Evaluating How Accurately Lawn Fertilizers Are Applied Using Homeowner Equipment

STEVEN ARTHURS*1 AND KAREN STAUDERMAN2

1University of Florida, IFAS, Mid Florida Research and Education Center, 2725 S. Binion Road, Apopka, FL 32703-8504
2University of Florida, IFAS, Volusia County Extension Office, 3100 East New York Avenue, DeLand, FL 32724-6497

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Inappropriate use of fertilizers in urban environments has been implicated in increased nutrient loads in Florida water bodies. We tested how accurately lawn fertilizers were applied by 36 master gardeners and other volunteers. Subjects were asked to apply a label rate of fertilizer [30% fine granular slow-release formulation (32–0–10) at 1.37 kg/100 m² (2.81 lb/1000 sq ft) and a coarse granular readily available nitrogen fertilizer (10–0–10) at 3.17 kg/100 m² (6.5 lb/1000 sq ft)] using three spreaders [a hand-held rotary, a broadcast rotary (push), and a drop spreader]. Results showed that under the test conditions applications using the hand-held rotary spreader were the most accurate (averaging 98% of target rate over two tests), while applications using the push rotary spreader tended to be over-applied (138% to 301% of target rate), and those of a drop spreader tended to be under-applied (31% to 48% of target rate). Our simple study highlights that lawn fertilizers are not always accurately applied. Sources of error included variability in applicator walking speed, inaccurate swath widths (e.g., too narrow with push rotary or too wide with drop spreader), and the amount of fertilizer loaded into hoppers. A good approach to provide a quick check of overuse or underuse is for applicators to determine the area to be treated and calculate and weigh the required amount of fertilizer before application. The inclusion of a volumetric measurement on the bag label (in addition to weight) would facilitate calibration for homeowners without requiring access to weigh scales.

Applying lawn fertilizers represents a cheap and simple method to achieve and maintain a beautiful green lawn. To facilitate their use, various mechanical fertilizer spreaders are available to homeowners through common garden retail outlets. However, inappropriate use of fertilizers in urban environments has been implicated in the degradation of inland and coastal water bodies as well as groundwater (Anderson et al., 2002; Bierman et al., 2010; Easton et al., 2007; King et al., 2007; Lehman et al., 2009). Issues contributing to an increased pollution risk may include inappropriate timing or placement of fertilizer, for example, applying high rates during turf establishment (Erickson et al., 2008) or during periods when grass is not actively growing or rainfall is heavy (Erickson et al., 1999).

In response to such concerns, some counties and municipalities in Florida have introduced voluntary and non-voluntary fertilizer ordinances in an attempt to limit runoff and groundwater leaching of nitrogen (N) and phosphorus (P) (Hochmuth et al., 2009). While many measures appear to be common sense, such as applying fertilizer within label rates, using controlled-release formulations and implementing fertilizer-free zones near water bodies, other strategies, such as the use of “black out” periods during the growing season, are more controversial (Hochmuth et al., 2009).

To avoid “over use” in a single application, most fertilizer manufacturers and/or distributors provide basic instructions to apply their product at recommended label rates. In addition, they may also adjust the N, P, K, and micronutrient analysis of their available merchandise according to the season in which they are sold. However, due to the different types of available fertilizers, spreader equipment, and inevitable differences in applicator technique, it is not at all clear how often recommended label rates of fertilizers are achieved. We report on a study evaluating how accurately groups of volunteers applied lawn fertilizers using common homeowner-type application equipment.

Materials and Methods

Studies were conducted at the University of Florida’s Volusia County Cooperative Extension Service office in DeLand. Our volunteers consisted of master gardeners in training along with some staff members. Each subject was asked to apply a label rate of fertilizer to a marked plot of turf grass using one of three types of homeowner fertilizer spreaders (Fig. 1). To account for differences in fertilizer type we asked volunteers to apply both a 30% slow-release high N content (fine granular material) and a higher volume of readily available low N (coarse granular material), i.e., 32–0–10 at a product application rate of 1.37 kg/100 m² (2.81 lb/1000 sq ft) and 10–0–10 at 3.17 kg/100 m² (6.5 lb/1000 sq ft), respectively. The assignments of spreaders and order that fertilizers were applied were selected randomly. Plots for the different treatments were 9.6 m × 9.6 m (1000 sq ft) and laid out using different colored flags in a randomized block design with six replicates.

In the first study, volunteers were provided a pre-weighed

*Corresponding author; phone: (407) 884-2034, ext. 151; email: spa@ufl.edu

quantity of fertilizer in an unmarked 1-gal Ziploc® bag (these contained approximately 50% more fertilizer than needed) and a copy of the instructions provided from the fertilizer bag. The settings for the wheeled spreaders were pre-selected by the researchers to apply the target rate at the swath width specified on the bag. The volunteers were not provided with a weigh scale and were asked to estimate the amount of fertilizer needed. An observer ensured that each volunteer stayed within the boundaries of their plot. At the end of the test, any unused fertilizer was collected and weighed with a precision balance to determine the actual rate applied. Volunteers always started in the same corner of the plot. In the occasional cases when volunteers ran out of fertilizer, the percentage of the plot already covered was estimated to calculate rate of fertilizer applied. To investigate basic demographic data, the gender and age of volunteers (in the categories <35, 36–45, 46–59, 60–70, and 71+) were recorded, and they were also asked to rate their gardening experience (novice, intermediate, and experienced).

The study was repeated with a second group of volunteers, with two small modifications. As in the first test it was possible that volunteers may have been somehow biased by the pre-weighed samples in the Ziploc® bags. This time they were provided with the whole [≈18 kg (40 lb)] fertilizer bag (at least half full), and a different fertilizer (5% N, 85% slow-release formulation, natural organic activated sewage sludge that is available for use on home lawns) was substituted in the 6.5-lb rate. Results of both studies were analyzed by univariate analysis of variance on log-transformed data. Where appropriate, post hoc mean separations were conducted using Fisher’s protected LSD at $P < 0.05$.

Results

The amount of fertilizer applied by volunteers was strongly influenced by the type of spreader used in both the first ($F_{2,30} = 19.5$, $P < 0.001$) and second test ($F_{2,30} = 85.3$, $P < 0.001$). There was no interaction between the type of spreader used and the rate (or type) of fertilizer applied in either case ($F_{2,30} = 1.4$, $P = 0.26$; $F_{2,30} = 2.5$, $P = 0.10$, respectively). The gender, age, and self-reported experience level of volunteers did not explain a significant amount of variation in the amount of fertilizer applied in either the first or second test ($F ≤ 0.83$, $P ≥ 0.52$ and $F ≤ 0.77$, $P ≥ 0.55$, respectively).

Applications using a hand-held rotary spreader were the most accurate (averaging 98% of target rate over both tests) while applications using a push rotary spreader tended to be over-applied (138% to 301% of target rate) and those of a drop spreader tended to be under-applied (31% to 48% of target rate) (Fig. 2A–D). Similar results were observed in both tests although a slightly clearer statistical trend between the three different spreaders was observed in the second test, where the entire fertilizer bag was provided to volunteers (Fig. 2C–D).

Discussion

Our simple experiment highlights that lawn fertilizers are not always accurately applied and that the choice and calibration of spreader equipment is an important consideration. In our study, volunteers using a push rotary spreader tended to over-apply, by as much as three times in one test (based on the target rate, not necessarily the label rate), while those using a drop spreader (which does not spread the fertilizer away from the hopper) generally failed to apply the target rate. Volunteers using the hand-held rotary spreader achieved relatively consistent application rates and presumably good coverage (although distribution of fertilizer within the plots was not specifically measured).

There are several possible explanations for our observations. The inexperience of volunteers may have reduced their accuracy; the use of an overly narrow and overly wide swath width, respectively, likely contributed to the variability between the push rotary and drop spreaders. Although less time efficient than rotary spreaders, drop spreaders allow a more accurate placement of fertilizer. Drop spreaders may therefore be the best choice when targeting areas adjacent to impervious surfaces like roads, or walkways or else on grass verges narrower than the throw diameter from a rotary spreader. One source of error may have been the actual turf plot used in our study, which was patchy with large brown spots following an extended freezing spell. Some volunteers reported difficulty in seeing the tracks left by the wheeled spreaders, which
may have been more of a disadvantage in the case of the drop spreader, which required a larger number of passes. The differences between the two rotary spreaders are less clear. However, volunteers using the hand-held variety tended to stand upright and look ahead (rather than looking down while pushing) which presumably provided a better view of where fertilizer had been applied over the whole plot during application, thus improving coverage achieved. Although not quantified, there may have been differences in accuracy among the spreader equipment. Other sources of variability in our tests included the different walking speeds and directions taken among the volunteers. It is also possible that the amount of fertilizer loaded into hoppers (which were different sizes and had different flow capacities through the aperture) may have caused some volunteers to speed up or slow down to compensate. Finally, accuracy may have improved with larger plots, although the area used was comparable to small lawns.

In order to ensure lawn fertilizers are accurately applied, human applicators should calibrate their equipment individually. A simple method to provide a check of overuse or underuse at an individual’s walking speed for a particular spreader and setting is for applicators to determine the area to be treated and calculate and weigh the required amount of fertilizer before application. However, in practice many homeowners may not use (or may not have ready access), to accurate scales. A possible solution to this limitation would be the inclusion of a volumetric measurement on the bag label and possibly the provision of a cheap plastic measuring scoop in fertilizer bags that would allow calibration on a volumetric basis.

Even when applied at the correct amount, using fertilizer at incorrect times can result in ground water pollution. Following prescribed UF/IFAS Florida Friendly Landscaping™ recommendations will ensure that lawns receive the maximum benefit of the fertilizer and negligible amounts are lost (FDEP, 2009). In general, fertilizers with slow-release nitrogen and no or low phosphorus are recommended for most Florida lawns. However, coated controlled-release fertilizer granules can be damaged by some spreaders (especially the rotary type that can damage up to 10% of the granules) and can increase the release rate of nitrogen (Parish, 2001). A soil test available through county cooperative extension services and private laboratories can be used to determine availability of P, K, Ca, Mg, and lime requirement if pH is below 6. It should also be noted that reclaimed water for irrigation may already contain nitrogen or other elements, which may reduce the need for routine fertilizer applications.

**Literature Cited**

Lehman, J.T., D.W. Bell, and K.E. McDonald. 2009 Reduced river phosphorus following implementation of a lawn fertilizer ordinance. Lake Reserv. Mgt. 25:307–312