

SOME NEW HERBICIDES FOR GOLF COURSES

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The agricultural chemical industry has developed numerous herbicides in recent years, several of which have been registered recently for use on turfgrasses. Among the most promising herbicides for golf courses are Prograss and Acclaim. Prograss was first registered in 1982 for annual bluegrass control in overseeded bermudagrass, but its proper use in cool season grasses is commonly misunderstood. Acclaim was marketed in 1987 and is the first, new chemistry postemergence annual grass herbicide to be commercialized in turf in 30 years. Some groups and individuals are recommending Acclaim for use on bentgrass. Acclaim, however, can be phytotoxic to bentgrass and is therefore not labelled for use on this species. Telar, Escort and Hoelon are not currently registered for use on fine turf, but they show promise for selectively controlling tall fescue in Kentucky bluegrass. In the pages to follow, some of our research with the aforementioned and other herbicides will be discussed. Hopefully, this information will be of value to you as you learn to effectively and safely control weeds with these new herbicides.

Prograss (common chemical name - ethofumesate) is a herbicide used primarily for the selective control of annual bluegrass in perennial ryegrass turf on golf courses. One of the outstanding characteristics of Prograss is that it can be applied just prior to or right after overseeding areas with perennial ryegrass, without adversely affecting germination of the ryegrass. Prograss is used in the south to convert bermudagrass putting greens to temporary perennial ryegrass greens after the bermudagrass has gone dormant. It is important to note that overseeding with turf species other than ryegrass is not recommended when utilizing Prograss. In addition to annual bluegrass, Prograss also controls common chickweed postemergently. The ability of Prograss to control annual bluegrass or other weeds preemergently requires further study and documentation.

Prograss has been evaluated on turfgrasses since 1981 at the University of Maryland. Early studies showed that Prograss may stunt or discolor Kentucky bluegrass in a single application, but a repeat application can severely injure Kentucky bluegrass. Studies conducted on golf course fairways in the Baltimore area in 1983 yielded a mix of fair to excellent results in controlling annual bluegrass. In 1984, various rates of Prograss were evaluated on Penncross creeping bentgrass putting greens at two golf courses (Chartwell Country Club and the U.S. Naval Academy Golf Course). The objective of this study was to determine if annual bluegrass could be safely controlled in putting green turf. A second study was also conducted on a mixed perennial ryegrass - annual bluegrass fairway to determine the lowest effective rate of Prograss.

Herbicide treatments were initially applied on September 20, 1984 and the sequential treatments were applied on October 18, 1984. Prograss was applied in 50 gallons of water per acre at 38 psi. Putting greens were mowed 24 hours before application; whereas, the fairway turf was mowed 48 hours following application. All three sites were again mowed 48 hours following application. It is important to leave a 24 to 48 hour mowing-free period

following application of Prograss to insure maximum translocation of the herbicide in the weed species. It is also important to note that application of Prograss should begin within 30 days following annual bluegrass emergence in the fall or spring. Percent plot area covered by annual bluegrass was determined the following spring. Overall turfgrass quality was visually determined on a 0 to 10 scale where 0 = brown turf, 8 = minimum acceptable quality for golf course turf and 10 = optimum color and density.

The annual bluegrass levels in the bentgrass putting greens at both locations were similar (33 to 38%). At Chartwell Country Club, the low rate of Prograss (0.75 lb ai/A) either in a single or sequential application did not control annual bluegrass (Table 1). The 1.0 lb ai/A rate, applied alone or sequentially, provided a similar level of control (50 to 64%). At the U.S. Naval Academy, a single Prograss application also provided a minimal level of control (33 to 37%); while the sequential treatments, regardless of rate, provided the same level of control (61%). Only the high rate of Prograss (1.0 + 1.0 lb ai/A) provided greater than 61% annual bluegrass control at both sites.

Overall quality, a measure of discoloration of the bentgrass turf caused by Prograss, was initially reduced by all rates (Table 1). About one month after the initial application (i.e. 18 October) all treatments at the U.S. Naval Academy had reduced the turf quality below the minimum acceptable level. At both golf courses in early November 1984 (about 6 to 7 weeks after the initial application), turf in plots treated only once with Prograss had recuperated from injury. Turf in sequentially treated plots, however, continued to exhibit unacceptable quality. All Prograss treated plots recovered by mid-January and treated bentgrass possessed a darker green color than untreated plots throughout the winter. Results of this bentgrass study suggest that the rates of Prograss required to effectively control annual bluegrass will discolor bentgrass putting green turf for too long of a period to be considered tolerable by most golf course superintendents.

Prograss did not discolor the perennial ryegrass fairway turf. The low rate of Prograss (0.75 lb ai/A) yellowed, but did not control annual bluegrass and the 0.75 + 0.75 and 1.0 lb ai/A treatments provided only 19 to 23% control (Table 2). A single application at 2.0 lb ai/A (81%) was just as effective as the 1.0 + 1.0 lb ai/A sequential treatment (85%) in reducing annual bluegrass coverage. The 2.0 + 2.0 lb ai/A rate, however, provided an exceptional level (99%) of control. The study was repeated in 1985 and a single application at 1.0 lb ai/A was shown again to provide poor (40%) annual bluegrass control. The single, 2.0 lb ai/A rate again provided good (81%) control, and split applications gave (93-99%) excellent control. Hence, the most cost effective rate of Prograss for annual bluegrass control in perennial ryegrass fairway turf was 2.0 lb ai/A.

In phytotoxicity, studies conducted on four separate Kentucky bluegrass turfs showed that turf quality was slightly reduced by Prograss applied at 1.0 or 2.0 lb ai/A. Split applications of 2.0 + 1.0 or 2.0 + 2.0 lb ai/A in the fall severely reduced bluegrass cover and overall quality for seven months. Other studies have shown that Prograss applied in the fall can delay spring green-up of zoysia grass the following year. Hence, Prograss is only known to be safe on perennial ryegrass turf, but can be safely used on Kentucky bluegrass if applied only once in the fall at 2.0 lb ai/A.

Acclaim is used for postemergence control of smooth and hairy crabgrass, goosegrass, barnyardgrass, foxtails and panicums. Acclaim does not control broadleaf weeds or sedges, and has no preemergence activity on annual grassy weeds. Acclaim is absorbed primarily through foliage and visual injury to weeds becomes evident 4 to 10 days after application. Acclaim works slowly and control of mature weeds will take up to 21 days. Visible effects begin as a general yellowing and reddening of the leaf surface.

Acclaim should only be applied to stands of Kentucky bluegrass, fine fescues and annual bluegrass that are at least one year old. Perennial ryegrass and tall fescue seedlings, however, are remarkably tolerant to Acclaim in the seedling stage. Bentgrass and bermudagrass, however, may be severely damaged by Acclaim. Acclaim should be applied to young, actively growing weeds. The effectiveness of Acclaim is reduced when applied to drought hardened or drought stressed annual grasses. For best results, Acclaim should be applied between June 15 and July 15 to crabgrass and other grassy weeds that are vigorously growing, i.e. weeds that are not under drought stress. Irrigating drought stressed areas one or two days prior to application will be helpful in improving Acclaim effectiveness. This herbicide should be applied in 30 to 60 gallons of water per acre (0.7 to 1.4 gallons per 1000 ft²) using 30 to 60 psi. Flat-fan or cone-style nozzles are recommended. Acclaim effectiveness is erratic when applied with flood jet nozzles. Thorough coverage of the weed foliage is essential for optimum results. It is very important to insure that maximum leaf area is present at time of application, therefore, a 24 hour no mow period before and after application is needed to insure good coverage and proper time for penetration and translocation of herbicide into weedy foliage.

In general, a single application of Acclaim around July 4, will provide satisfactory results for crabgrass control. Species germinating throughout the summer, such as goosegrass, will necessitate a second application. A second application may also be needed when dense populations of weeds prevent thorough spray coverage of the entire leaf surface of target weeds. Recommended rates and timings of application are outlined in another article in this proceedings entitled "Success and Failure in the Control of Crabgrass with Herbicides."

Acclaim has been evaluated extensively on bentgrass in Maryland. Years of testing have shown that the safest rate to apply to bentgrass is 0.04 lb ai/A or the equivalent of 5.1 fluid ounces per acre (or 3.5 milliliters per 1000 ft²). This rate will effectively control crabgrass seedlings in the 1 to 3 leaf stage. To aid in the safening of Acclaim on bentgrass it should be applied with chelated iron products such as Ferrimec or LESCO's Iron + N to help improve the appearance of bentgrass turf treated with Acclaim (Table 3). The interval for Acclaim applications at 0.05 lb ai/A should not be less than 21 days. It is important to note that Acclaim applied at rates above 0.08 lb ai/A can cause several weeks of severe discoloration and possible thinning of turf (Table 3). Because of its sensitivity to Acclaim, bentgrass is not a labelled species.

Tall fescue is a highly desirable turf species, however, when present in Kentucky bluegrass turf it becomes an unsightly weed. To date, the only means of removing tall fescue, without complete destruction of Kentucky bluegrass,

is to spot apply a non-selective herbicide such as Round-up to individual tall fescue plants. Field studies conducted between 1982 and 1987 at the University of Maryland have identified three herbicides (i.e., Hoelon, Telar, Escort) that can selectively remove tall fescue from Kentucky bluegrass. All three herbicides have been shown to injure or discolor Kentucky bluegrass and none is currently registered for fine turf. Registration of Telar for spot application to tall fescue is currently pending EPA approval.

Hoelon 3ED (diclofop-methyl) is a herbicide primarily used in the wheat and soybean markets. The developer of Hoelon (Hoechst-Rousell Agri-Vet) is currently seeking registration for Hoelon use in bermudagrass turf for goosegrass control. Our studies have shown that two fall applications followed by one spring application of Hoelon at 2.0 lb ai/A (5.3 pints/A) will provide 85 to 95% control of tall fescue. Hoelon at this rate will discolor Kentucky bluegrass and in some cultivars, it may dramatically thin the stand. Hoelon is also extremely injurious to perennial ryegrass and Kentucky bluegrass turfs less than one year old.

Telar and Escort are sulfonylureas, which have both plant growth regulator and broadleaf herbicide properties. Currently, Telar is registered for broadleaf control in low maintenance, industrial-type turfs. Telar, however, is injurious to both tall fescue and perennial ryegrass. Little is known about Escort safety to most turfgrass species. Research summarized in Table 4, demonstrates that extremely low rates of either Telar or Escort can provide greater than 90% tall fescue control in a single or split application. Telar and Escort will variously stunt growth or discolor Kentucky bluegrass, but the length of injury is only a few weeks; whereas, Hoelon injury may persist several months depending on the cultivar(s) treated. The greatest injury from Telar and Escort, however, may not be perceived in turf until the summer following a fall application of either herbicide. Tests have shown that Telar and Escort treated turf will be thinned more by drought stress the following summer than Hoelon treated Kentucky bluegrass. The thinning can range from 10 to 20% of the turf. Hence, Telar or Escort treated turf should not be subjected to drought within one year of treatment. It is again important to note that Telar and Escort are currently not registered for use on fine turf.

Recent and largely unfounded, concerns regarding the use of 2,4-D have stimulated interest in phenoxy alternatives (or at least 2,4-D alternative) for use on turfgrasses. Among the largest group of herbicides under study is the sulfonylureas. Among the products of this group being tested in 1897 are Classic, Harmony and Harmony + Ally. Of these, Harmony + Ally appears to be most promising. Triclopyr (trade name of Garlon in the field crop market) is being tested in combination with chlorflurenol (trade name = Breakthru) and a new herbicide called clopyralid. These products generally provide poor weed control when applied alone, but in a three way combination they appear to be as effective as 2,4-D + MCPP + dicamba. Quinclorac (or BAS 514) is another experimental herbicide that has shown promise in turf, especially for control of common blue violet.

Amine formulations of 2,4-D + triclopyr (trade name = Turflon D) and 2,4-D + 2,4-DP (trade name Weedone DPC) were marketed for the first time in 1987. Testing has shown that these amine formulations are as effective as the ester formulations, which have been on the market several years. Improved formulations of Trimec Encore, which is a three way mix of MCPA + MCPP +

dicamba, appears to be giving equivalent levels of control when compared 2,4-D + MCPP + dicamba.

The aforementioned, broadleaf products have not been extensively evaluated on bentgrass turf. Our preliminary tests, however, suggest that most of these herbicides will be too injurious to bentgrass. Among the many herbicides marketed for broadleaf weed control, only MCPP (or mecroprop) is relatively non-injurious to bentgrass. Unfortunately there are few weeds other than white clover and chickweed that are sensitive to MCPP applied alone.

Blockade (common chemical name - prodiamine) and Dacthal flowable are the only new preemergence annual grass weed herbicides that will (probably) enter the market in 1988. Both products are effective for preemergence control of crabgrass. Gallery, tested under the designation of EL-107, may be approved for 1988. Gallery will be marketed for the purpose of preemergence broadleaf weed control. Gallery, however, is weak against crabgrass at the label use rate and will need to be tank mixed with a dry flowable formulation of Balan, Team or similar herbicide if preemergence crabgrass control is desired.

Table 1. Efficacy of various rates of Prograss in controlling annual bluegrass in 'Penncross' creeping bentgrass greens at two locations in Maryland, and subsequent effects of the herbicide on overall turfgrass quality.

Treatment	Rate (1b ai/A)	Chartwell C.C.			U.S. Naval Academy			
		Annual bluegrass		Overall	Annual bluegrass		Overall quality	
		Cover	Control	quality 8 Nov 84 (0-10 Scale)	Cover	Control	18 Oct 84	1 Nov 84
Prograss 1.5E	0.75	34a**	10	8.6a	22b	33	7.1b	9.1a
Prograss 1.5E	1.00	19b	50	8.8a	21bc	37	6.0cd	9.2a
Prograss 1.5E	0.75+0.75	30a	20	6.2b	13c	61	6.6bc	7.9b
Prograss 1.5E	1.0+1.0	14b	64	5.6b	13c	61	5.6d	7.1c
Untreated control	---	38a	--	8.5a	33a	--	8.9a	9.5a

*Percent of plot area covered by annual bluegrass was visually estimated on a 0 to 100% scale on 18 April, 1985.

**Significantly different means were separated by LSD, 5% level.

Table 2. Annual bluegrass control in a perennial ryegrass fairway with Prograss.

Prograss Rate		Annual Bluegrass Control	
(1b ai/A)	(qt/A)	Apr 1985	Apr 1986
0.75	2.0	0	*
1.0	2.7	28	40
2.0	5.3	81	81
0.75 + 0.75	2.0 + 2.0	19	*
1.0 + 1.0	2.7 + 2.7	84	93
2.0 + 1.0	5.3 + 2.7	*	99
2.0 + 2.0	5.3 + 5.3	99	99

In 1984, Prograss was applied 20 Sept; sequential 18 Oct.

In 1985, Prograss was applied 10 Sept; sequential 17 Oct.

Table 3. Penncross creeping bentgrass sensitivity to Acclaim + Ferrimec, Silver Spring 1987.

Rate Acclaim (lb/A)	8 July		Overall Quality in July			
	Iron (oz/M ²)		13th	17th	23rd	31st
0.04	0.0		6.1d**	6.0de	6.2b	6.8ab
0.06	0.0		6.1d	5.8c	6.2b	7.0ab
0.08	0.0		5.8d	5.2f	5.8c	6.6b
0.04	6.0		7.6a	7.4a	7.5a	7.5a
0.06	6.0		6.2d	6.2cd	5.8c	7.2a
0.08	6.0		5.8d	5.4f	5.3d	6.4b
Untreated	---		6.8b	7.1ab	7.1a	7.4a

*Acclaim was applied 8 July.

**Bayes LSD, 5% level.

Table 4. Selective K-31 tall fescue control in Kenblue KBG, 1985-1986.

Herbicide ^x	Rate (lb ai/A)	KBG Cover, 1986			Tall Fescue	
		Mar	Aug	Oct	No. plants per plots	% Control
Telar	0.06 + 0.06	99	76	97	3*	97
Telar	0.125	99	74*	95	8*	93
Telar	0.125 + 0.125	99	71*	94	2*	99
Escort	0.06	100	80	95	10*	91
Escort	0.125	99	81	97	8*	93
Hoelon	3.0 + 3.0	51*	76	96	21*	82
Untreated	---	100	90	97	115	--

^xApplied 25 Sept; sequential 25 Oct 1985

*Significantly different from control, LSD 5% level.