

Corn Gluten Meal and Other Natural Products for Weed Control in Turfgrass

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Introduction

The idea of using naturally-occurring compounds as herbicides has ancient origins. The quest for such compounds has taken on renewed vigor as environmental stewardship gains momentum in the U.S. Historically there have been few naturally-occurring compounds which could be used to selectively control weeds in turf. New research in the 1980's and especially the 90's is leading to new possibilities.

Products

Corn gluten meal

The idea of using corn gluten meal for weed control burst on the scene in the early 1990's after Dr. Nick Christians at Iowa State accidentally discovered its herbicidal properties while he was testing it for suppression of turf diseases. After several years of efficacy studies and product development, corn gluten meal has gained national attention as being the first effective "organic" herbicide. Corn gluten meal is not a registered pesticide because the U.S. EPA has granted an exemption for corn gluten meal as an herbicide.

Corn gluten meal is a product of the wet milling process. Corn gluten meal can act as a pre-emergent herbicide by inhibiting root formation during germination. While it is at least partly active against many plant species, its practical utility for turf situations is as against crabgrass, barnyardgrass, foxtails (*Setaria* spp.), dandelion, lambsquarters, pigweed, purslane and smartweed. It is safe to use on established turf but cannot be used during turfgrass establishment as it will stunt or inhibit root growth of the turfgrass plants.

Research shows 50-60% control can be achieved in the first year when applied at 20 lb per 1000 ft². Studies suggest that control is improved in successive years and as use rates increase. Currently it is sold as a dry product under various trade names, including Dynaweed, Safe 'N Simple, Earth Friendly, W.O.W.!, Corn Gluten Meal Herbicide, and Propac. It is sold for the homeowner market in retail stores as Concern-Weed Prevention Plus. Until recently it was only offered in powder form. A granular form is now available which can be more easily be applied with Vikon spreaders, rotary and drop spreaders. Application rates vary from 12 to 20 lbs per 1000 ft² depending on the intended use. For crabgrass control in turf, two applications are recommended at 12 lb/1000 ft², once in early to mid-spring and another in early to mid-August. Since the corn gluten meal is about 10% nitrogen, this catches two flushes of crabgrass and spreads out the nitrogen effect. Two applications at 12 lb/1000 ft² will provide nearly 2.5 lb N/1000 ft² per year. The nitrogen is in a slow release form so there is little to no potential for foliar burn. Bulk orders cost about \$950/ton; 50 lb. bags run between \$25 and \$30. This is the

same corn gluten meal sold at feed mills for animal feed; however, it is pelletized for easier and more uniform application.

Portions of at least two proteins in the corn gluten meal, called peptides, are the active ingredients in corn gluten meal. Laboratory studies show the peptides themselves to be significantly more effective at preventing weed germination than the corn gluten meal itself. Unfortunately the peptides do not persist in the soil when used as a spray long enough for effective control. Current research is aimed at isolating and packaging these peptides to produce a sprayable product.

Borax

Borax contains boron, a naturally-occurring compound. Boron is an element and is incapable of being degraded. It is not "organic" in the chemical sense as it does not contain any carbon. Boron is a micronutrient for turf, required in very limited quantities, of which there is typically a sufficiency in the soil and/or irrigation water. In turf, research has been geared towards the use of borax for ground ivy control.

Data from University of Wisconsin and Iowa State University do not completely agree on the ability of Borax to control ground ivy. While some post-emergent control was obtained over two year periods at both sites, Iowa State University data indicated good control, while at UW control ranged from 20 to 60% (Table 1). ISU data show better control was obtained when liquid borax was used compared to dry borax (Hatterman-Valenti, 1996). Borax, especially liquid, caused temporary though occasionally severe turf injury.

Table 1. Comparison of Borax to conventional herbicides for post-emergent control of ground ivy (*Glechoma hederacea* L.).†

	Rate (lb ai/A)	1994 plants/plot		Rate (lb ai/A)	Timing	1995 % control		
		18 Jun	31 Aug			28 Apr	9 Jun	11 Sept
Control	---	18	47	---	---	0	0	0
20 Mule Team Borax	5 gal/A	13	16	11 gal/A	Spring	8	24	30
20 Mule Team Borax				11 gal/A	Fall	44	38	21
Triplet	1.0	0.7	1.0	1.0	Spring	33	100	60
Triplet				1.0	Fall	98	88	65
Confront	1.0	0.7	19	1.0	Spring	21	88	56
Confront				1.0	Fall	33	85	58
LSD (0.05)		7	11			15	12	7

† 1994 data from Rossi, F. and H. Berg. 1995. Postemergence ground ivy control. Wisconsin Turf Research Results of 1994 Studies. XII:66. 1995 Data from Rossi, F., A. Sausen, and H. Berg. 1996. Effective timing for postemergence ground ivy control. Wisconsin Turf Research Results of 1995 Studies. XIII:90-93.

The best recommended procedure is to use 20 oz/1000 ft² of liquid borax in Kentucky bluegrass turf. It is unknown how often the product can be applied. Since Boron is an element, it cannot

be degraded. Boron is not very mobile in soil and will be taken up by plants (Foth, 1984). Boron can build up in soils to toxic levels although the limit for toxicity in turf is not known. Turfgrass does accumulate Boron in the leaf tips (Harivandi et al., 1992), allowing soil Boron concentrations to be reduced over time if clippings are removed.

Xanthomonas campestris pv. *poaannua*

Bacteria and other microbes are only beginning to be researched for their potential to control turf weeds. The best model for which data is published is annual bluegrass (*Poa annua* L.) control using the bacterium *Xanthomonas campestris* pv. *poaannua* (Zhou and Neal, 1995). Since microbes require specific environmental conditions for pathogenicity their ultimate use may be limited. Unlike fungi, bacteria require wounds to infect plants; their entry into weeds injured by mowing will be facilitated in a mowed turf stand, e.g. *Poa annua* control by *X. campestris*.

During the early 1990's a battery of growth chamber and field tests were conducted to evaluate control of annual bluegrass in turf using *X. campestris* pv. *poaannua*. Weekly inoculations with the bacterium provided approximately 90% control of both the annual and perennial biotypes of *P. annua*. In the field, efficacy was approximately 10%. Control in the field was enhanced to 40% by applying the bacterium three times weekly for four weeks, but populations of the weed recovered within two to five weeks once the treatments were stopped.

Additional research conducted at Michigan State University showed some efficacy under field conditions. Application of this technology for *P. annua* control in golf turf may be limited if current trends toward the development of management techniques and improved *P. annua* cultivars continue to grow.

Literature Cited

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