

Adjusting nitrogen rates when clippings are returned

Returning clippings to fairways and roughs boosts natural nitrogen levels and reduces the need for inputs.

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- Returning clippings to fairways and roughs increases nitrogen in those areas.
- Excess nitrogen increases turfgrass yield, which means more mowing and increased labor and fuel costs.
- To gain the maximum benefit from returning clippings to fairways and rough areas, nitrogen fertilization rates should be reduced.

Key points

Returning clippings to fairways and roughs is a common practice on golf courses. Because returned clippings provide a supplemental, organic source of nitrogen to the turf, and because of the potential environmental impacts of overusing nitrogen fertilizer, nitrogen fertilization rates should be reduced when clippings are returned to turfgrass areas.

Previous research

A few earlier studies have examined the effects of returning grass clippings to turfgrass. A 2000 study (1) returned clippings to Kentucky bluegrass (*Poa pratensis* L.) by mulching mower. Results suggested that returning grass clippings improved the color of turfgrass compared with removing clippings and that reducing nitrogen fertilization by 50 percent did not decrease turfgrass color when clippings were returned. A 1981 study (6) included

casual observations of Kentucky bluegrass-creeping red fescue (*Festuca rubra* L. spp. *rubra*) quality in relation to clipping management and determined that returning clippings gave turfgrass a greener and “more luxuriant” appearance. The study also found that returning clippings increased nitrogen uptake of turfgrass.

Other studies (2,3,4) have found that turf quality was higher when clippings were returned to Kentucky bluegrass, bermudagrass (*Cynodon dactylon* L.) and tall fescue (*Festuca arundinacea* Schreb.).

Overall, few studies have considered the effects of the combination of returned grass clippings and nitrogen fertilization on nitrogen use and turfgrass quality. Therefore, we decided to explore the effects of returned grass clippings and varying nitrogen fertilization rates on growth, nitrogen use and quality of turfgrass in a fairway or

rough situation. In addition, we attempted to quantify the reduction in nitrogen fertilization that should accompany clipping return.

Materials and methods

A field experiment was conducted at the University of Connecticut’s Research and Teaching Farm in Storrs, Conn., during the growing seasons of 1998 and 1999.

Treatments

Experimental treatments included four rates of nitrogen fertilizer (0, 2, 4 and 8 pounds nitrogen/1,000 square feet/year) in three split applications and two clipping treatments (returned or removed). The nitrogen source was a mixture of 65 percent 30-4-4 (urea, methylene urea, ammonium phosphate and ammonium sulfate–5.2 percent water-insoluble N) and 35 percent 33-0-0 (NH₄NO₃) fertilizer. The wide range of nitrogen fertilization rates simulated an equally wide range of management practices.

The site was seeded with a bluegrass-ryegrass-fescue mixture, and experimental data were collected beginning in May 1998 and continuing through the growing season of 1999. The experimental fertilization rates were also applied to the site in 1997 although data were not collected. Subsamples of clippings were collected from the plots for analyses.

Analyses

To determine total nitrogen concentration, samples were analyzed using a LECO FP-2000 Carbon/Nitrogen Analyzer. The uptake of nitrogen was calculated as clipping dry weight × nitrogen concentration. Apparent nitrogen recovery was calculated as [(nitrogen uptake at N_x – nitrogen uptake at N₀)/(applied nitrogen at N_x) × 100 percent]. Nitrogen use efficiency was calculated as: [(yield at N_x – yield at N₀)/applied nitrogen at N_x] in units of pounds of clippings produced per pound of nitrogen applied.

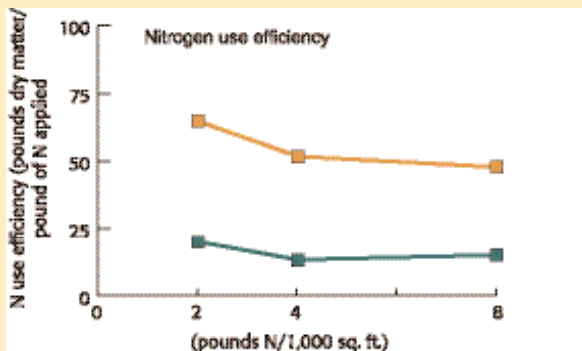
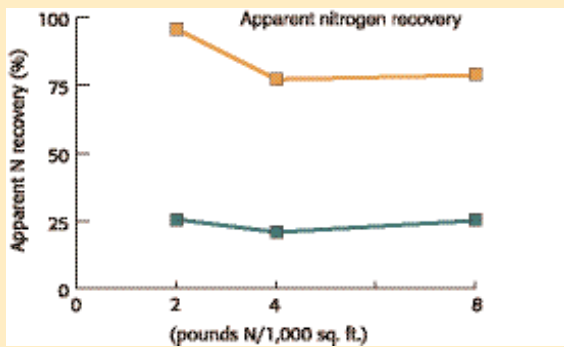
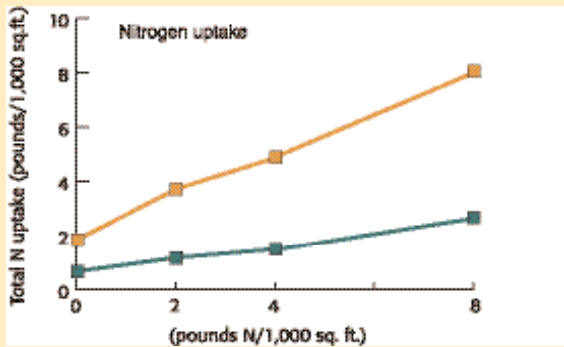
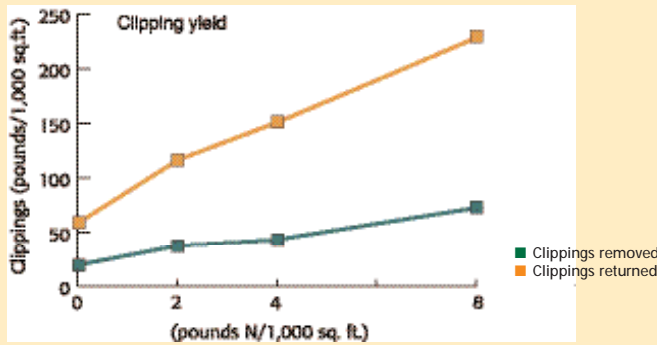
For example, if a total of 45 pounds of clippings was obtained at the 4 pounds of nitrogen per 1,000 square feet treatment, and 15 pounds of clippings were obtained at the 0 pound of nitrogen per 1,000 square feet treatment, nitrogen use efficiency could be calculated as:



Photo courtesy of Kelly Kopp

Returning clippings to the turf results in increased nitrogen levels, which, in turn increase clipping yield.

Clippings removed vs. returned



Effects of four nitrogen fertilization treatments (0, 2, 4 and 8 pounds/1,000 sq. ft./year) on clipping yield, nitrogen uptake, apparent nitrogen recovery and nitrogen use efficiency are compared when clippings are removed and when clippings are returned.

45 lbs. of clippings – 15 lbs. of clippings/
4 lbs. N per 1,000 square feet =
7.5 lbs. of clippings produced per pound of nitrogen applied.

Quality ratings were made monthly for all plots. An overall quality rating for each month (ranging from 1 to 9, where 1 = lowest quality and 9 = highest quality) was determined as a function of color and density (5).

Results

Clipping yield

We considered clipping yield an indicator of the vigor of the turfgrass system. Both increased nitrogen rates and returned clippings were found to increase clipping yield. We found that the treatment with 0 pound nitrogen/1,000 square feet/year with clippings returned produced a clipping yield comparable to the treatment with 8 pounds nitrogen/1,000 square feet/year with clippings removed. On the average, returning grass clippings increased clipping yield by 221 percent.

Total nitrogen uptake in clippings

Optimizing total nitrogen uptake is desirable in order to get the most out of nitrogen fertilizer applications. In this study, total nitrogen uptake increased when clippings were returned and when nitrogen fertilization rates were increased. Returning clippings increased total nitrogen uptake because there was more overall nitrogen in the system as it was released from the returned clippings. Uptake of nitrogen at 0 pound nitrogen/1,000 square feet/year with clippings returned was comparable to total nitrogen uptake at 8 pounds nitrogen/1,000 square feet/year with clippings removed. On the average, returning grass clippings increased total nitrogen uptake by 205 percent.

Apparent nitrogen recovery

We observed a general decrease in

Turfgrass quality

apparent nitrogen recovery as nitrogen fertilization rates increased. This finding was expected because the nitrogen requirements of the turfgrass would have been met and then exceeded by the wide range of increasing nitrogen rates in the study.

Apparent nitrogen recovery ranged from 21 to 26 percent with clippings removed and from 77 to 96 percent with clippings returned, depending on fertilizer treatment. Therefore, when clippings were returned under the conditions of this experiment, fertilizer nitrogen that was taken up by the clippings was slowly released as the clippings decomposed. This release of nitrogen more closely coincides with plant demands, thereby increasing recovery.

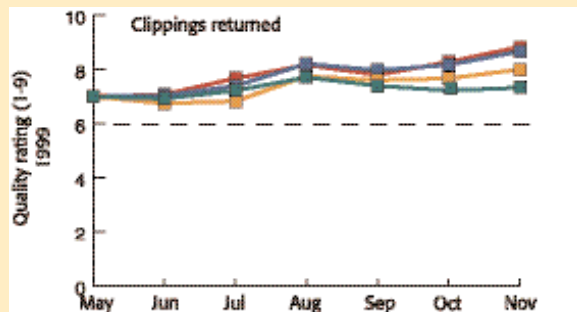
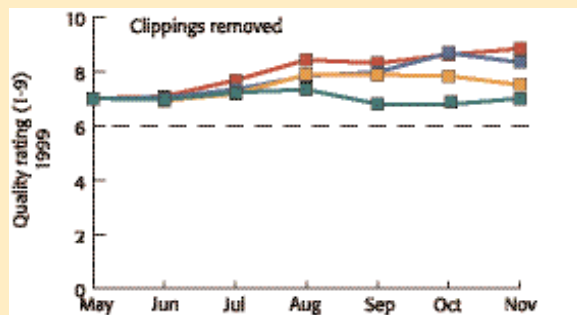
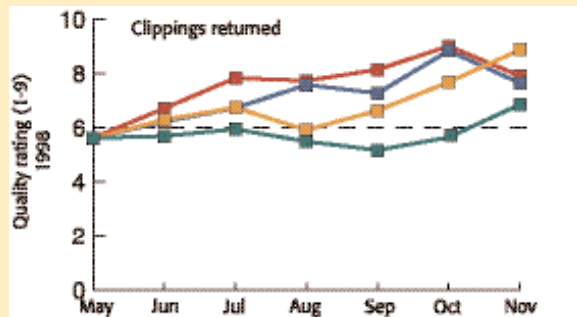
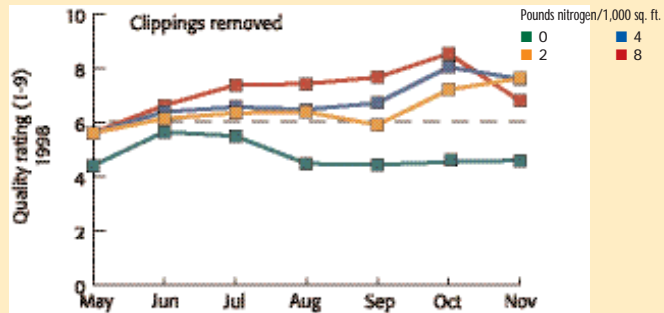
When the nitrogen from clippings is accounted for, less nitrogen is required from fertilizer sources. If the nitrogen in the clippings is not accounted for, fertilizer applications will probably result in excess nitrogen and potential leaching and runoff losses.

Nitrogen use efficiency

Nitrogen use efficiency describes the amount of clippings produced in relation to the amount of nitrogen fertilizer applied. Optimizing nitrogen use efficiency is desirable in order to gain the most benefit from nitrogen fertilization with the fewest costs. In this study, returning clippings increased nitrogen use efficiency.

When clippings were returned, nitrogen use efficiency ranged from 48 to 65 pounds of clippings per pound of nitrogen applied. When clippings were removed, nitrogen use efficiency ranged from 15 to 20 pounds of clippings per pound of nitrogen. On the average, returned grass clippings increased nitrogen use efficiency by 263 percent.

When the fertilizer nitrogen that is taken up by the clippings is slowly released, the turfgrass plant has more opportunity to absorb that nitrogen. This increases the efficiency of the system, and there is less reliance on fertilizer nitrogen to supply the optimal



Turf quality was rated over a seven-month period (May–November). Dashed lines indicate the acceptable quality rating, 6.

amount required by the grass.

Quality

Significant effects on turfgrass quality for each monthly rating period were attributed to the practice of returning clippings, nitrogen fertilization rate, and the interaction of clipping management and nitrogen fertilization rate. In general, as nitrogen fertilization rate increased, turfgrass quality also increased. When the effect of returned clippings was significant, turfgrass quality generally improved.

The most dramatic results in turfgrass quality that we observed were comparable quality ratings for plots receiving no fertilization with clippings returned and plots receiving 4 and 8 pounds nitrogen/1,000 square feet/year with clippings removed. This observation indicates that, under the conditions of this experiment, eliminating fertilization did not decrease quality if clippings were returned.

Summary and conclusions

The results of this study suggest that the practice of returning clippings improves the growth response and nitrogen use characteristics of turfgrass. Clipping yield, total nitrogen uptake, apparent nitrogen recovery and nitrogen use efficiency increased significantly when clippings were returned.

We generally observed statistically significant impacts of clipping management on turfgrass quality when clippings were returned. Certainly, the return of clippings did not detract from turfgrass quality. In fact, when we returned clippings, the turfgrass in our study reached acceptable quality ratings more often than when we removed clippings.

Returning grass clippings to turfgrass managed as fairways or roughs causes significant increases in nitrogen use efficiency, apparent nitrogen recovery and total nitrogen uptake. In addition, returning clippings without reducing nitrogen fertilization rates increases

clipping yield. Increased clipping yield means more frequent mowing of turfgrass and increased labor and fuel costs. Nitrogen losses from the golf course may also increase.

Therefore, if grass clippings are returned, nitrogen rates should be reduced. Begin with a 25 percent reduction and observe the quality of the turf. If quality remains consistent, continue reducing nitrogen fertilizer applications by small increments until a balance is achieved among nitrogen fertilization, clipping return and acceptable turfgrass quality. ■

Acknowledgments

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