from turf. Recently a strain of *Xanthomonas campestris*, labeled PAR5, was isolated from *Poa annua* ssp. *reptans* which selectively controlled annual bluegrass under controlled environmental conditions. A study was initiated June 1998 at the Hancock Turfgrass Research Center in East Lansing, MI to determine the integrated effects of PAR5 as a bio-herbicide in the control of *Poa annua* ssp. *reptans*. In this study PAR5 was applied alone and integrated with the chemicals primisulfuron and a compound we have temporarily designated X-factor. For comparative purposes the antibiotic oxytetracycline was applied alone and in combination with primisulfuron and X-factor. Untreated and dead bacterial controls were also included in the study.

Results from this field study show that *X. campestris* PAR5 is an effective bio-herbicide for the removal of annual bluegrass from creeping bentgrass, killing 5-10%. Integration of both primisulfuron and the X-factor improved the efficiency of the PAR5 bacteria. While integrating PAR5 with primisulfuron had the largest kill rate (65-80%), this combination also inhibited the growth and caused minor damage to the creeping bentgrass. Integrating the PAR5 bacteria with the X-factor also improved the kill rate (45-55%) compared to PAR5 alone. However, with PAR5 + X-factor the death of the annual bluegrass plants progressed gradually over the season and did not impede the growth of the bentgrass. This allowed the bentgrass within the plots to replace the annual bluegrass as it was killed.

Treatments	Application rate	Application interval
1. *Xanthomonas campestris* PAR5	2 H 10^7 CFU=s (live bacteria)	2 to 3 days
2. *Xanthomonas campestris* PAR5 + primisulfuron (Beacon)	2 H 10^7 CFU=s (live bacteria) 5 g/1000 ft^2	2 to 3 days 14 days
3. *Xanthomonas campestris* PAR5 + X-factor	2 H 10^7 CFU=s (live bacteria) 0.1 g/1000 ft^2	2 to 3 days 14 days
4. *Xanthomonas campestris* PAR5 + X-factor	2 H 10^7 CFU=s (live bacteria) 0.05 g/1000 ft^2	2 to 3 days 14 days
5. primisulfuron (Beacon) + oxytetracycline (Mycoshield)	5 g/1000 ft^2 10.2 g/1000 ft^2	14 days 14 days
6. X-factor + oxytetracycline (Mycoshield)	0.1 g/1000 ft^2 10.2 g/1000 ft^2	14 days 14 days
7. oxytetracycline (Mycoshield)	10.2 g/1000 ft^2	14 days
8. Boiled *X. campestris* PAR5	2 H 10^7 (dead bacteria)	2 to 3 days
9. Untreated control		