Influence of Insecticide and N on Kentucky Bluegrass Thatch

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Thatch has been defined as the living and dead roots, rhizomes, stolons and crown tissue accumulating between verdure and soil. It has been suggested that excess thatch is detrimental because it reduces water infiltration, provides an exchange complex allowing pesticides to inactivate, provides harbors for disease and insect pests, and reduces drought and wear tolerance.

Previous research has pointed to N as being causal for thatch accumulation, but research at Michigan State University has documented the degradation of thatch with application of excessive rates of N as bio-organic turfgrass amendments. In that research as rate of N from the bio-organics increased thatch thickness decreased and earthworm populations increased. It was concluded that N was limiting for decomposition to occur and that soil animals (i.e., earthworms) must play a vital role in the decomposition process. Research currently being conducted sought to determine the influence of insecticide and widely used N carriers on thatch equilibrium.

Two experiments were initiated at the Robert Hancock Turfgrass Research Center in East Lansing. The first, referred to as the N Carrier/Insecticide study was initiated in 1987 on a seeded block of 'Touchdown' Kentucky bluegrass. For both studies thatch thickness averaged 28-30 mm thick prior to treatment. Experimental design was a RCBD with 3 replications. Treatments were arranged factorially and included Lawn Restore (10-4-4 Ringer), urea (46-0-0 CIL), IBDU (31-0-0 Par Ex), Bio-groundskeeper (no N KLM), A-299-9 (9-3-4 Andersons), MSU-PDC (6-3-4 Berndt/Vargas) and an untreated control. All treatments were applied in combination with and without the persistent insecticide chlordane at 1.1 kg/ha. Plots were irrigated daily to prevent wilting. Treatment carriers were applied at rates of 1 pound of N per 1000 square feet (or label rates) monthly beginning in May for the years 1987, 1988 and 1989. Chlordane was applied 4 times in 1987, 4 times in 1988 and 2 times in 1989. The second study, referred to as the Heavy N Rate study was initiated in 1989 on 'Touchdown' Kentucky bluegrass. Treatments included Lawn Restore (10-4-4 Ringers), A-299-9 (9-3-4 Andersons), A-299-10 (10-3-4 Andersons), and urea (46-0-0 CIL) applied at rates of 0, 2,

4, and 8 pounds of N per 1000 square feet per application. Treatments were applied 4 times in 1989 on 15 May, 15 June, 15 July and 15 August to bring total N applied to 0, 8, 16, or 32 pounds per 1000 square feet. These rates were considered excessive. Again, irrigation was provided daily to prevent wilt and so that water would not be limiting for decomposition.

Thatch samples for the N Carrier/Insecticide study were harvested in the fall of both 1988 and 1989. Sample analysis is at this time incomplete, thus limited data will be presented. Samples will also be harvested in fall, 1990 to provide 3 years worth of data. Samples for the Heavy N rate study were harvested in fall, 1989. Sample analysis for this study is likewise incomplete at the time of writing. Again, limited data will be presented.

Data regarding thatch thickness and bulk density for the N Carrier/Insecticide study for years 1988 and 1989 are presented in tables 1 and 2. Data regarding thatch thickness and bulk density for the Heavy N rate study is presented in table 3. Bulk density data reflects the amount of soil incorporated into thatch and not the weight of plant material per se. For the N Carrier/Insecticide study adding N at traditional levels (i.e., 1# N/M/app.) did little to modify thatch thickness in either 1988 or 1989 compared to the untreated control. Thatch thickness did decline for all treatments except urea (-) from 1988 to 1989. As urea was the only quick release carrier in the study this suggested N release rates may impact rate of decay. Thatch treated with insecticide was less dense regardless of depth or carrier for 1988 and 1989. Thatch not receiving insecticide increased in bulk density from 1988 to 1989 regardless of depth. Surface thatch (i.e., 0-1 cm depth) treated with chlordane also increased in bulk density regardless of treatment but thatch at 1-2 cm depth actually became less dense from 1988 to 1989. It was not determine why this was observed but perhaps thatch was beginning to "accumulate." The 1990 data on bulk density for each treatment by depth will indeed be very interesting.

For the Heavy N Rate study adding increasing levels of N regardless of carrier resulted in a decrease in thatch thickness and increase in bulk density in as little as 5 months. Even the urea treatment produced a thatch 50% thinner at the very high rate compared to untreated control plots. The decrease in thatch thickness probably occurred as a result of N being limiting in the excessive thatch situation (i.e., thatch C:N = 35-40:1). In other

words N rates greater than traditional levels were necessary to provide conditions suitable for visible decomposition to occur. Increases in bulk density were again attributed to soil animal activity. It must be emphasized that soil animal activity is extremely important with regard to initiating the decay process in thatch. Soil animals (i.e., earthworms and micro-arthropods) could be thought of as "primary degraders" which set the stage for secondary degraders (i.e., micro-organisms) to proliferate.

This research has suggested that in excessive thatch situations N was probably limiting for significant decomposition to occur. Traditional N application rates did little to enhance decomposition while 'excessive' N applications effected a visible change in a short time period. It was also demonstrated that addition of persistent insecticides such as chlordane prevented soil animal activity which was considered a vital part of the overall decomposition process. The research suggested that N was not causal in thatch accumulation but that insecticide application may be. Why thatch accumulates is still an unanswered question, but this research leads one to wonder about previous research described in the literature involving N and thatch where insecticide application (as chlordane or heavy metal arsenates) was a routine cultural practice previous to the initiation of the study, and just what effect this had without being accounted for! The research calls for more research involving N application rates and carrier types, and more importantly experimentation with other decomposition parameters such as irrigation level and frequency.

Table 1. Thatch thickness means for the N carrier/insecticide thatch decomposition study for 1988 and 1989. Thickness values were reported in mm. A + denoted addition of insecticide as chlordane while a - denoted no addition. Carriers were applied at rates of 1 pound actual N per 1000 square feet monthly through the growing season. Biogroundskeeper contained no N and was applied at label rates. Turf type was a 'Touchdown' Kentucky bluegrass.

Carrier	1988	1989
Lawn Restore -	29 d*	22 efg
Lawn Restore +	39 ab	30 abc
Urea -	25 d	25 cde
Urea +	35 bc	31 ab
IBDU -	28 d	20 fg
IBDU +	37 abc	30 abc
Biogroundskeeper -	28 d	19 g
Biogroundskeeper +	35 bc	28 bcd
A-299 -	27 d	21 fg
A-299 +	37 abc	30 ab
MSU-PDC -	25 d	18 g
MSU-PDC +	41 a	33 a
Check -	28 d	20 g
Check +	34 c	25 def
LSD P = 0.05	4	4
S.E.	1	2

* Means followed by similar letters were not different by LSD P = 0.05.

Table 2. Thatch bulk density means for 1988 and 1989. Bulk density was reported as kg thatch per square meter centimeter from depths of 0-1 cm and from 1-2 cm. Carriers were applied at rates of 1 pound N per 1000 square feet monthly. Biogroundskeeper contained no N and was applied according to label rates. A + indicated addition of insecticide as chlordane while a - denotes no insecticide addition.

Carrier	1988		1989	
	0-1 cm	1-2 cm	0-1 cm	1-2 cm
Lawn Restore -	2.1 fghi	7.2 a	6.0 cd	7.4 abc
Lawn Restore +	0.9 i	2.9 cdefg	3.2 e	2.7 e
Urea -	3.8 bcdef	7.7 a	8.5 ab	8.1 abc
Urea +	1.1 hi	4.4 bcd	3.6 e	2.2 e
IBDU -	2.3 fghi	6.8 a	4.2 de	6.5 bc
IBDU +	1.1 i	4.1 bcde	3.9 de	2.5 e
Biogroundskeeper -	4.6 b	8.0 a	6.0 cd	7.1 abc
Biogroundskeeper +	1.2 ghi	2.5 efghi	3.2 e	2.4 e
A-299 -	2.8 defgh	6.6 a	7.1 abc	8.6 ab
A-299 +	1.3 ghi	4.7 b	4.1 de	2.1 e
MSU-PDC -	4.5 bc	7.5 a	6.7 bc	9.1 a
MSU-PDC +	1.0 i	3.1 bcdef	2.0 e	2.4 e
Check -	4.2 bcde	7.1 a	7.0 abc	9.0 a
Check +	1.0 i	3.8 bcdef	3.1 e	3.3 e
LSD P = 0.05	1.7	1.7	2.2	2.2
S.E.	0.6	0.6	0.8	0.8

* Means followed by similar letters were not different by LSD P = 0.05.

Table 3. Thatch thickness and thatch bulk density means for the heavy N rate thatch decomposition study for 1989. Turf type was a 'Touchdown' Kentucky bluegrass. Thickness means were reported as mm while bulk density means were reported as kg thatch per square meter to a depth of 2 cm.

Treatment	Rate of N*	Thatch Thickness	Bulk Density
A-299-9	0	30 a **	5 c
	2	22 bc	6 bc
	4	22 bc	11 a
	8	16 ef	12 a
A-299-10	0	30 a	5 c
	2	21 bcd	9 ab
	4	23 b	9 ab
	8	20 bcdef	11 a
Lawn Restore	0	30 a	5 c
	2	17 cdef	11 a
	4	17 cdef	11 a
	8	21 bcd	13 a
Urea	0	30 a	5 c
	2	21 bcd	9 ab
	4	16 ef	10 ab
	8	15 f	11 a
LSD P = 0.05		5	4
S.E.		2	1

* N rates correspond to pounds of actual N applied per 1000 square feet per application. Four applications were made during 1989.

** Means followed by similar were not different by LSD P = 0.05.