Fertilizing home lawns

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Lawns need to be fertilized to maintain color, density, and vigor. The healthier and more vigorous a lawn is, the better it can withstand stress from heat, drought, traffic, and pets as well as competing against weeds, diseases, and insects. Excess fertilizing can produce a dark green lawn, but is likely not the healthiest. Fertilizing in moderation to maintain moderate growth and good density is most effective for lawns.

The amount of fertilizer applied annually to a lawn depends on a number of factors. Fertilization programs may need to be adjusted to apply slightly more or less nutrients annually depending on the following factors:

- Desires: A dark green and dense lawn will require more fertilizer than a lighter colored lawn. However, applying more fertilizer annually also requires more mowing, irrigation, pest control, and other inputs.
- Location: Because the growing season is longer in southeast Nebraska versus northwest Nebraska, more fertilizer will be needed to maintain the same turf quality in southeast Nebraska versus northwest Nebraska.
- Species: Turf-type tall fescue or buffalograss perform better with less nitrogen than Kentucky bluegrass or perennial ryegrass.
- Weather: A rainy summer will stimulate growth and will usually necessitate more annual fertilizer than a dry summer. The same holds true for irrigated versus an unirrigated lawn.
- Soil type: Turf grown on a sandy or a heavy clay soil will need more fertilizer than turf grown on a silt loam soil. Soils with inherent high fertility will require less fertilizer than inherently infertile soils. Soil type and pH will have a large effect on phosphorus and potassium needs. Sandy soils will need more frequent applications at lower rates to minimize potential for leaching.
- Age and quality of existing lawn: A new lawn will need more fertilizer for the first few years to enhance density. Improving a neglected or thin lawn may also require more annual fertilizer for the first few years. Annual nitrogen can likely be reduced with no consequences on a lawn fertilized for many years.
- Clippings: Clippings should always be returned to the lawn. Removing clippings for composting or mulch removes about 1.0 lb N/1000 sq ft/yr.
- Indicators: Presence of white clover or the diseases rust or dollar spot indicate a shortage of nutrients, whereas the

Figure 1. Intentional or unintentional applications of high N rates in the spring causes too much growth and decreases long-term health of the turfgrass.

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diseases brown patch or pythium indicate too much annual nitrogen.

Fertilizers

All fertilizers will have a series of three numbers displayed prominently on the label. These numbers represent the percentage by weight of nitrogen (N), phosphorus (as $P_2O_{5)}$), and potassium (as K_2O). For instance, a 24-4-8 fertilizer will have 24% N, 4% P_2O_5 and 8% K_2O. A 46-0-0 fertilizer will have 46% N, 0% and 0% K_2O. The rest of the bag will consist of carriers, inert products, other non-nutrients or perhaps sulfur (S) or iron (Fe). Though all three elements are important in maintaining a healthy turf stand, N will cause the greatest response. Because of this, most fertilizer recommendations for lawns are listed as lbs. N/1000 sq ft.

Nitrogen fertilizers come in two basic forms: quick-release (soluble) nitrogen and slow-release (insoluble) nitrogen. Examples of slow- and quick-release N forms are listed in Table 1. Quick-release nitrogen normally causes a response in one week or less, whereas slow-release nitrogen will cause a response over three to ten weeks or more. Quick-release nitrogen is inexpensive and may burn leaf blades if applied improperly. Slow-release forms tend to be more expensive, but will rarely burn leaf blades even when applied at temperatures above 85F. Both N forms can and should be used on lawns. Both forms of N are often blended in one fertilizer bag to provide a quick N response shortly after application plus a more gradual and longer response.

Figure 2. White clover (top) or the disease rust (bottom) indicate the lawn needs more annual N.

Fertilizing with phosphorus and potassium is also important in maintaining a healthy lawn. Phosphorus and/or potassium applications should always be based on soil tests as described in tables 2 and 3 and information in Soil Testing for Turf Areas at http://turf.unl.edu/pdfcaextpub/SoilTesting2012g.pdf .

Fertilization Programs

For cool-season grasses like tall fescue or Kentucky bluegrass, fertilize lightly in spring and early summer, apply little to none in summer, and apply most of the fertilizer after Labor Day. Applying high rates of N in spring and summer stimulates excess leaf growth at the expense of root growth. Not only does this increase mowing requirements, it reduces turf quality during the summer and potentially increases susceptibility to heat, drought, and pests. Conversely, warm-season grasses like buffalograss should be fertilized primarily in summer after green-up with no fertilizer prior to green-up in spring or after the last mowing in the fall.

Table 4 lists the University of Nebraska recommendations for fertilization of Kentucky bluegrass or tall fescue, while Table 5 lists the program for buffalograss. Keep in mind that the initial seven points in this publication will affect your fertilization program and the rates may need adjusting.

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The dates listed are for eastern Nebraska, so adjust dates by one to two weeks later in spring and earlier in the fall for northern and western Nebraska.

In addition to the applications listed in Table 4, preemergence herbicides applied in late April/early May are often combined with nitrogen. Since cool-season grasses need little N in the spring, try to purchase a product with a low percent N and/or a high percentage as slow-release N (Figure 6). If you apply a preemergence herbicide combined with fertilizer in April, the May N application should be reduced or skipped. Professional lawn care companies have more flexibility with products available to them, and thus they may increase the number of applications while decreasing the rate of N per application. This can give a more gradual feeding of the grass plants and produce a high quality lawn.

How Much Fertilizer to Apply

It is critical to apply the correct amount of fertilizer to your lawn. Table 6 explains how to calculate the proper amount of fertilizer to apply or Table 7 lists the amount of fertilizer needed, given the desired rate and the p N in the product. Additionally, the fertilizer bag may list the proper spreader setting for your spreader. If the setting is not listed, refer to the later section on "Calibrating a Fertilizer Spreader." Even if your settings are listed on the label, you should calibrate your spreader to make sure it is still accurate. As spreaders get older, settings gradually change because of wear and tear. Regular cleaning and lubrication of the spreader will help it last longer. One fool-proof way to spread the correct amount of fertilizer is to calculate the amount of product needed for your lawn, set the spreader very light, spread one half of the total in one direction and spread the other half of the total in a perpendicular direction.

Fertilizer Application

Apply fertilizer uniformly over the lawn. Overlap wheel tracks for drop-type spreaders. For rotary spreaders, apply the fertilizer so the wheel is at the edge of the pattern from the previous pass. Improper spreading of fertilizer will result in "streaking", the alternate dark- and light-green stripes in a lawn (Figures 1 and 3). Agricultural type fertilizers (10-10-10, 12-12-12, etc.) that have large particle sizes should not be applied with a drop-type spreader, but a rotary spreader should be used instead. Irrigation or rain following fertilization is important to move nitrogen

Figure 3. Uniform and accurate applications are essential to maximize intended agronomic effects and to further minimize the already small risk of offsite movement of turf-applied fertilizers.

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off the leaf blades and into the soil. Be sure to read the label instructions on fertilizer/herbicide combination products because some need to be applied to dry turf and watered in, whereas others need to be applied to wet turf so it sticks on leaf blades of the weeds. Combination fertilizer/insecticides for white grubs always have to be watered-in. Avoid applying fertilizer to drought-stressed or dormant turf, or when temperatures are over 80F.

Figure 4. Avoid applying fertilizers to impermeable surfaces and sweep/blow fertilizer into the turf after application.

Fate of Nitrogen

There is some concern about nitrogen leaching into groundwater or running off into surface water. Research shows that when applied correctly and accurately, nitrogen remains where it is applied. A dense turf canopy prevents water run-off and thus prevents nitrogen from moving across a lawn. The thatch and dense rooting of grass plants absorbs nitrogen and also prevents it from moving through the root zone. However, fertilizing too late in the fall or over-fertilization for many years increases the chances for N leaching. Also avoid applying fertilizer to impervious surfaces like walks and drives, and sweep or blow fertilizer granules from these areas into turf after fertilizing (Figure 4).

Leave an untreated/unfertilized buffer strip around all water bodies to prevent spreading phosphorus-containing fertilizers into the water. Do not apply near drain tile inlets or surface drains. Never dump clippings into water bodies or storm drains (clippings contain 1-2% P dry weight). Avoid dumping tree leaves into water bodies or storm drains for the same reason. Be sure to calibrate your spreader, and follow all label instructions on the fertilizer bag to reduce the risk of nitrogen moving away from the target.

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Table 1. Fast- and slow-release nitrogen sources found in fertilizers for athletic fields.

Fast release (water soluble)	Slow release (slowly water soluble or insoluble)
Urea	Coated N (sulfur, plastic, or resin-coated)
Ammonium sulfate	Urea formaldehydes
Any source listed as “ammoniacal”	Methylene ureas
Any source listed as “water soluble”	Organic N (animal byproducts, etc)
	IBDU (isobutylenediurea)
	Any source listed as “slowly water soluble”
	Any source listed as “water insoluble”

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Table 2. Recommended total lbs P_2O_5/1000 sq ft applied between soil tests using Bray P1 testing. Soil tests should be run every 3 to 5 years after establishment. Modified from the University of Wisconsin's "Interim Turf Nutrient Management Guide" at http://www.turf.wisc.edu/docs/dnr1100-TurfNutrientManagement.pdf.

Soil test results		Bare soil establishment from seed or overseeding of existing turfs to improve density	Bare soil establishment from sod	Established, lawns, parks, golf course roughs
ppm P	lbs/A P	lbs P_2O_5/1000 sq ft recommended to be applied between soil tests		
0-5	0-11	3	3	3
6-10	12-21	3	3	2
11-15	22-30	3	2	1
16-20	31-40	2	2	0
21-30	41-60	2	1	0
31-40	61-80	1	0	0
41-50	81-100	1	0	0
>50	>100	0	0	0

Table 3. Recommended total lbs K_2O/1000 sq ft applied between soil tests.

Soil test results		Established lawns, parks, golf course roughs
ppm K	lbs/A K	lbs K_2O/1000 sq ft/yr
0-25	0-50	4-5
25-50	50-100	2-3
50-75	100-150	1
75-100	150-200	0
100+	200+	0

Table 4. Fertilizer recommendations for Kentucky bluegrass or tall fescue list in order of importance. Dates listed are for eastern Nebraska and should be adjusted for your area.

Month	Kentucky bluegrass		Turf-type tall fescue		Notes
	lbs N/ 1000 sq ft	% slow release	lbs N/ 1000 sq ft	% slow release	
Sept. 10	1.0	20-50%	1.0	20-50%	Should be applied to all cool-season lawns
Oct. 20	0.75-1.0	0-20%	0.75-1.0	0-20%	Should be applied to all cool-season lawns, except those under very low maintenance. Apply when the lawn slows growth in the fall but is still green (shortly before the final mowing).
April 25	0.25-0.75	20-50%	0.25-0.75	20-50%	Apply with preemergence herbicide, purchase product containing low N.
May 20	0.75-1.0	20-50%	0.75-1.0	20-50%	Reduce rate if N applied earlier with PRE herbicide. Product for this application is often sold with herbicides to control dandelions and other broadleaf weeds. This application can be omitted if lower maintenance lawn is desired.
July 15	0.25-0.50				Apply with white grub control on KBG lawns. This application can be omitted if lower maintenance lawn is desired.

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Table 5. Fertilizer recommendations for buffalograss listed in order of importance. Dates listed are for eastern Nebraska and should be adjusted for your area.

	Buffalograss		
Month	lbs N/ 1000 sq ft	% slow release	Notes
April 25	0.25-0.75	20-50%	Apply with preemergence herbicide, purchase product containing low N.
June 1	1.0	0-25%	Reduce the rate of N if N was applied earlier with PRE herbicide
July 1	1.0	0-25%	Apply only to buffalograss lawns that need extra fertility to establish or recover from damage.

Table 6. Determining the amount of fertilizer to apply when given the fertilizer rate in lbs N/1000 ft2

Step 1. Calculating the amount of fertilizer/1000 sq ft:

$$\frac{\text{Desired rate in lbs N or other nutrient}}{\text{1000 sq ft}} \div \text{\% N} = \frac{\text{fertilizer needed}}{\text{1000 sq ft}}$$

Step 2. Calculating the amount of fertilizer to treat the entire turf area:

$$\frac{\text{fertilizer needed}}{\text{1000 sq ft}} \times \text{Area to be treated in sq ft} = \text{lbs fertilizer needed to treat the area}$$

Example: how much 16-8-8 fertilizer do you need to apply 0.75 lbs N/1000 sq ft to an 8000 sq ft lawn?

Step 1. Calculating the amount of fertilizer/1000 ft^2:

$$\frac{\text{0.75 N}}{\text{1000 sq ft}} \div \text{0.16 nutrient} = \frac{\text{4.69 lbs 16-8-8}}{\text{1000 sq ft}}$$

Step 2. Calculating the amount of fertilizer to treat the entire turf area:

$$\frac{\text{4.69 lbs 16-8-8}}{\text{1000 sq ft}} \times 8000\ ft^2 = \text{37.5 lbs fertilizer needed to treat 8000 sq ft}$$

Or you can use Table 7 where calculations are already done.

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Table 7. Amount of fertilizer required given target rate in lbs N/1000 and percent N in product.

		Target rate in lbs N/1000 sq ft								
		0.25	0.40	0.50	0.60	0.70	0.75	0.80	0.90	1.00
% N in fertilizer or fertilizer/pesticide combo (from label)	1	25	40	50	60	70	75	80	90	100
	2	13	20	25	30	35	38	40	45	50
	3	8.3	13.3	17	20	23	25	27	30	33
	4	6.3	10.0	13	15	18	19	20	23	25
	5	5.0	8.0	10	12	14	15	16	18	20
	6	4.2	6.7	8.3	10	12	13	13	15	17
	7	3.6	5.7	7.1	8.6	10	11	11	13	14
	8	3.1	5.0	6.3	7.5	8.8	9.4	10	11	13
	9	2.8	4.4	5.6	6.7	7.8	8.3	8.9	10	11
	10	2.5	4.0	5.0	6.0	7.0	7.5	8.0	9.0	10
	11	2.3	3.6	4.5	5.5	6.4	6.8	7.3	8.2	9.1
	12	2.1	3.3	4.2	5.0	5.8	6.3	6.7	7.5	8.3
	13	1.9	3.1	3.8	4.6	5.4	5.8	6.2	6.9	7.7
	14	1.8	2.9	3.6	4.3	5.0	5.4	5.7	6.4	7.1
	15	1.7	2.7	3.3	4.0	4.7	5.0	5.3	6.0	6.7
	16	1.6	2.5	3.1	3.8	4.4	4.7	5.0	5.6	6.3
	17	1.5	2.4	2.9	3.5	4.1	4.4	4.7	5.3	5.9
	18	1.4	2.2	2.8	3.3	3.9	4.2	4.4	5.0	5.6
	19	1.3	2.1	2.6	3.2	3.7	3.9	4.2	4.7	5.3
	20	1.3	2.0	2.5	3.0	3.5	3.8	4.0	4.5	5.0
	21	1.2	1.9	2.4	2.9	3.3	3.6	3.8	4.3	4.8
	22	1.1	1.8	2.3	2.7	3.2	3.4	3.6	4.1	4.5
	23	1.1	1.7	2.2	2.6	3.0	3.3	3.5	3.9	4.3
	24	1.0	1.7	2.1	2.5	2.9	3.1	3.3	3.8	4.2
	25	1.0	1.6	2.0	2.4	2.8	3.0	3.2	3.6	4.0
	26	1.0	1.5	1.9	2.3	2.7	2.9	3.1	3.5	3.8
	27	0.9	1.5	1.9	2.2	2.6	2.8	3.0	3.3	3.7
	28	0.9	1.4	1.8	2.1	2.5	2.7	2.9	3.2	3.6
	29	0.9	1.4	1.7	2.1	2.4	2.6	2.8	3.1	3.4
	30	0.8	1.3	1.7	2.0	2.3	2.5	2.7	3.0	3.3
	32	0.8	1.3	1.6	1.9	2.2	2.3	2.5	2.8	3.1
	34	0.7	1.2	1.5	1.8	2.1	2.2	2.4	2.6	2.9
	38	0.7	1.1	1.3	1.6	1.8	2.0	2.1	2.4	2.6
	46	0.5	0.9	1.1	1.3	1.5	1.6	1.7	2.0	2.2

Pounds N /1000 sq ft = N rate in lbs N/1000 ÷ % N*

**Note convert percent to decimal before calculation by dividing by 100 (18% =.18, or 7%=.07)

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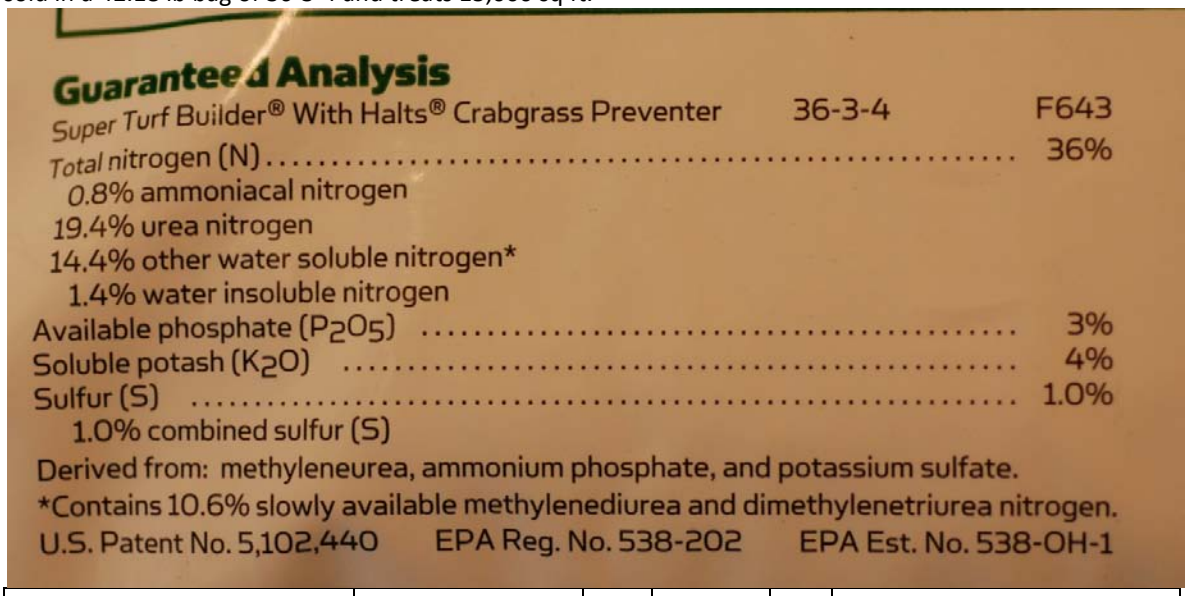
Figure 5. Calculating the lbs N/1000 sq ft and % slow release from a typical fertilizer label. This product is sold in a 42.18 lb bag of 36-3-4 and treats 15,000 sq ft.



Step 1. Calculating the pounds of N in the bag	42.18 lbs	X	0.36 N	=	15.18 lbs N in bag
Step 2: Calculating the rate in N/ sq foott	15.18 lbs N in bag	÷	15000 sq ft	=	0.00101 lbs N/ sq ft **(prefer to be 0.5 to 0.75)**
Step 3: Calculating the rate in N/1000 sq feet	0.00101 lbs N/ sq ft	X	1000	=	1.01 lbs N/ sq ft **(prefer to be 0.5 to 0.75)**
Step 4: Calculating percent of N as slow release	1.4 + 10.6 = 12%	÷	36%	=	33% N is slow release **(higher the better)**

Figure 6. Calibrating a drop-type fertilizer spreader

1	Measure the distance between the outside holes of the spreader:	_____in.
2	Convert this to feet by dividing by 12	_____ft.
3	Measure off a convenient distance to run the spreader, The longer the distance, the more accurate the calibration:	_____ft.
4	Multiply the number in step 2 by the number in step 3 to calculate the area covered by the spreader:	_____ sq ft
5	Weigh a portion of the product and dump into spreader:	_____lb.
6	Run the spreader over the area previously measured in step 3, being careful to shut the spreader on and off precisely at the beginning and end of the course.	
7	Weigh the amount of product left in the spreader:	_____lb.
8	Subtract the number in step 7 from the number in step 5. This is the amount of product applied to the area you have measured:	_____lb.
9	Divide the number in step 8 by the number in step 4 to give lb. product per square foot:	_____lb./sq ft
10	Multiply the number in step 9 by 1000 to give lb. product/1000 sq ft:	_____lb./1000 sq ft
11	Is this number close to the recommended rate listed on the bag? Adjust the spreader setting and repeat the process until the spreader is applying the recommended rate listed on the bag.	

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Figure 7. The effective pattern of a rotary spreader.
A rotary spreader is different than a drop spreader in that the distribution is not uniform across the width of the pattern. More product lands near the spreader and less product lands near the edge of the pattern. To compensate for this, the spreader must be run so the edge of the pattern is just touching the wheel tracks from the previous pattern. The "effective pattern" is the distance from one edge of the spreader pattern to the center of the spreader. All products and spreaders have a specific effective pattern.

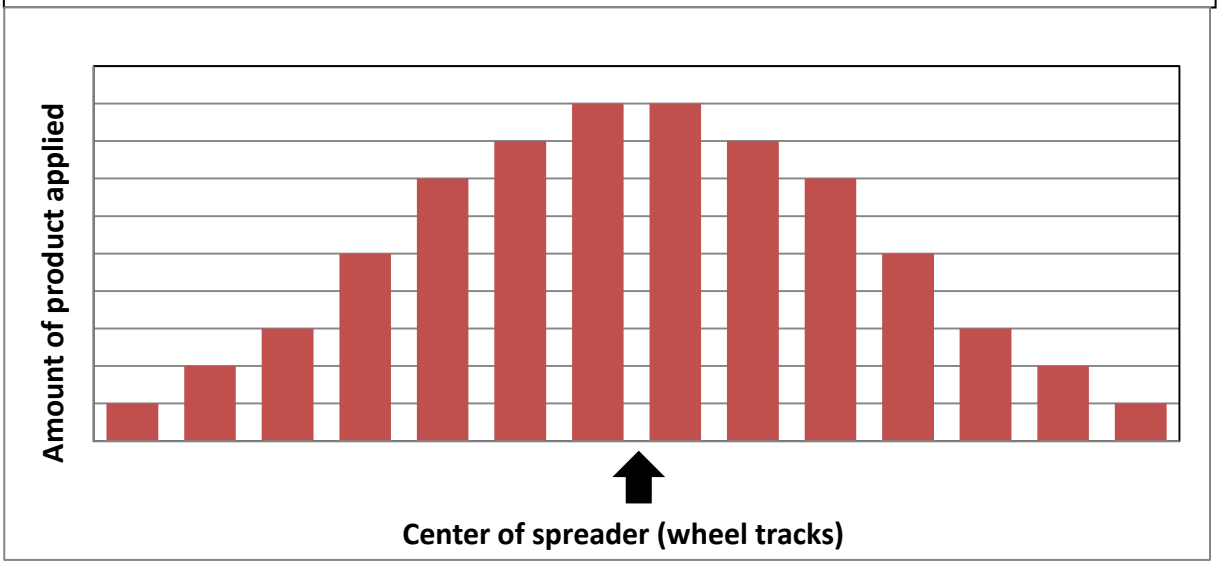

Figure 8. Calibrating a rotary fertilizer spreader.

1	Measure the width of the effective pattern of the spreader: This is simply the distance from the center of the spreader to the edge of one side of the pattern. See "Effective Pattern of a Rotary Spreader" above.	_____ft.
2	Measure off a convenient distance to run the spreader. The longer the distance, the more accurate the calibration:	_____ft.
3	Multiply number in step 1 by the number in step 2 to calculate the area covered by the spreader:	_____ sq ft
4	Weigh a portion of the product and dump into spreader:	_____lb.
5	Push the spreader over the area previously measured in step 3, being careful to shut the spreader on and off precisely at the beginning and end of the course:	
6	Weigh the amount of product left in the spreader:	_____lb.
7	Subtract the number in step 6 from the number in step 4. This is the amount of product applied to the area you have measured:	_____lb.
8	Divide the number in step 7 by the number in step 3 to give lb. product per square foot:	_____lb./sq ft
9	Multiply the number in step 8 by 1000 to give lb. product/1000 sq ft:	_____lb./1000 sq ft
10	Is this number close to the recommended rate listed on the bag? Adjust the spreader setting and repeat the process until the spreader is applying the recommended rate listed on the bag.	