

PRE-EMERGENT APPLICATION GUIDE

BENSUMEC™ 4 LF, PRE-SAN® GRANULAR AND TUPERSAN® HERBICIDES

TABLE OF CONTENTS:

Introduction	1
Where to Use	
Bensumec 4 LF and Pre-San	2
Application Methods	3
Application Schedules	3
Reseeding Intervals	4
Bensulide Environmental Factors	5
Tupersan Pre-Emergent Control When Seeding & Hydroseeding	6
Bermudagrass Encroachment	6
Siduron Environmental Factors	6
Bensulide Fertilizer Compatibility Testing	7



INTRODUCTION:

Bensumec™ 4 LF is a pre-emergent herbicide which provides effective control of annual grass and broadleaf weeds in greens, tees, fairways, and dichondra and grass lawns. Extensive trials throughout the U.S. have demonstrated the effectiveness of Bensumec 4 LF for seasonal control of crabgrass, annual bluegrass, pigweed, and other weeds with single or multiple applications. Bensumec 4 LF, PBI/Gordon's formulation of Betasan® Herbicide (bensulide), has been the preferred choice of country clubs for over 20 years.

Bensumec 4 LF has been formulated to mix easily with water soluble fertilizers, or other products registered for turf care. Spontaneous emulsification assures complete mixing and eliminates spray-tank layering or clogging even with limited agitation. Foaming problems are

eliminated and spray application equipment cleanup is achieved by thorough flushing with water.

Because of the proven weed control, compatibility with other turf products, and high turfgrass tolerance, Bensumec 4 LF has been widely trusted and accepted by golf course superintendents and landscape managers.

Pre-San® Granular 12.5G and Pre-San Granular 7G are ready-to-use granular herbicides providing the consistent efficacy and low phytotoxicity of Bensumec 4 LF.

Bensumec 4 LF, Pre-San Granular 12.5G, and Pre-San Granular 7G provide equally effective weed control and maintain turfgrass quality.

When seeding, Tupersan® Herbicide Wettable Powder provides excellent control of smooth and large crabgrass, fox-tail and barnyardgrass. Tupersan's

high degree of selectivity allows you to make your pre-emergent herbicide application at the time of seeding without causing injury to germinating seedlings of most cool-season grasses. Tupersan is also EPA-registered for use through hydroseeders.

Research has shown Tupersan to be the most effective product for reducing bermudagrass encroachment into bentgrass greens.

The literature contained herein is not intended to be used as a substitute for the information contained on the labels of product containers. Specimen labels and other literature are subject to revisions. Before using any product in this catalog, read and follow all label instructions on the container/package.

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**Weeds controlled by
BENSUMEC 4 LF,
PRE-SAN Granular 12.5G,
and PRE-SAN Granular 7G**

Annual Bluegrass (<i>Poa annua</i>)	Large Crabgrass (<i>Digitaria sanguinalis</i>)
Barnyardgrass (<i>Echinochloa crusgalli</i>)	Lambsquarters (<i>Chenopodium album</i>)
Deadnettle and Henbit (<i>Lamium spp.</i>)	Redroot Pigweed (<i>Amaranthus retroflexus</i>)
Fall Panicum (<i>Panicum dichotomiflorum</i>)	Shepherdspurse (<i>Capsella bursa pastoris</i>)
Foxtails (<i>Setaria spp.</i>)	Smooth Crabgrass (<i>Digitaria ischaemum</i>)
Goosegrass (<i>Eleusine indica</i>)	

**WHERE TO USE
BENSUMEC 4 LF,
PRE-SAN GRANULAR 7G and
PRE-SAN GRANULAR 12.5G**

Bensumec 4 LF, Pre-San Granular 7G, and Pre-San Granular 12.5G can be used to prevent infestations of crab-

grass and other weeds on established turf. On turf containing older varieties of bentgrass, this selective herbicide offers excellent control where other herbicides may cause injury or discoloration.

Bensumec 4 LF, Pre-San Granular 7G, and Pre-San Granular 12.5G are

labeled for use on the following turf-grass species:

- Kentucky bluegrass • Fescue spp.
- Bentgrass spp. • Bermudagrass spp.
- Perennial ryegrass • Rough-stalk bluegrass • St. Augustinegrass
- Bahiagrass • Centipedegrass
- Zoysiagrass • Redtop



APPLICATION METHODS:

Bensumec 4 LF should be applied with spray equipment that will provide uniform applications such as backpack sprayers, wheel operated sprayers, power sprayers fitted with a boom, or manually operated pressure sprayers, knapsack sprayers, or pressure sprayers. Spray volumes of

80 to 100 gallon per acre or 2.0 to 2.5 gallons per 1,000 square feet are suggested.

Pre-San Granular 7G, and Pre-San Granular 12.5G are granular herbicides that are best applied with drop-type or spinner-type spreaders. Calibrate the spreader and follow the recommendations of the

equipment manufacturer to ensure uniform applications.

Remove leaves, dead tall grass, and other debris before applying Bensumec 4 LF, Pre-San Granular 7G, and Pre-San Granular 12.5G to turf areas.



APPLICATION SCHEDULES:

All products containing bensulide must be applied prior to the germination of weed seeds. All products should be applied only to established grass lawns at least 4 months prior to reseeding. The herbicide must be watered into the soil immediately after application.

Applications of Bensumec 4 LF, Pre-San Granular 7G, and Pre-San Granular 12.5G must precede emergence of weeds from the soil. Crabgrass will emerge from the soil from 4 to 6 weeks before it is visible above lawn sod. If weeds are visible above the soil, it is too late to apply these products.

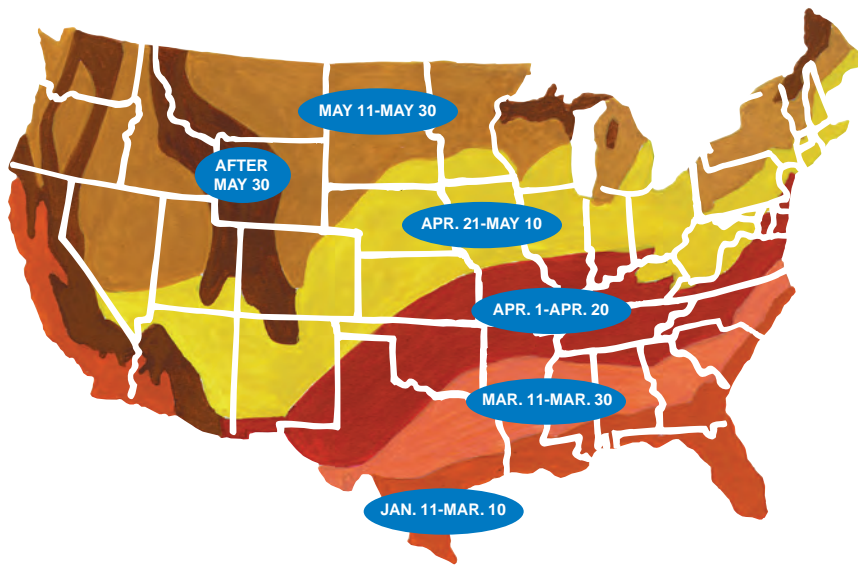
Since the best time to make applications depends on the species of weeds to be controlled and since climate, soil temperature and other factors may vary from region to region, a single recommendation for the entire U.S. cannot be made. For specific information on timing in your area, consult the local weed specialist at your State Agricultural Extension Service.

One of the primary criteria for selecting a pre-emergence herbicide is the tolerance of the turfgrass to the herbicide. The tolerance of established bentgrass to bensulide at labeled rates has been cited as good to excellent by users and researchers.

However, environmental and management practices can narrow the tolerance range of turfgrass to any pre-emergent herbicide.

Established bentgrass root systems are not significantly affected with bensulide applications. Field studies indicate that minor sod loss (2 to 5%) of bentgrass occurred after the third year with multiple applications of bensulide. Other studies showed that bensulide caused little or no injury to bentgrass. Bensulide applications to bentgrass will provide effective weed control and will maintain the uniformity, density, and color of bentgrass.





When your pre-emergent application fails to provide adequate control, crabgrass and other post-emergence grassy weeds, as well as nutsedge and many broadleaves can be controlled post-emergence with Gordon's Trimec® Plus Post-Emergent Grass and Broadleaf Herbicide or Q4® Turf Herbicide for Grassy & Broadleaf Weeds. Trimec Plus, formulated with MSMA, is approved for bluegrass, bermudagrass, zoysiagrass and fescue. Q4 shows less discoloration on cool-season turfgrasses than MSMA. Species include bluegrasses, perennial and annual ryegrasses and fescues.

CRABGRASS: Generally, pre-emergent herbicides such as bensulide are best applied at least two weeks before the seed germination of crabgrass. A good index to schedule the initial application of bensulide in the spring is when the soil temperature reaches 50 to 53°F. In certain areas, pre-emergent applications may be applied 6 to 8 weeks before the expected seed germination of crabgrass.

Golf course superintendents may use different formulations for the

initial and sequential applications. For example, Pre-San Granular 7G, and Pre-San Granular 12.5G may be used during cold periods in early spring and Bensumec 4 LF may be used later in the year. For the control of crabgrass, apply these formulations at the recommended rates anytime from fall (September or October) through early spring for spring and summer control. Again, late winter or early spring applications must be applied prior to crabgrass emergence.

Sequential applications of

bensulide have proved more effective than single applications for season-long control of crabgrass. Because the seed germination of crabgrass extends throughout the season, sequential applications are recommended at the recommended rates to maintain effective control. Two applications per season are appropriate for crabgrass and *Poa annua* control.

ANNUAL BLUEGRASS (*Poa annua*): Products containing bensulide have established the performance standards for *Poa annua* control and the margin of safety for bentgrass greens. Two applications per season are recommended on greens.

For two applications of Bensumec 4 LF, Pre-San Granular 7G, and

Pre-San Granular 12.5G: Apply these products at the recommended rates before the *Poa annua* emerges from the soil. A second application of these formulations should be made 4 to 5 months after the first application.

For three applications of Bensumec 4 LF, Pre-San Granular 7G, and Pre-San Granular 12.5G: Two applica-

tions in the spring and one application in the fall of these products will provide high level of pre-emergent control.

RESEEDING INTERVALS:

Herbicides that provide effective control of annual grasses may affect new lawn grass seedlings which germinate after treatment. Proper fertilization and watering will encourage the existing turfgrass to fill in the thin or bare spots formerly occupied by crabgrass.

The following procedures are suggested in order to minimize any stunting of turfgrasses which may occur when reseeding into treated areas:

1. Do not reseed within 4 months after application.
2. Renovate the area to be reseeded by raking thoroughly to scarify the soil surface. Where practical, mix peat in with the soil to provide an optimum seedbed.
3. When turf diseases or physiological disorders necessitate reseeding sooner than 4 months after application, apply powdered activated charcoal prior to reseeding to deactivate the bensulide.

4. Apply the active charcoal at a rate of 7 pounds in 14 gallons of water per 1,000 square feet (300 pounds in 600 gallons of water per acre).
5. Following application, irrigate the turf with sufficient water to wash the charcoal into the soil.
6. Reseed no sooner than 7 days after applying the charcoal.

BENSULIDE ENVIRONMENTAL FACTORS



PHYSIOLOGICAL AND BIOCHEMICAL BEHAVIOR¹:

A. Translocation characteristics: Bensulide is adsorbed on the root surfaces, and a small amount is absorbed by the roots, but very little or none is translocated upward to the leaves.

B. Mechanism of action: Bensulide inhibits the growth of roots of weeds, but the mechanism of action is not known.

BEHAVIOR IN OR ON SOIL²:

1. Adsorption and leaching characteristics in basic soil types: Bensulide is inactivated in soils containing high amounts of organic matter. Therefore, peat moss should not be applied before treatment. Bensulide leaches very little in sand, clay or organic soils.

2. Microbial breakdown: Bensulide is degraded slowly by soil microorganisms.

3. Loss from photodecomposition and/or volatilization: When bensulide is applied to the soil surface there is very little if any loss by volatilization, but there is a small amount of photodecomposition in a period of several days.

4. Resultant average persistence at recommended rates: The half life of bensulide in moist loam soil at 21 to 27°C (70 to 80°F) was 4 months. In a moist loamy sand soil at 21 to 27°C (70 to 80°F) the half life was 6 months.

¹From: Herbicide Handbook of the Weed Science Society of America, Sixth Edition, 1989.

²ibid: Herbicide Handbook Committee, N.E. Humburg, Chairman, S.R. Colby, R.G. Lym, E.R. Hill, W.J. McAvoy, L.M. Kitchen and R. Prasad.

WHERE TO USE TUPERSAN HERBICIDE WETTABLE POWDER

PRE-EMERGENT CONTROL WHEN SEEDING AND HYDROSEEDING

Tupersan Herbicide Wettable Powder is a sprayable formulation of siduron allowing the turf manager greater control over fertilizer program requirements than other formulations of siduron which have been combined with fertilizers. Tupersan provides effective control of smooth and large crabgrass, as well as controlling foxtail and barnyard-grass. Tupersan is highly selective and can be applied at the time of seeding without injury to germinating seedlings of most cool-season grasses, including bentgrass greens.

Tupersan is EPA-registered for use when hydroseeding. Tupersan can be mixed with seed, fertilizer and mulch and applied with a hydroseeder or hydrolic seeder. Mixing instructions are provided under the “SPRAY EQUIPMENT AND SPRAY PREPARATION” section of the product label.

BERMUDAGRASS ENCROACHMENT BAND TREATMENT

Tupersan is also EPA-registered for the removal of encroaching bermudagrass from bentgrass greens. Tupersan is applied as an 8 to 12-inch band with a single-nozzle sprayer along the perimeter of the greens to

suppress the stolon growth of the bermudagrass. The initial application should be made as soon as the bermudagrass has green leaf tissue, generally in March or April, at the one-pound rate per 1,000 square feet rate. Subsequent applications should be scheduled at four to five week intervals. Research at Clemson University in South Carolina has shown that effective control can be accomplished at the ½ pound per 1,000 square feet rate when retreating¹. In this study, “Tupersan’s performance against bermudagrass in a bentgrass green led all treatments”.

¹Lowe, Todd; McCarty, Ph.D., Bert; Whitwell, Ph.D., Ted, “Bermudagrass encroachment: A menace on bentgrass greens”, *Golf Course Management*, September 2000.

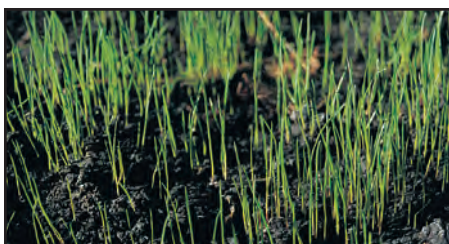
SIDURON ENVIRONMENTAL FACTORS

PHYSIOLOGICAL AND BIOCHEMICAL BEHAVIOR:

A. Translocation characteristics: Siduron is readily absorbed by the root, but only minimal is absorption into the leaves.

Siduron translocated in the xylem upward in the shoots and downward in the roots.

B. Mechanism of action: Siduron inhibits the growth of roots. It is thought to inhibit mitosis.



BEHAVIOR IN OR ON SOIL:

1. *Adsorption and leaching characteristics in basic soil types:* Adsorption increases as clay or organic matter increases.

Adsorption also increases with increases in cation exchange capacities. Siduron is moderately resistant to leaching.

Movement is least in soils high in clay or organic matter and highest in sand.

2. *Microbial breakdown:* Siduron is primarily degraded by microbes.

3. *Loss from photo-decomposition and/or volatilization:* There is minimal loss by photo-degradation. Loss by volatilization is negligible.

4. *Resultant average persistence at recommended rates:* Moderate residual with a typical field half-life of 90 days.



MATERIALS REQUIRED

- Bensumec 4 LF
- Liquid fertilizer.
- Adjuvant to be added to tank mix.
- Two 1-quart, wide mouth glass jars with caps.
- Measuring spoon, pipette or graduated cylinder with milliliter measurements.
- One 8 fluid ounce (237 milliliter) measuring cup.

FERTILIZER COMPATIBILITY TESTING (MIXING BENSUMEC 4 LF WITH LIQUID FERTILIZER)

Turf management professionals have long recognized the advantages of mixing Bensumec 4 LF with liquid fertilizers. The economic benefits of accomplishing two functions with one application are obvious, but care should

be taken to make certain that the liquid fertilizer and Bensumec 4 LF are compatible.

Bensumec 4 LF is formulated to mix readily with liquid fertilizers, but it is sometimes necessary to use an adjuvant.

By helping to keep mixtures emulsified, adjuvants can avoid problems that occasionally arise when mixtures are attempted without them.

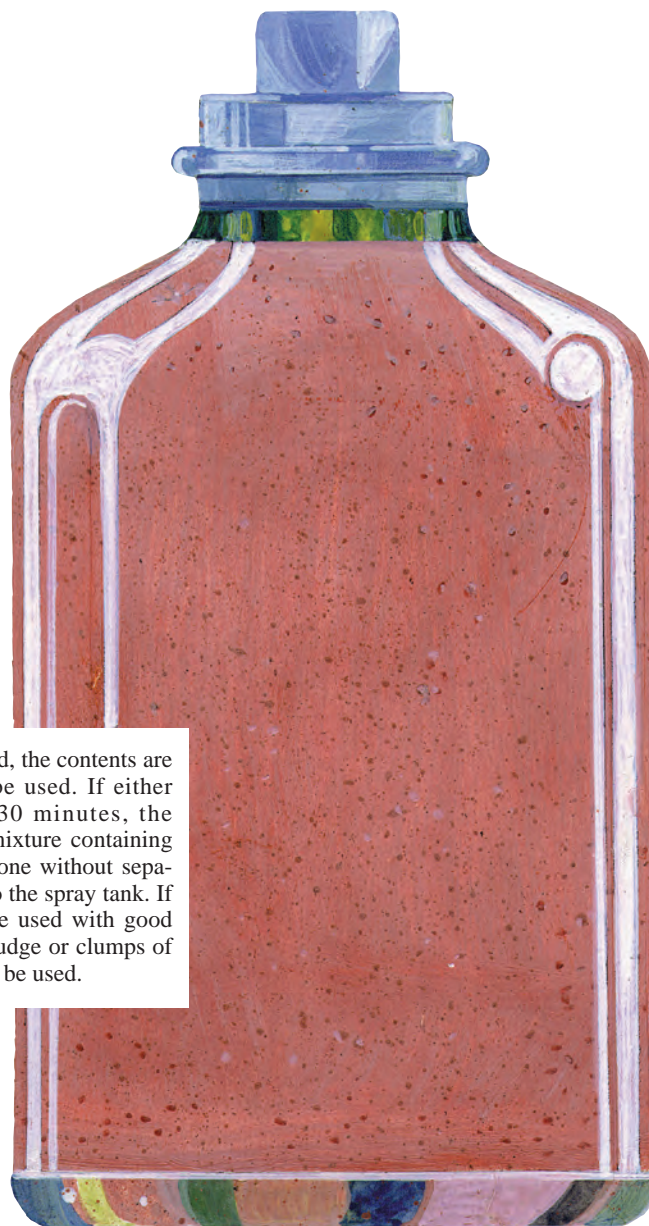
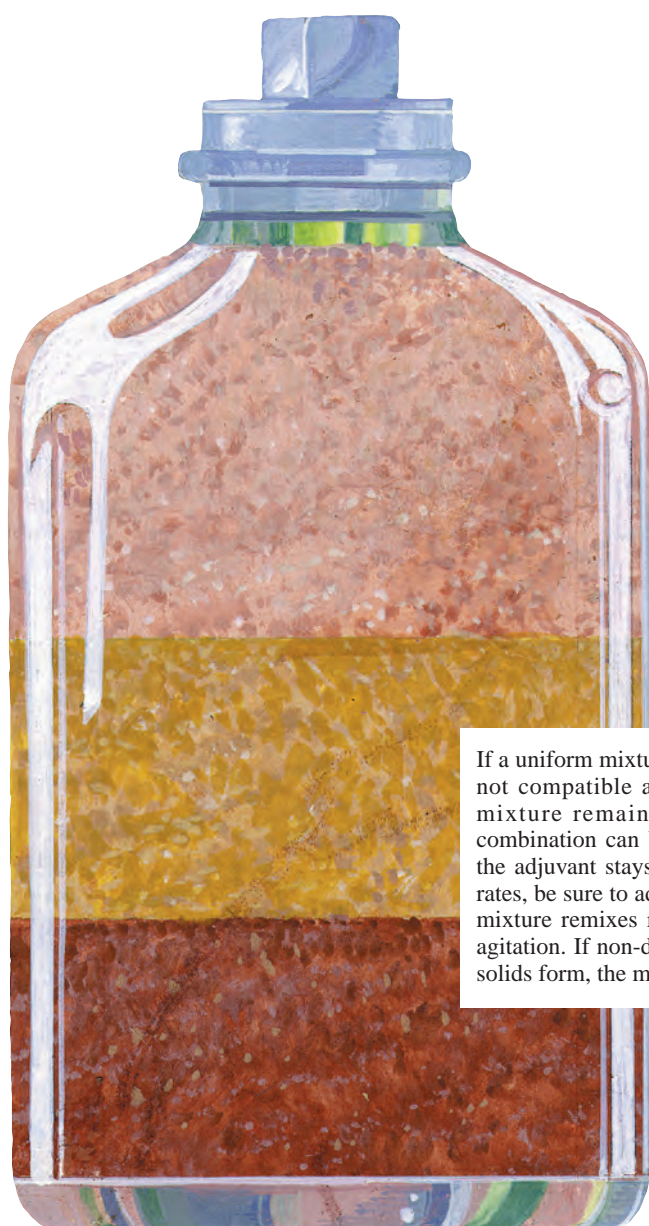
Therefore, a “jar test” following the procedure below is recommended.

TEST MIXING PROCEDURES

- Pour 16 fluid ounces (1 pint or 474 milliliters) of liquid fertilizer into each of the quart jars.
- Add adjuvant to one of the jars at the rate recommended for jar tests on the adjuvant label and mix.
- Add Bensumec 4 LF to both jars according to milliliter rates shown on the following page.
- Fasten caps onto both jars and invert them 10 times to mix contents thoroughly.
- Inspect both mixtures immediately and after jars have stood for 30 minutes.
- If a uniform mixture is not observed, the contents are not compatible and should not be used.
- If either mixture remains uniform for 30 minutes, the combination can be used.
- If the mixture containing an adjuvant stays mixed but the one without an adjuvant separates, be sure to add the recommended amount of adjuvant to the spray tank before application.
- If either mixture separates after 30 minutes but remixes readily after 10 additional jar inversions, it may be used if good agitation is maintained in the spray tank throughout application.
- If non-dispersible oil, sludge or clumps of solids form, the mixture should not be used.

FERTILIZER JAR TEST RATE FOR BENSUMEC 4 LF

Liquid Fertilizer (gallon per acre)	If BENSUMEC 4 LF rate per acre is:			
	1 Gallon	1 7/8 Gallon	2 1/2 Gallon	3 1/8 Gallon
	Milliliters of BENSUMEC 4 LF to be added to 1 pint of liquid fertilizer			
50	10 ml	18 ml	25 ml	30 ml
75	7 ml	12 ml	18 ml	20 ml
100	5 ml	9 ml	13 ml	15 ml
125	4 ml	7 ml	10 ml	12 ml
150	4 ml	6 ml	10 ml	10 ml
175	3 ml	5 ml	8 ml	9 ml
200	3 ml	5 ml	8 ml	8 ml



If a uniform mixture is not observed, the contents are not compatible and should not be used. If either mixture remains uniform for 30 minutes, the combination can be used. If the mixture containing the adjuvant stays mixed, but the one without separates, be sure to add the adjuvant to the spray tank. If mixture remixes readily, it may be used with good agitation. If non-dispersable oil, sludge or clumps of solids form, the mixture should not be used.