EMBARK FOR ANNUAL BLUEGRASS GROWTH SUPPRESSION

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Many golf course superintendents in Michigan use Embark to control Poa annua seedheads and to reduce mowing requirements. The technique works well however some superintendents do not make use of it. The reasons for using Embark include excellent seedhead control, reduced mowing requirements, and enhanced root growth of annual bluegrass. The primary reason for not using Embark is the potential for turf discoloration which occurs to varying degrees with most Embark applications. Other reasons cited for not using Embark include inconsistent results from year to year and a lack of wear tolerance of the treated turf.

At Michigan State University, we have been working with Embark for the last ten years. Our experiences have shown very good results and we have concentrated on developing a model that would predict the best time for Embark application based upon growing degree days (GDD). Growing degree day modeling assumes that plants grow based upon heat accumulation and that their growth stage each growing season will be the same at the same level of heat accumulation. Thus, timing herbicide or plant growth regulator applications will be more consistent from year to year when based upon GDD's than when based upon calendar days. In order to determine GDD's, one must know the temperature at which the species you are studying begins growth. This is called the base temperature and for annual bluegrass it has been reported in the literature that the base temperature is 50 F (10 C). Growing degree day accumulation should begin as soon as the possiblity of GDD accumulation occurs which in Michigan is around March 1st. To accumulate GDD's a formula is used which, simply stated, says to sum the high and low temperature for each day, divide by 2, and subtract the base temperature or for those who prefer formulas - $\{(T_{max} + T_{min})/2 - T_{base} = GDD\}$. For annual bluegrass the target GDD's for Embark application are 45-90 when using the fahrenheit temperature scale and 25-50 when using the celsius scale. These are equivalent scales so either one will give the same results as long as you are consistent. As an example, suppose that on the first day you are accumulating GDD's, you have a high of 70 and a low of 50 F. According to the formula above (50 + 70)/2 - 50 = 10 GDD. Thus, you have accumulated 10 GDD towards a target of 45-90 GDD. If on the next day you accumulate 5 GDD, then you have a total of 15 GDD towards the target range of 45-90. You never subtract GDD only accumulate, a cool day would result in 0 GDD even if the formula were to indicate a negative number. If you use the Celsius scale, everything works the

same way only the base temperature is 10 and the target range is 25-50.

Our experience has shown that applications in the 25-50 range (Celsius) give excellent control (Figure 1) but if you go beyond the 50 GDD target, seedhead control is rapidly lost. Also, we have observed that the earlier the application, the more phytotoxicity will be seen on the annual bluegrass. Thus, the best strategy is to apply the Embark as close to the 50 GDD target as possible without going beyond 50 GDD.

In order to mask sone of the phytotoxicituy observed with Embark, we have tried to use various iron sources as masking agents. Our results have been mixed but have demonstrated that many of the commercially available iron sources will antagonize the Embark and reduced seedhead control will be seen (Table 1). The only iron source that did not cause antagonism when tank mixed with Embark was Agriplex. However, little to no masking of the injury caused by Embark was evident from the Agriplex. The best iron source was a granular iron formulation from O.M. Scotts. Unfortunately, this product is primarily for greens and would be prohibitively expensive to use on fairways.

We will continue to research this application and concentrate on finding an iron source that effectively masks the injury seen with the use of Embark. One of our concerns is that the published value for the base temperature of annual bluegrass may be incorrect. Most C3 grasses like annual bluegrass have a base temperature of 0 C. If this is the case, new target temperatures would have to be determined but the model would be more accurate.

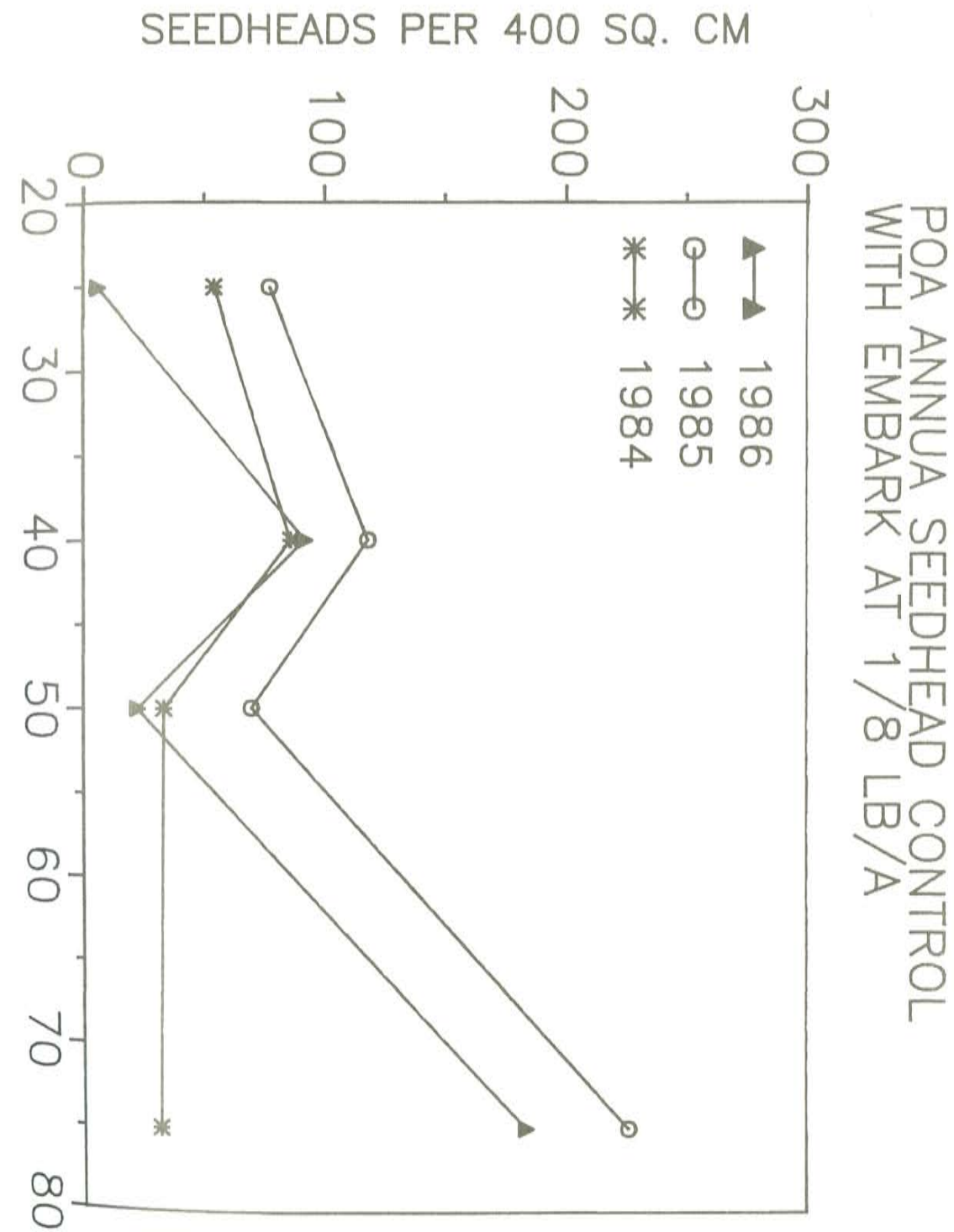
To summarize, using Embark to control annual bluegrass seedheads is an effective tool for fairway management. Further research is needed to optimize the technique and particularly to overcome the discoloration caused by the Embark. If an effective way to mask the injury can be developed, then this would indeed be an attractive way to manage fairways in the spring to reduce mowing, reduce annual bluegrass seedhead production, and to increase the spring root production of annual bluegrass.

TABLE 1. Effect of Embark plus Iron on Annual Bluegrass Seedhead Control.

Treatment		% Seedhead Cover	
		5/18/89	5/24/89
Embark + Scott's Iron-S		2	12
Embark + Agriplex	1.0 oz/M	4	12
Embark + Agriplex	1.5 oz/M	5	12
Embark + Agriplex	0.5 oz/M	8	15
Embark		8	15
Embark + Chipco Microgreen	2 oz/M	13	27
Embark + Ferromec AC	6 oz/M	13	40
Embark + Ferromec	4 oz/M	18	45
Embark + Ferromec	2 oz/M	20	37
Embark + Ferromec	6 oz/M	21	33
Embark + Ferromec AC	4 oz/M	24	50
Embark + $FeSO_4$	5.0 oz/M	24	52
Embark + Ferromec AC	2.0 oz/M	28	42
Embark + $FeSO_4$	3.6 oz/M	43	67
Control (No Embark)		60	85

*All Embark rates were 1/8 lb AI/A.

Figure 1.


POA ANNUA SEEDHEAD CONTROL
WITH EMBARK AT 1/8 LB/A
SEEDHEADS PER 400 SQ. CM
0
100
200
300
1986
1985
1984
20
30
40
50
60
70
80
GROWING DEGREE DAYS