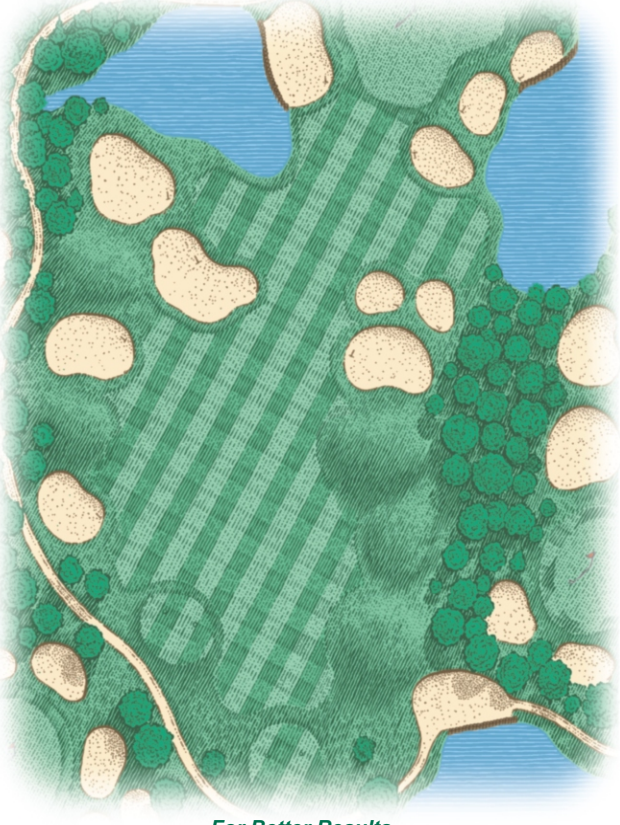
LOG BOOK

& REFERENCE GUIDE



For Better Results.
Naturally.

Milorganite®

Table of Contents

How to use the Milorganite Log Book & Reference Guide

The Milorganite Log Book & Reference Guide is a summary of information to help you understand and use Milorganite. It includes research, tips, fact sheets and conversion tables.

Included are:

- helpful information on planning projects, with a variety of valuable suggestions on proven uses of Milorganite
- summary of research showing ways to improve your turf with Milorganite
- tips on successfully growing turf, trees, shrubs and flowers with Milorganite
- measurement and conversion tables to help ensure accuracy for purchasing, measuring and calibration

Fertilizing with Milorganite

The following rate charts give general rates and timing of fertilizer applications. They are meant to be used as guidelines in the absence of soil tests and specific site recommendations.

For best results, analyze the soil for each area you are managing. Combine this information with nutrient recommendations from researchers who have worked with your grass type in your area.

Milorganite Professional Product Line

Milorganite® 6-2-0 Classic
This is the product we have made for more than 75 years. Across North America and around the world, anywhere you need to fertilize, Milorganite is proven, reliable and a safe organic nitrogen fertilizer. Sized at SGN* 160, this fairway sized granule quickly drops through most turf canopies to rest on the soil surface until rain or irrigation activates its nutrients.

Milorganite® 6-2-0 Greens Grade
The same nutrient package you get from the original Milorganite Classic is also available as Greens Grade. These SGN* 90 granules contain the same nutrients as Milorganite Classic. The particles are small enough to fall through most canopies of close-cut turf. This minimizes mower pick-up and the impact on ball roll. Spoon-feeding greens with Milorganite® 6-2-0 Greens Grade keeps your golfers returning time after time!

Milorganite 1,000 lb. and 2,000 lb. Bulk Bags
Milorganite is available in both 1,000 and 2,000 pound bulk bags. These large bags are provided for convenience and reducing packaging waste. Both Milorganite Classic and Milorganite Greens Grade are available in these sizes. These heavy-duty bulk bags are plastic lined to resist moisture penetration. Durable lift straps make handling these a breeze. A closable spout simplifies filling spreaders.

* SGN refers to the Size Guide Number. This is the millimeter measurement of the average diameter of a fertilizer granule, i.e., a fertilizer with a SGN of 160 contains granules with an average diameter of 1.60 millimeters.

Specifications

Nutrient Analysis
Milorganite is an organic nitrogen fertilizer guaranteed to contain not less than 6% nitrogen, 85% of that being water insoluble (WIN). The Water Insoluble Nitrogen in Milorganite does not burn, does not easily leach and only becomes available during growing conditions favorable for plant growth.

Milorganite contains 2% available phosphorus. This nutrient is important in helping provide energy for plants to grow and repair damage.

Milorganite also contains 4% organically complexed iron. Iron keeps plants deep green without causing excessive top growth. This high amount of iron does not stain walks and patios or other concrete surfaces.

Guaranteed Analysis

Total Nitrogen (N)…..…….	6.0 %
0.75% Water Soluble Nitrogen	
5.25% Water Insoluble Nitrogen*	
Available Phosphate (P_2O_5)…….	2.0%
Calcium (Ca)……..….	1.2%
Total Iron (Fe)…….……	4.0%
Chlorine (Cl) maximum……	1.0%

*5.25% Slowly available nitrogen
Nutrients derived from: Biosolids

Size Guide Number (SGN) and Uniformity Index (UI)

The Size Guide Number (SGN) and Uniformity Index (UI) are used to accurately define the size of fertilizer granules. The Size Guide Number is a measurement of the average diameter of a fertilizer granule, i.e., a fertilizer with a SGN of 160 contains granules with an average diameter of 1.60 millimeters.

The Uniformity Index indicates the uniformity of fertilizer granules for a specific SGN size in a batch. You can think of this in terms of a traditional bell curve (think of the teachers grading curve for a class). Steep sides of the curve indicate that the data is uniform. More sloping sides indicate that the data is less uniform. The Uniformity Index is the measure of this uniformity.

A fertilizer with a high Uniformity Index indicates a fertilizer that is very uniform while a low Uniformity Index indicates that the granule size varies considerably. Fertilizers with a high UI spread accurately. Blended fertilizers with a high Uniformity Index indicate that the blend will tend to be uniform and not segregate when handling and spreading.

	SGN	UI
Milorganite Classic	160	60-70
Milorganite Greens Grade	90	60-70

Milorganite Slow Release Nitrogen

Milorganite contains 6% nitrogen. 85% of this nitrogen, 5.25 units, is in the Water Insoluble form. This source of nitrogen cannot leach into groundwater until soil microbes slowly change it into soluble forms. This change occurs steadily, usually at the same rate as plants utilize this soluble nitrogen.

Milorganite releases its nitrogen through the action of soil microbes. When moisture and temperature are adequate for soil microbes to grow, nitrogen is mineralized (converted from the organic to the mineral form) and Milorganite's nitrogen is released into the soil. When soil and growing conditions are poor, Milorganite's nitrogen stays in the Water Insoluble form.

Nutrient release is very slow in cold weather and poor moisture (either too much or too little) conditions. Nitrogen release peaks with moderate temperatures of late spring, slows with excessive summer heat and increases again with moderating temperatures of fall. This follows the same level of activity that plants have during those times. This allows for minimum loss of nutrients and the most efficient use of fertilizer. In the tropics, release is assured any time of the year when moisture is sufficient to support growth.

Milorganite's nitrogen is released, depending on weather conditions, over an eight to ten week period. As a general rule, applying Milorganite every eight weeks ensures that a steady supply of this nutrient is available.

Milorganite Iron

Iron is necessary to make chlorophyll. Chlorophyll gives plants their green color. While plants differ in how deep this coloring is, anything that enhances the formation of chlorophyll enhances their green color. Iron also improves turfgrass color when nitrogen applications have been reduced.

Iron chlorosis, or deficiency, appears as yellowing between the veins of leaves. While this yellowing may be caused by other nutrient deficiencies, it most often is the result of a low amount of available iron in the soil.

The iron in Milorganite is organically complexed. It stays in a form available to plant roots. Because it is organically complexed, Milorganite iron does not stain concrete walks and patios.

Unlike applying extra nitrogen to help turf become dark green, Milorganite iron does not cause excessive growth. Plants that take up excess iron simply become darker. This darkness, combined with the natural green color imparted by chlorophyll, gives plants a dark green color. Obtaining this same coloration by using nitrogen would produce a high amount of growth, which will result in an excessive amount of clippings.

Milorganite and Salts

Milorganite contains virtually no chemical salts. Chemical salts, found in high concentrations in most synthetic fertilizers, can dehydrate and burn plants. This is especially true in low moisture conditions. Droughty soils add to this burn potential.

Salts can also build up in the soil to create residual concentrations. If you are watering with 'gray' or effluent water, you are adding salts to your turf. Using Milorganite, with its low salt content, doesn't add to the salt burden of your soil. All plants can only tolerate a finite amount of soil salts.

The following table compares salt concentrations of some common fertilizers with Milorganite.

Fertilizing Material	Salt Index
Potassium chloride	116
Ammonium nitrate	109
Sodium nitrate	100*
Urea	75
Potassium nitrate	74
Ammonium sulfate	69
Calcium nitrate	53
Sulfate of potash	46
Methylene urea	24
Ureaform	10
IBDU	5
Milorganite	**2**

* Sodium nitrate has been traditionally given a Salt Index of 100. This creates a benchmark with which to measure the relative “saltiness” of fertilizing materials.

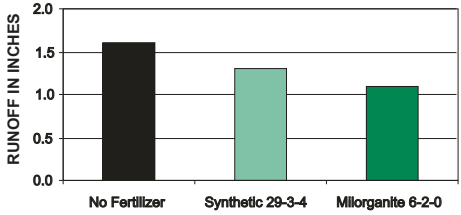
Milorganite and Environmental Respect

A University of Wisconsin Madison study shows that runoff from well-maintained lawns contains less nutrients than runoff from poorly maintained lawns. A well-maintained lawn uses the nutrients from fertilizer. Poor quality lawns lack the turf density and extensive root system to retain nutrients efficiently, thereby allowing more to move into groundwater, lakes, and streams.

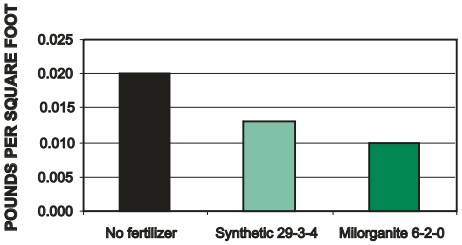
This study examined the runoff from fertilized and non-fertilized Kentucky bluegrass plots. The fertilized plots each received four applications of either a synthetic fertilizer or Milorganite. The application rate was one pound Nitrogen per 1000 sq. ft. Runoff water was collected after each rain or snowmelt. The amount of nitrogen and phosphorous in this runoff water was measured. As the graphs demonstrate, runoff from the unfertilized turf exceeded runoff from the plots fertilized with Milorganite by as much as 100%.

It was also found that 60% of the nitrogen and 80% of the phosphorous in leachate occurs when the soil is frozen. To the researcher, this indicates that most of these nutrients are from leaf tissue and not from turf fertilizer.

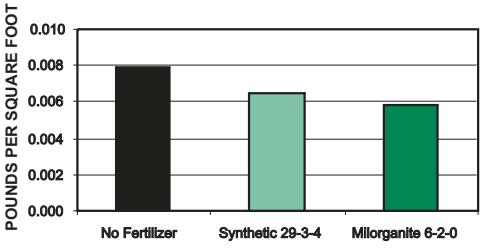
Influence of Fertilization on Total Runoff from Kentucky Bluegrass Turf



Influence of Fertilization on Phosphorus Runoff from Kentucky Bluegrass Turf



Influence of Fertilization on Nitrogen Runoff from Kentucky Bluegrass Turf



Properly fertilized turf reduces runoff. Increased turf density slows water movement, allowing more time for nutrient and water absorption to occur. Failing to fertilize properly can lead to a decline in turf density and increased runoff. This research shows that fertilizing with Milorganite is one of the most environmentally sound ways to encourage healthy turf and reduce nutrient runoff.

(For a copy of the study, Runoff and Leaching Losses of Nutrients from Kentucky Bluegrass Turf, visit our web site at www.milorganite.com/professional/about/research.cfm

Fertilizer Recommendations

The following charts show general fertilizer rates for different turf types and uses. These charts assume that all nitrogen needs are filled by the use of Milorganite 6-2-0.

Many factors exist that will change these recommendations. They include:

- Turf type
- Type of use
- Local climate
- Desired results
- Available budget
- Soil analysis results
- Other aspects of your fertilizer program

If you are in doubt as to specific recommendations for your turf, contact your local supplier or university extension professional.

Milorganite and Greens

Players expect the green to play the ball the way they putt. Nothing should interfere with this. That's why we developed Milorganite Greens Grade, SGN 90. These small particles fall through the turf canopy so the fertilizer doesn't interfere with the putting surface or find its way into greens mower baskets.

Spreading uniform, dust free granules of Milorganite® 6-2-0 Greens Grade is one of the best ways to make sure your players return time after time.

Cool Season Turf (1) (4)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1 lbs.	17 lbs.
Summer	½ lbs.	6-8 ½ lbs.
Fall	1 lbs.	17 lbs.
Dormant	1 ½ lbs.	25 lbs.

Warm Season Turf (2) (4)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1-2 lbs.	17-34 lbs.
Summer	1-2 lbs.	17-34 lbs.
Fall	1-2 lbs.	17-34 lbs.
Fall over-seeding (3)	1 lb.	17 lbs.

(1) Cool Season Turf Bentgrass and poa annua,
(2) Warm Season Turf Bermuda, seashore paspalum and zoysiagrass
(3) In regions where killing frosts can be expected, avoid nitrogen applications to warm-season grasses in the fall less than one month prior to the average date of the first killing frost. For best results, fertilize when over-seeding with cool-season grasses.
(4) All rates monthly except dormant which is annual.

Milorganite and Tees

Tees take some of the roughest abuse on the golf course. Their care and maintenance is continually under fire due to the desire by golfers for that perfect tee shot. By including Milorganite in your care program for tees, you remove some of this stress.

Cool Season Turf (1) (4)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1 lbs.	8 ½ lbs.
Summer	½ lbs.	8 ½ lbs.
Fall	1 lbs.	17 lbs.
Dormant	1 ½ lbs.	25 lbs.

Warm Season Turf (2) (4)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1-2 lbs.	17-34 lbs.
Summer	1-2 lbs.	17-34 lbs.
Fall	1-2 lbs.	17-34 lbs.
Fall over-seeding (3)	1-2 lb.	17-34 lbs.

(1) Cool Season Turf Bentgrass, poa annua, Kentucky bluegrass, fescue and perennial ryegrass
(2) Warm Season Turf Bermuda, seashore paspalum and zoysiagrass
(3) In regions where killing frosts can be expected, avoid nitrogen applications to warm-season grasses in the fall less than one month prior to the average date of the first killing frost. For best results, fertilize when over-seeding with cool-season grasses.
(4) All rates monthly except dormant which is annual.

Milorganite and Spoon Feeding

Superintendents need to keep golf greens an even green color throughout the playing season. To do this, many superintendents spoon feed small amounts of nutrients on a regular schedule.

The object of these applications is to keep a steady supply of nutrients available. This eliminates peaks and valleys in nutrient supply that are common with large, infrequent applications. Using Milorganite® 6-2-0 also helps to level these peaks and valleys because its nitrogen releases slowly over time, without excessive amounts being available quickly after application

Milorganite Greens Grade is a very uniform small granule fertilizer. These dust free granules easily work into tight greens. This results in less mower pickup than other larger sized fertilizer granules.

Because you are applying small amounts of nitrogen, using a low analysis fertilizer helps eliminate streaking. Milorganite contains 6% nitrogen. This means that to apply 0.33 lbs. nitrogen per 1000 square feet in a spoon-feeding program, you need to apply 5 ½ lbs. Milorganite per 1000 square feet. This is easier to spread evenly than the 1 1/3 lbs. of a 27% nitrogen granular fertilizer needed over that same area.

Spoon-feeding with a granular fertilizer offers other advantages. Frequent light applications of Milorganite® Greens Grade 6-2-0 provide a constant energy source for soil microbial activity. This also provides a constant source of organically complexed iron for deep green color throughout the season. Spoon feeding also offers the benefits of faster, easier and affordable applications. One spoon feeding application can be accomplished by one employee in about the same time it takes to change cups. 100,000 square feet of greens will require less than ten bags at an application rate of 0.35 pounds of nitrogen per 1,000 sq. ft.

Milorganite and Fairways

Fairways are usually the most picturesque part of the golf course. All golfers instantly note the level of care and maintenance they receive. Including Milorganite in your care program for fairways helps insure that your fairways are a highlight of your course.

Cool Season Turf (1) (4)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1 lbs.	17 lbs.
Summer	½ lbs.	8 ½ lbs.
Fall	1 lbs.	17 lbs.
Dormant	1 ½ lbs.	25 lbs.

Warm Season Turf (2) (4)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1-2 lbs.	17-34 lbs.
Summer	½-1 lbs. monthly	8-17 lbs. monthly
Fall	1 lbs.	17 lbs.
Fall over-seeding (3)	½-1 lb.	8-17 lbs.

(1) Cool Season Turf Bentgrass, poa annua, Kentucky bluegrass, fescue and perennial ryegrass
(2) Warm Season Turf Bermuda, seashore paspalum and zoysiagrass
(3) In regions where killing frosts can be expected, avoid nitrogen applications to warm-season grasses in the fall less than one month prior to the average date of the first killing frost. For best results, fertilize when over-seeding with cool-season grasses.
(4) All rates monthly except dormant which is annual.

Milorganite and Roughs

Remember when roughs were a place where golfers never wanted to go? Today, they are expected to be nearly playable. This means that you are, to some degree, mowing and maintaining your roughs. Milorganite is a part of that program. Having over 85% slow release nitrogen, each Milorganite application is long lasting.

Cool Season Turf (1) (4)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	½-1 lbs.	8-17 lbs.
Summer	No summer applications	
Fall	½-1 lbs.	8-17 lbs.
Dormant	1 ½ lbs.	25 lbs.

Warm Season Turf (2) (4)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1 lbs.	17 lbs.
Summer	1 lbs.	17 lbs.
Fall	1 lbs.	17 lbs.

(1) Cool Season Turf Bentgrass, poa annua, Kentucky bluegrass, fescue and perennial ryegrass
(2) Warm Season Turf Bermuda, seashore paspalum and zoysiagrass
(3) In regions where killing frosts can be expected, avoid nitrogen applications to warm-season grasses in the fall less than one month prior to the average date of the first killing frost. For best results, fertilize when over-seeding with cool-season grasses.
(4) All rates monthly except dormant which is annual.

Milorganite and Athletic Fields

Milorganite has long been an integral part of sports field maintenance, including the preparation for many Super Bowls. Milorganite promotes dense turf, which increases footing and fall protection. Milorganite's high amount of slow release nitrogen encourages deep rooting for durability and stress resistance.

Cool Season Turf (1) (4) (5)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1 lbs.	17 lbs.
Summer	½-1 lbs.	8½ lbs.
Fall	1 lbs.	17 lbs.
Dormant	1 ½ lbs.	25 lbs.

Warm Season Turf (2) (4) (5)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1-2 lbs.	17-34 lbs.
Summer	½-1 lbs. monthly	8-17 lbs. monthly
Fall	1-2 lbs.	17-34 lbs.
Fall over-seeding (3)	1-2 lb.	17-34 lbs.

(1) Cool Season Turf Bentgrass, poa annua, Kentucky bluegrass, fescue and perennial ryegrass
(2) Warm Season Turf Bermuda and zoysiagrass
(3) In regions where killing frosts can be expected, avoid nitrogen applications to warm-season grasses in the fall less than one month prior to the average date of the first killing frost. For best results, fertilize when over-seeding with cool-season grasses.
(4) All rates monthly except dormant which is annual.
(5) Summer applications are monthly. All others are annual.

Milorganite and Lawn Care

Milorganite is the ideal choice for lawn fertilizer programs that use organic nitrogen as their base. Milorganite® 6-2-0 will not burn turf. It will not cause "leggy" ornamental plants if it accidentally is applied to them. Produced and sold since 1926, Milorganite delivers the results customers demand.

Cool Season Turf (1)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring	1 lbs.	17 lbs.
Summer (4)	½ lbs.	8½ lbs.
Fall	1 lbs.	17 lbs.
Dormant	1 ½ lbs.	25 lbs.

Warm Season Turf (2) (3)

	N per 1,000 sq. ft.	Milorganite 6-2-0 per 1,000 sq. ft.
Spring (4)	1 lbs.	17 lbs.
Summer (4)	1 lbs.	17 lbs.
Fall	1 lbs.	17 lbs.
Fall over-Seeding (3)	1 lb.	17 lbs.

(1) Cool Season Turf Bentgrass, poa annua, Kentucky bluegrass, fescue and perennial ryegrass
(2) Warm Season Turf Bermuda grass, Bahia grass, zoysiagrass, centipede grass and St. Augustine grass
(2) Annual totals may be adjusted for grass variety and location, based on the Florida Turf Recommendation Chart, IFAS Fact Sheet SL-21.
(3) In regions where killing frosts can be expected, avoid nitrogen applications to warm-season grasses in the fall less than one month prior to the average date of the first killing frost. For best results, fertilize when over-seeding with cool-season grasses.
(4) Monthly applications.

Milorganite and Lawn Care

Florida Turf Recommendations
High turf quality[(1)(2)]
Lbs. N recommended per 1000 sq. ft. per season

Turf type	North[(2)]	Central[(2)]	South
Bahia	3	4	4
Bermuda	5	6	6
Centipede	2	3	3
St. Augustine	4	5	5
Zoysia	5	6	6

(1) Taken from University of Florida IFAS Fact Sheet SL-21.
(2) In regions where killing frosts can be expected, avoid nitrogen applications to warm-season grasses in the fall less than one month prior to the average date of the first killing frost. For best results, fertilize when over-seeding with cool-season grasses.

Greens Construction and Establishment

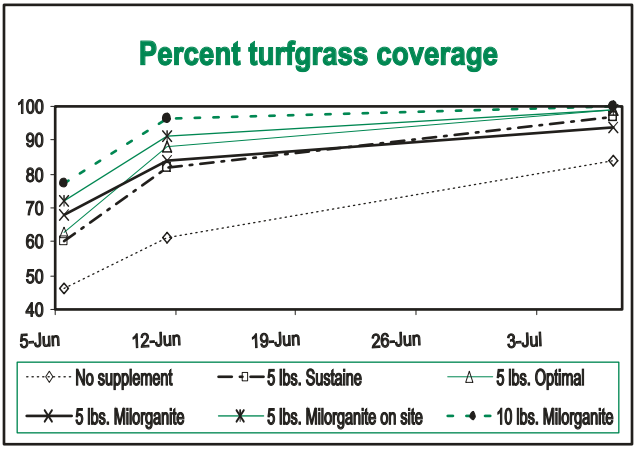
The majority of greens today are constructed using high sand content root zone mixes. Although sand based greens resist soil compaction and drain well, they frequently have a low cation exchange capacity. The resulting weaknesses, a tendency to develop localized dry spots, shallow rooting of turfgrass and high rates of potassium leaching, are not uncommon on greens today.

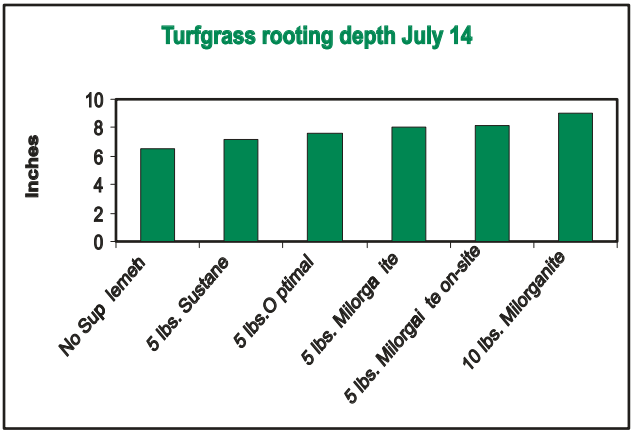
A University of Wisconsin-Madison study determined that amending the root zone mix with an organic supplement at the time of construction vastly improves overall green quality. In 1996, an experimental putting green was constructed in compliance with USGA standards. The initial root zone mix consisted of an 80:20 sand:peat combination with a pH of 6.3. Root zone amendment treatments were then created by adding specific organic materials to the original sand:peat root zone mix. Each organic supplement was added to the root zone mix at a rate of 5 lbs. per cubic yard. An additional treatment was created by adding 10 lbs. of Milorganite per cubic yard. These sand, peat and organic supplements were mixed off-site, as recommended by the USGA. An additional treatment was created on-site by tilling the equivalent of 5 lbs. of Milorganite per cubic yard into the top six inches of the 80:20 sand:peat root zone mix.

Differences between the original and amended root zone mixes were obvious soon after germination. Not only did the supplemented plots achieve more rapid and complete grow-in, the study also found that the addition of organic materials to the root zone mix increased root zone firmness and stability, improved water retention and water infiltration rates, enhanced color, increased rooting depth and reduced phosphorous deficiency.

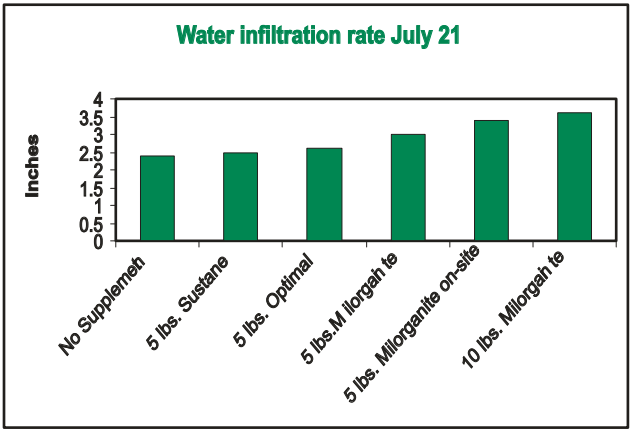
The graphs on page 20 and 21 provide the complete data from measurements of these turf characteristics.

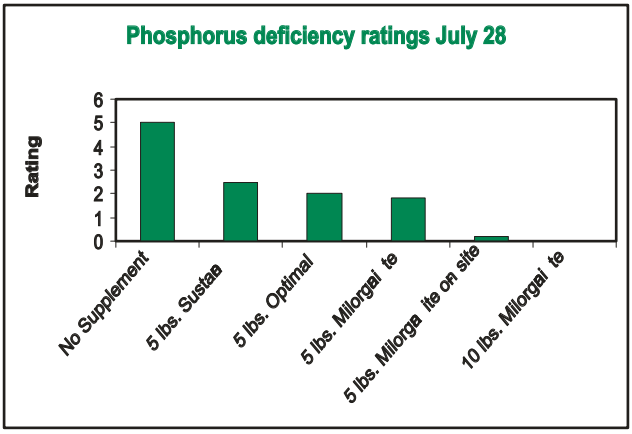
Greens Construction and Establishment





Greens Construction and Establishment





Milorganite and Turf Establishment

Providing adequate nitrogen and phosphorus to newly established turf is critical to successful establishment. Because new turf is growing rapidly, it has a higher requirement for nutrients than mature turf.

The best guarantee of success for any fertility program begins with a soil analysis. However, the guidelines below can be used when a soils analysis has not been performed and you know the general soil type.

Why Milorganite?
Milorganite contains the nitrogen and phosphorus that are required for a fast developing lawn. Mix Milorganite 2-4 inches into the root zone. This places nutrients where they are readily available to young seedling roots. The high amount of Water Insoluble Nitrogen in Milorganite helps keep this nutrient in the soil profile and available to seedlings, even when you are heavily irrigating the area during establishment. This also helps prevent phosphorus tie-up when high amounts are applied to the soil surface.

Rates of Milorganite when seeding, sodding and sprigging

Rate Chart for Using Milorganite to Seed, Sod or Sprig

	Milorganite® 6-2-0 lbs. per 1,000 sq. ft.	
Soil Type	**Seeding and Sodding**	**Sprigging**
Sand	50-100 lbs. *	50-100 lbs. *
Native Soil	25-50 lbs. *	25-50 lbs. *

* Use the higher rates with turf types that are high nitrogen users, such as Kentucky bluegrass or Bermuda grass and in soils with low organic matter, very infertile root zones. Mix 10 lbs. Milorganite per cubic yard root zone mix for Green's Construction.

Milorganite and Turf Establishment

Mixing seed with Milorganite

Mixing grass seed with Milorganite makes it easier to accurately spread seed. The standard Milorganite-to-seed is 4 to 1 by weight. When mixing seed and Milorganite, make sure you decrease the rate of other Milorganite applied to avoid over-fertilization.

Milorganite Seed Mixing Chart

Seed Type	Milor-ganite lbs.	Seed lbs.	Seed per 1000 sq. ft.	Coverage area of Mix	Milo. Per 1000 sq. ft.
Bentgrass	20	5	1 lb.	5,000 sq. ft.	4 lbs.
Bermuda Grass	20	5	1 lb.	5,000 sq. ft.	4 lbs.
Blue Grass	100	25	4 lbs.	6,250 sq. ft.	16 lbs.
Blue-Rye Mix	100	25	6 lbs.	4,250 sq. ft.	23 lbs.
Rye Grass	100	25	8 lbs.	3,250 sq. ft.	30 lbs.

Seeding

Spread seed or Milorganite - seed mix evenly on the prepared soil. Gently work the seed into the soil 1/16 to 1/8 inch. On light (sandy) soils, watering alone may be adequate for seed incorporation. Cover with a thin layer of weed seed free mulch to help conserve moisture.

Watering

Keep the seeded area moist until seed emerges. Frequent, light watering is necessary at this time. After seedlings are ½ to 1 inch tall and climatic conditions allow, reduce watering to several times per week at depth of one to two inches. Keep the root zone moist. Decrease frequency and increase depth of watering as seedlings mature.

Mowing

Mow the new turf as you would mature turf. Keep your mower blades sharp. Mow only when turf is dry. Remove a maximum of 1/3 leaf at any one time. Because new turf contains a high amount of water, collect clippings to prevent smothering new turf.

Milorganite and Dormant Feeding

Golfers desire to start golfing earlier and earlier each year. This means that early spring green-up of courses is becoming increasingly important. This is especially true in the Snow Belt. Superintendents use every tool available to them to have courses ready for play as soon as snow cover melts. Applying Milorganite in very late fall or just prior to a winter snow cover is part of this program.

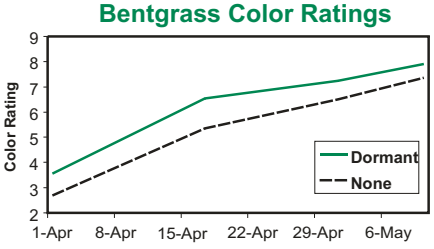
This practice is dormant feeding. It has been used for many years in Snow Belt areas. Research shows late fall applied Milorganite provides early spring green-up. Microbial activity, releasing Milorganite's nutrients, occurs during winter months. When spring comes, these nutrients help turf green up early.

The University of Wisconsin conducted a two-year study to evaluate dormant feeding on bentgrass greens. Color response was measured. It was found that microbial activity occurred during winter months. This released a small amount of nitrogen. This nitrogen was then available to the bentgrass as soon as snow melted.

Bentgrass color was recorded every seven to 10 days after snowmelt. Measurements continued until mid-May. Dormant applications of Milorganite significantly improved bentgrass color, ranging from 0.4 to 1.4 units. This increase in quality was noted on both well and poorly drained greens.

Additional benefits of a dormant Milorganite application include:

- earlier recovery from winter injury
- aids in recovery from snow mold damage
- Turf damage repair from early season play



Taken from: *Factors Affecting Spring Color Response of Creeping Bentgrass to Dormant Applications of Milorganite, Kussow, 1995-1996*

Milorganite and Trees & Shrubs

Trees and shrubs, being slow growing compared to most other yard plants, like fertilizers that release slowly and evenly. Milorganite® 6-2-0, containing over 85% slow release nitrogen, does just that.

ESTABLISHED TREES

Drill one-inch holes from the drip line of the tree to an area five to ten feet past the drip line. Space these holes two feet apart, drilling them twelve inches deep. Fill them with Milorganite® 6-2-0 to within two inches of the top. Fill in the top of the hole with soil.

TRANSPLANTING TREES

Mix Milorganite® 6-2-0 with soil in the bottom of the holes before transplanting trees.

- 4-foot tree (1/2" caliper or 3-gallon container) use 2 lbs. Milorganite® 6-2-0
- 10-foot tree (1½" caliper or 7-gallon container) use 5 lbs. Milorganite® 6-2-0
- 20-foot tree (4" caliper, ball and burlap, or 3-ft. diameter ball) use 10 lbs. Milorganite® 6-2-0

ESTABLISHED SHRUBS

Uniformly scatter five lbs. Milorganite® 6-2-0 for every 100-sq. ft. of shrub area. For individual shrubs, apply one pound Milorganite® 6-2-0 to the root zone area. If possible, work the Milorganite® 6-2-0 into the soil with a rake or hoe, taking care to not damage roots.

TRANSPLANTING SHRUBS

Mix Milorganite® 6-2-0 with soil in the bottom of the holes before transplanting shrubs.

- 18" shrub (1-gallon container) use ½ lb. Milorganite® 6-2-0
- 48" shrub (7-gallon container) use 2 lbs. Milorganite® 6-2-0

Water trees and shrubs deeply when transplanting. For best results, follow instructions given with each specific species. Apply mulch around the trunk to prevent mower damage.

For specific help, contact your nursery supplier or local County Horticultural Extension Agent for advice.

Note: Three cups Milorganite® 6-2-0 weighs approximately one pound.

Milorganite and Annual Flowers

Annual flowers provide color to a background of perennials in the landscape. This creates visual excitement and enjoyment of the area. The slow release nitrogen in Milorganite yields long-lasting plants to withstand growing season stress. In addition, the high iron content assures your leaves are a deep green color throughout the season.

Planting

Till the soil two to three inches below rooting depth. Break up any clods and remove any sticks and debris.

Fertilizing

Apply 3 lbs. Milorganite® 6-2-0 per 100-sq. ft. of bed at planting. When plants bud, apply 2 lbs. per 100-sq. ft. of bed.

Note: Three cups Milorganite® 6-2-0 weighs approximately one pound.

Watering

Water plants at planting or transplanting. When plants mature, water to root depth twice a week. Frequent watering promotes surface root growth, which can limit plant vigor.

Care

Mulch plants to protect roots from hot summer weather and to control weeds. Remove dead flowers to encourage further new buds and flowering. For more help, contact your local nursery, County Horticultural Extension Agent or nursery supplier for information concerning specific types of plants and their care.

Soil pH

A special “lime-requirements buffer” soil test must be requested to obtain a recommendation for the amount of lime required to raise the soil pH to a suitable level. However, the guidelines below can be used when a soils analysis has not been performed and you know the general soil pH and soil type...

Ground limestone can be applied to turf to adjust soil acidity levels. Use a dolomitic lime on soils which are low in available magnesium to eliminate any possibility of a plant food deficiency.

General Guidelines for Raising Soil pH

Amount of Dolomatic Lime to Apply				
Bluegrass, Bermuda, Ryegrass				
	Sandy loams		Loams, clays	
Soil pH	lbs. / acre	lbs. / 1000 sq. ft.	lbs. / acre	lbs. / 1000 sq. ft.
7.0	0	0	0	0
6.3 to 7.0	0	0	0	0
5.8 to 6.2	1,000	25	1,500	35
5.3 to 5.7	2,000	50	3,000	70
4.8 to 5.2	3,000	75	4,000	100
4.0 to 4.7	4,000	100	6,000	150

Soil pH

General Guidelines for Raising Soil pH

Amount of Dolomatic Lime to Apply				
Fescue, Bent greens				
	Sandy loams		Loams clays	
Soil pH	lbs. / acre	lbs. / 1000 sq. ft.	lbs. / acre	lbs. / 1000 sq. ft.
7.0	0	0	0	0
6.3 to 7.0	0	0	0	0
5.8 to 6.2	0	0	0	0
5.3 to 5.7	1,000	25	1,500	35
4.8 to 5.2	2,000	50	3,000	70
4.0 to 4.7	3,000	75	4,000	100

These figures are for fine to medium ground limestone. They should be increased 25 to 50 percent for coarser material. The rate for hydrated lime should be reduced by 25 to 30 percent (74 pounds of hydrated lime equals the neutralizing value of 100 pounds of pure ground limestone).

Rates for applying finely ground limestone to greens. Hydrated lime should not be applied to greens at more than 20 pounds per 1000 sq. ft. at any time. Use lower rates when turf is actively growing. Do not use hydrated lime immediately before, or right after, an application of a fertilizer containing ammonia-containing nitrogen sources. Milorganite does not contain an appreciable amount of ammoniacal nitrogen.

Soil pH

General Guidelines for Lowering Soil pH

	Amount of Elemental Sulfur to Apply*	
Soil Type	**Lbs. per acre**	**Lbs. per 1000 sq. ft.**
Loamy sand	300	7
Sandy loam	500	11
Loam	800	18
Silt or clay loam	1200	28

* Source: Wolf, B., J. Fleming and J. Batchelor, 1985. Fluid Fertilizer Manual, National Fertilizer solutions Association, Peoria, IL.

Caution: The rates in this table are suitable for incorporation into soil before the turfgrass is established. For use on established greens, sulfur rates should not exceed ½ to 1 lb. sulfur per 1000 sq. ft. per application, spaced 3 to 4 week intervals, and should be discontinued during periods of high stress. In established fairways, tees, and lawns, application rates may be 2 to 5 lbs. sulfur per 1000 sq. ft. monthly, avoiding periods of high stress. In all cases, irrigate following application to remove sulfur from leaf surfaces, and do not exceed 10 lbs. sulfur per 1000 sq. ft. annually.

Calibrating Your Fertilizer Spreader

To get the best results from Milorganite® 6-2-0, you must be able to apply the correct amount. This can only be done if your fertilizer spreader is accurately calibrated. As spreaders become older and worn, re-calibration ensures you obtain the best results from your investment.

These steps show you how to calibrate your granular fertilizer spreader to deliver 1 lb. nitrogen per 1000 sq. ft.

1. Set your spreader so that the opening(s) in the bottom are ¾ open when engaged.
2. Put eight pounds of Milorganite® 6-2-0 into your spreader.
3. Begin fertilizing your lawn, starting along an edge, and continue until the spreader is empty. Leave the spreader where it was when emptied. Make sure you overlap patterns when using a rotary spreader.
4. Measure the area of lawn you fertilized. You should have covered about 500 square feet (20' x 25', 10' x 50', etc.). If so, skip steps 5 and 6 and continue fertilizing your lawn. If not, go to step 5 or 6.
5. If you covered much more than 500 square feet, increase the size of the opening(s) in the bottom of the spreader and repeat steps 2-4 on an unfertilized lawn area.
6. If you covered much less than 500 square feet, decrease the size of the opening(s) in the bottom of the spreader and repeat steps 2-4 on an unfertilized lawn area.

Calibrating Your Fertilizer Spreader

Spreading tips

- Clean your spreader after each use. Follow manufacturers' instructions as to lubrication, cleaning and storage. Remember, Milorganite® 6-2-0 contains no corrosive salts that can damage your spreader.
- With drop spreaders, overlap the wheel tracks. This helps ensure you don't leave 2-3 inch non-covered strips between each pass. (Yellow Lane Markers)
- With rotary spreaders, overlap the coverage. For most spreaders, more fertilizer is applied nearer to the spreader than at the farthest reach of the pattern. Your spreader manual should give you tips on how far various types of fertilizer are thrown.
- For best results with any type of spreader, spread a half-rate then another half-rate perpendicular to the first pass.
- Make sure your drop spreader drops granules evenly. Check you manual for any adjustments and procedures that may be available to correct any deficiencies.
- Make sure your rotary spreader distributes granules evenly to each side. Granule distribution will “tail off” at the edges of the pattern. Check your manual for specific adjustments and procedures that may be available to correct any deficiencies.
- Walk at an even pace. When you slow down or speed up, the amount of material applied will change. Slower speeds will increase rates and faster speeds will decrease rates.
- Constantly check the amount of material you have spread versus the area covered. This will serve as another calibration check.

Calibrating Your Fertilizer Spreader

Classic Milorganite® 6-2-0 Spreader Settings (SGN 160)

		Nitrogen lbs. / 1,000 sq. ft.		
Spreader	Width	0.33	0.5	1.0
Earthway	10 ft.	15	18	27
Lesco	10 ft.	H	J	Q
Prize Bigfoot	11 ft.	K	N	W
Scotts R8-A	11 ft.	M (Cone 5)	P(Cone 5)	X(Cone 5)
Andersons SR2000 & AP2000	11 ft.	M (Cone 5)	P(Cone 5)	X(Cone 5)
Spyker	20 ft.	5	6	9
Lely (Hole 6, 4 ½ mph)	20 ft.	-	5	8
Lely (Hole 3, 4 ½ mph)	40 ft.	-	8	8-2X

Greens Grade Milorganite® 6-2-0 Spreader Settings (SGN 100)

		Nitrogen lbs. / 1,000 sq. ft.		
Spreader	Width	0.33	0.5	1.0
Earthway	8 ft.	12	15	28
Lesco	8 ft.	F	H	R
Prize Bigfoot	9 ft.	H	K	X
Scotts R8-A	9 ft.	J (Cone 7)	M(Cone 7)	X(Cone 7)
Andersons SR2000 & AP2000	9 ft.	J (Cone 7)	M(Cone 7)	X(Cone 7)
Spyker	9 ft.	4	5	9
Lely (Hole 6, 4 ½ mph)	20 ft.	-	5	8

Calibration Tips

To apply 0.33 lbs. Nitrogen

5.5 lbs. Milorganite® 6-2-0/1000 sq. ft.

To apply 1.0 lb. Nitrogen

17 lbs. Milorganite® 6-2-0/1000 sq.ft.

To apply 1.5 lbs. Nitrogen

25 lbs. Milorganite® 6-2-0/1000 sq. ft

Measuring Area - Fairways

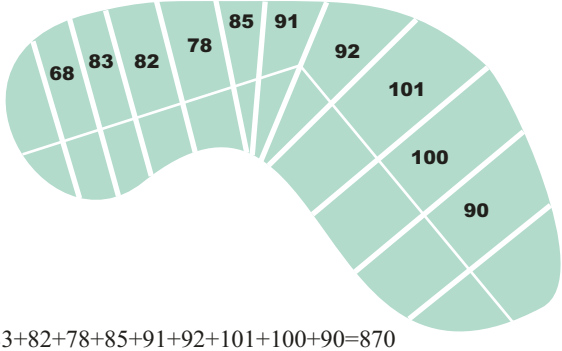
An accurate area measurement of each playing surface is important in knowing how much fertilizer to purchase and for confirming that the correct amount has been applied. Review the "**Calibrating your lawn spreader"** section for further information.

Fairways usually represent the largest area of a golf course with regular applications of fertilizers and plant protection required to deliver quality turf. It is very important from an environmental responsibility standpoint that accurate measurements be available for proper purchasing and applications.

The method for determining the area of a fairway is simple and can be accomplished by one person in a matter of hours for the entire golf course. Basically, consider the fairway to be more or less a large rectangle. The area of a rectangle is calculated by multiplying the length by the width. The length of the fairway rectangle may be measured with a measuring wheel by traveling down the center of the fairway.

The width of the fairway is determined by finding the average width of the fairway. Multiple measurements must be obtained taken perpendicular to the length. More measurements improve accuracy.

In the example below, the length of the fairway is 1,160 feet and the width measurements are indicated.



68+83+82+78+85+91+92+101+100+90=870
Divided by 10 measurements = 87 ft. average width
A = 87 ft. x 1,160 ft. = 100,920 sq. ft.
A = 100,920 sq. ft. divided by 43,560 sq. ft./acre = 2.32 acres

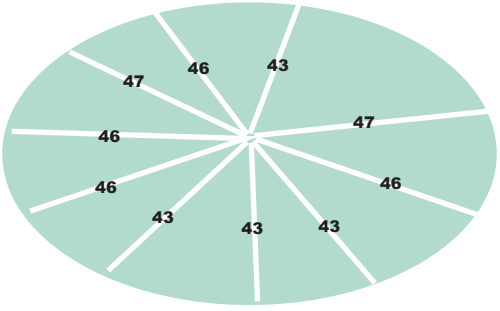
Measuring Areas - Greens

With very few exceptions, most golf course greens resemble a circle. This method for determining area of a green is based on the equation for determining area of a circle, $A = \Pi r^2$
A = the area of the circle, $\Pi = 3.14$, and r = the radius of the circle with r^2 being the radius times itself.

Measurements will determine the average radius to compute the area. To get started, it is easiest to have the cup cut near the center of the green. All you need is a good measuring tape and a note pad.

Using the cup as a pivot point, measure from the center of the green to the collar. It is helpful to mark this point on the ground to indicate a starting point. You may include the collar if you intend to apply the same materials to this area. Then move the tape over a few feet and record another measurement. Continue around the entire green until you reach the point where the original measurement was taken, much like the spokes of a wheel. Keep in mind that the more measurements taken, the more accurate the results will be. Generally, irregular shaped greens require more measurements to ensure accuracy.

After all the measurements have been recorded, determine the average radius of the green. This is done by adding the measurements, and dividing by the number of measurements taken. In the example below, the average "radius" is 56 feet. Using the geometric equation to determine the area of a circle, we calculate that the area of this green is 9,847 sq. ft.



47+46+43+43+43+46+46+47+46+43+=450
Divided by 10 measurements = 45 ft. average radius.
Area of the green (A) $= \Pi r^2$
Area of the green (A) = 3.14 x 45 x 45 = 6,358 sq. Ft.

Conversion Chart

English to Metric

If you know	Multiply by	To Get
A	**B**	**C**
Length		
inches	2.54	centimeters
foot	30	centimeters
yards	0.91	meters
miles	1.6	kilometers
Area		
sq. inches	6.5	sq. cent.
sq. feet	0.09	sq. meters
sq. yards	0.8	sq. meters
sq. miles	2.6	sq. kilometers
acres	0.4	hectares
Mass (Weight)		
ounces	28	grams
pounds	0.45	kilograms
short ton	0.9	metric ton

Metric to English

If you know	Multiply by	To Get
D	**E**	**F**
Length		
millimeters	0.04	inches
centimeters	0.4	inches
meters	3.3	feet
kilometers	0.62	miles
Area		
sq. centimeters	0.16	sq. inches
sq. meters	10.8	sq. feet
sq. meters	1.2	sq. yards
sq. kilometers	0.4	sq. miles
hectares	2.47	acres
Mass (Weight)		
grams	0.035	ounces
kilograms	2.2	pounds
metric tons	1.1	short tons

Conversion Chart

If you know	Multiply by	To Get	If you know	Multiply by	To Get
A	**B**	**C**	**D**	**E**	**F**
Rate					
lb./acre	1.12	Kg/ha	kg/ha	0.89	Lb./acre
Ton/acre	2.24	Tons/ha	Tons/ha	0.446	Tons/acre
Lb./1000 sq. ft.	4.88	g/m2	g/m2	0.205	Lb/1000 sq ft
Oz./gal	7.8	Ml/Liter	Ml/Liter	0.128	Oz./gal
Gal./acre	9.35	Liter/ha	Liter/ha	0.107	Oz./gal
Volume					
teaspoons	5	milliliters	Milliliters	0.2	teaspoons
tablespoons	15	milliliters	Milliliters	0.07	Tablespoons
fluid ounces	30	milliliters	milliliters	0.03	fluid ounces
cups	0.24	liters	liters	4.2	Cups
pints	0.47	liters	liters	2.1	pints
quarts	0.95	liters	liters	1.06	quarts
gallons	3.8	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35	cubic feet
cubic yards	0.76	cubic meters	cubic meters	1.3	cubic yards

Temperature

Fahrenheit	Subtract 32, then multiply by 5/9ths = Celsius
Celsius	Multiply by 9/5ths, then add 32 = Fahrenheit

For Better Results.
Naturally.

Milorganite®

Milorganite
260 West Seeboth Street, Milwaukee, WI 53204
Phone: 1-800-287-9645 ● Fax: (414) 221-6818
www.milorganite.com

4/13/04 04-020