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  ARSENAL controls more undesirable plant species than any other vegetation control method. It even gets woody vines and perennial grasses such as trumpetcreeper and Johnsongrass.

• **Stable in the spray tank**

• **Flexible application timing**
  ARSENAL herbicide can be applied at any time during active growth.

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Read and follow label directions carefully.

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Regal — it's the turf-type perennial ryegrass that's different.

Applications of potassium will greatly contribute to the hardness of the plant and help to "temper" the stimulating effects of nitrogen applications.

In contrast, most of the root growth in the warm season grasses, such as Bermudagrass, zoysiagrass and St. Augustinegrass, occurs during the spring and summer. Fertilization during these periods will stimulate root growth. However, only moderate applications of fertilizer should be made in early spring in areas where warm-season grasses experience winter dormancy.

Bermudagrass and St. Augustinegrass are subject to spring root dieback following spring greenup. Heavy fertilization during
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early spring may result in an additional stress during this critical survival period.

Like cool-season turfgrasses, warm-season turfgrasses accumulate carbohydrate reserves in the fall when shoot growth activity slows. Care must be taken with the timing of fall fertilization since it may decrease low temperature hardiness if applied late. Maintaining adequate potassium levels in fall will increase the tolerance to low temperatures.

As with cool-season turfgrasses, indiscriminate use of nitrogen fertilization in the summer can increase injury of warm-season grass subjected to disease or environmental stress. As mentioned previously, maintaining adequate soil potassium levels will aid warm-season turfgrass in their tolerance of heat, cold, mowing and wear stresses, and reduce their susceptibility to turfgrass diseases.

Rate of fertilization
The annual nitrogen requirement (pounds per 1,000 square feet) for turfgrass should be determined by considering several factors including the length of growing season, level of quality desired, purpose for which the turf is used, and the species and cultivars present.

The length of growing season or number of days (months) between the last killing frost in the spring and the first in the fall will vary greatly depending on location within the United States. Along the Gulf of Mexico and in certain areas of Arizona and California, the average growing season is in excess of eight months.

In contrast, northern portions of Maine and Minnesota have as little as three and a half months of growing season. Obviously, the longer the length of growing season, the greater the amount of nitrogen needed to maintain turfgrass quality.

Because the level of quality desired is subject to human interpretation, the rate of fertilization can be tailored to meet the expectations of the user. A home lawn maintained for aesthetic purposes, for example, can range from a weed-free turf of acceptable color and density to a season-long turf of premium appearance.

The purpose for which the turf is used, whether it be for an aesthetic or recreational function, will also influence the nitrogen fertility level. The rate of fertilization of bentgrass, for instance, can vary from four to ten pounds of nitrogen per 1,000 square feet. Lower rates may be used to provide a pleasing appearance on a home lawn while higher rates may be applied to maximize the playability on the golf course putting green.

Turfgrass species and cultivars can vary in amount of nitrogen required to maximize quality. Within the cool-season grasses, sheeps, hard and red fescues require a low level, Kentucky bluegrass a medium level, and bentgrass a high level of fertility. Improved cultivars of bermudagrass will require more nitrogen than common bermuda.

Cultural practices such as irrigation and clipping removal may require the use of higher annual nitrogen rates to maintain the desired turfgrass quality. Supplemental watering of turfgrasses will increase the rate at which nitrogen is leached from the turfgrass root zone. Losses of nitrogen are substantial particularly...
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Annual Nitrogen Requirement of Turfgrasses*

<table>
<thead>
<tr>
<th>Species</th>
<th>Length of Growing Season</th>
<th>Nitrogen per Season lbs./1,000 sq. ft.</th>
<th>Variations in Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool-Season:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sheeps &amp; hard fescue</td>
<td>4-8</td>
<td>0-3</td>
<td>low maintenance, roughs</td>
</tr>
<tr>
<td>red fescues</td>
<td>4-8</td>
<td>1-3</td>
<td>low maintenance to good care</td>
</tr>
<tr>
<td>Kentucky bluegrass</td>
<td>5-12</td>
<td>2-8</td>
<td>lawns, lawns, fairways</td>
</tr>
<tr>
<td>bentgrasses</td>
<td>4-8</td>
<td>1-4</td>
<td>medium care, lawn, lawns, fairways</td>
</tr>
<tr>
<td>bentgrass, greens</td>
<td>5-12</td>
<td>6-15</td>
<td>clippings removed, forced growth</td>
</tr>
</tbody>
</table>

| Warm-Season:          |                          |                                       |                          |
| zoysia                | 6-10                     | 1-6                                   | adequate cover           |
| common bermuda        | 7-12                     | 2-8                                   | most variable            |
| St. Augustine, Bahia  | 10-12                    | 2-8                                   | warm areas, lawns        |
| bermudagrass, fairways| 5-12                     | 4-9                                   | good management          |
| and tees              | 8-12                     | 8-20                                  | may rest over winter     |


when quick-release sources of nitrogen are applied to soils high in sand content. Collection of clippings following mowing has been estimated to remove approximately 20% of the nitrogen applied to turfgrass. Should clippings be routinely removed from turf, as on a golf course green, additional nitrogen should be factored into the yearly total.

Phosphorus and potassium have been routinely applied along with nitrogen using fertilizer with ratios such as 3:1:2, 5:1:2 or 4:1:1. These ratios are based on the relative amounts of nitrogen, phosphorus and potassium found in turfgrass clippings but do not take into consideration the inherent levels found in the soil. Rather than applying phosphorus and potassium each time nitrogen is applied, there use should be based on a soil test. The importance of determining inherent soil levels is exemplified when considering phosphorus application. Since many turfgrass soils contain high levels of phosphorus, little if any response is obtained when phosphorus is applied to established turf.

Two factors to be considered in making individual nitrogen applications are the nitrogen source used and the time of year. Applications using quick-release sources of nitrogen are commonly limited to no more than one pound of nitrogen per 1,000 square feet. This rule of thumb is observed in spring and fall to avoid overstimulating shoot growth. Likewise, summer fertilizer applications using quick-release sources are frequently limited to no more than one-half pound of nitrogen per 1,000 square feet. Lower rates of quick-release nitrogen sources will also minimize the potential to cause fertilizer burn.

In contrast, applications of nitrogen using controlled-release sources are generally made at rates from one to three pounds of nitrogen per 1,000 square feet. The longer residual of controlled-release nitrogen sources reduces the need for more frequent applications required when using quick-release sources. The need for less frequent applications is particularly desirable for turfgrass managers with labor and time restraints.

Method of application
Fertilizers can be applied in either dry...