ADDENDUM TO FINAL REPORT

MULTIFLORA ROSE CONTROL PROJECT (extended)

by

W. E. Chappell and P. L. Hipkins
Department of Plant Pathology
and Physiology
Virginia Polytechnic Institute and State University
Research Division
Blacksburg, Virginia 24061

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Multiflora Rose Control Project

Final Report

In 1981 the Multiflora rose control project was extended for one year in order to evaluate several facets of control not covered under the original work plan. Three areas of consideration were examined and each will be dealt with individually in this report. It should be noted that this work is geared to make the control of Multiflora rose as cost effective as possible without sacrificing quality.

The first area of consideration involved attempts at reducing the quantity of chemicals used by varying rates, timing, and the use of spray adjuvants.

Work performed under the original project identified the best time of year for chemical application such that the seed load of the plant was reduced to acceptable levels. Applications made during the spring of 1981 were applied during this 'best results window' with reduced rates applied at various times of the day. Evaluation of these plots indicate that rates may be reduced by approximately 15% under the following conditions. The spray must be applied at early full leaf expansion when the surface area of the foliage is at its greatest and the leaves are most tender. It would appear that applications at this time take advantage of the not yet fully developed cuticle and the fact that the majority of the translocation within the plant is still acropetal.

Applications must be made as early in the morning as possible, preferably at first light. A reduction in efficacy was noted after about 10:00 AM, however, this time will vary considerably depending on the weather of each individual day. Additionally, thorough coverage is imperative. Sections of bushes covered only marginally tended to produce unacceptable numbers of hips. Spray adjuvants, as discussed later, tended to aid spray coverage and lay-out.

Chemicals which were applied at reduced rates in tank mixes with each other gave no increase in efficacy. This was probably because each has a different site of activity and the action at each site was not sufficient to produce the desired results.

The use of spray adjuvants provided the most consistent results when chemical rates were reduced. These can be used in lieu of surfactants and thereby not impart increased costs. Two products that would be recommended are d-limonene (JLB International) and non-phytotoxic 70 second crop oil (produced by various manufacturers). The d-linonene should be added at 0.75 gal/100 gal. of water and the crop oil should be used at 0.375 gal/100 gal. of water.

The benefit of using spray adjuvants with slightly lowered chemical rates is basically monetary savings. The added adjuvants are less expensive than the chemical that is not used. However, it should be noted that the spray window is very narrow and the early morning application may not be practical. With this in mind, the reduced chemical rates may not be practical and the cost savings significantly reduced when considering the possibility of reduced chemical efficacy.

It should also be pointed out that 1981 was a very dry year and the results observed may not be consistent from year to year. Additionally, the recommendations made in this report are based on one year's observations and should be considered in that context.

Methods of application were explored in an effort to allow the program to be easily integrated into the established highway spray program. Initially it was felt that MH-30 could be applied to multiflora rose at the same time that it was being sprayed on the turf. This operation would work well for MH-30, however, the same operation could not be carried out using Embark®. Previous tests using Embark®

indicated that the compound would provide a reasonable measure of seed control when applied to fully expanded leaves. This point of development in the plant does not occur until well after prime turf application time. It would appear that the two operations will have to remain separate as long as the Highway Department continues to use Embark® as a turf growth retardant. Applications using Atrinal® would have to be made on a separate operation basis completely. The compound has no effect on grasses and would be of no value there.

Equipment modification to apply chemicals to multiflora rose plantings would be minimal. Offset nozzles of the type used for turf application appear to work well. The critical point is complete foliar coverage. Nozzle volume and vehicle speed would have to be adjusted to achieve this. Hand spraying would be necessary to cover plants not reached by the stationary nozzles. Most of the spray rigs in the VDH&T inventory are equipped with accessory hand-held spray guns.

At this point it would appear that all spraying of multiflora rose plantings will have to be a separate operation. With the limited amount of equipment and personnel available and the obligation for other types of vegetation maintenance, only the more critical areas of multiflora rose presence should be considered for spraying. This would allow highway personnel to perfect their technique while keeping the expense to a minimum. Expansion of the program could then be undertaken in a controlled manner in conjunction with other management practices.

Educational assistance in this area has been limited to explaining rates, the use of surfactants and adjuvants, and the necessity for complete foliar coverage. Most of the individuals contacted concerning the project seem to understand the concept quite well.

The efficacy of several new plant growth regulators that were recently developed was investigated as time permitted. Several were soil applied and had

no effect on seed (hip) set. One compound, MBR-18337 (3-M Co.), gave consistently good results. At last report the manufacturer had halted further development and would not predict when development would be reactivated. Efforts expended on the granular (soil applied) compounds have shown that, while not useful for multiflora rose control, several have potential as turf inhibitors.

This report concludes the multiflora rose control project. This work was initiated in order to find a mechanism which would control the spread of multiflora rose from highway plantings. That objective has been realized and demonstrated as effective. Proper utilization of techniques described in this and previous reports should provide a workable program of multiflora rose control.

REPORT ON THE 1981 RESULTS WITH EMBARK 2S on TURF IN VIRGINIA HIGHWAYS

by

W. E. Chappell and Kevin Phillips

December 1, 1981

INTRODUCTION

The application of Embark turf growth regulator by the Virginia Department of Highways and Transportation during Fall 1980 (Oct. - Dec.) and Spring 1981 (March - June) provided generally unacceptable results. While rates of application were consistent over the majority of the Virginia Highway System, performance evaluations ranged from very good to poor. In an attempt to evaluate the factors affecting the efficacy of Embark, data was collected from a variety of sources and analyzed. The following results and discussion comprise the analyses of these efforts.

Climatological Data

The state of Virginia is composed of a variety of topographical land forms, producing localized weather patterns within the western mountains, piedmont, and coastal plain zones. Initial considerations of the "spotty" results of Embark applications in Fall 1980/Spring 1981 were centered upon the hypothesis that abnormal climatic conditions may have affected the efficacy of the growth regulator.

Climatological data from February 1977 through May 1981 for the state was collected and broken down by individual districts on a monthly basis. The analysis included temperature average and departure from normal, as well as total monthly precipitation and departure from normal. This information produced no statistical explanation for the unsuccessful results.

A further breakdown of the climatological data, utilizing precipitation information only (total monthly precipitation, normal monthly precipitation, and % normal precipitation) was analyzed from a different

perspective. Using three specific district locations, selected according to the embark performance evaluations of the district environmentalists (i.e. Wytheville - unsatisfactory, Lynchburg - unsatisfactory, Fredicksburg - satisfactory), data was collected and analyzed for a 2-year period (June 1979 - May 1981). This analysis, considering precipitation per cent departure from normal, reflected the general drought of recent years, but again failed to offer a statistically sound explanation for the Embark results in 1981. See Table No. 1.

Temperature increases during February 1981 may have caused an early vegetative growth period resulting in reduced growth inhibitor efficacy during latter periods of spraying in some districts.

The climatological factors of drought and early-warming temperatures, exercising a synergistic effect, may account in part for the overall poor performance of Embark in 1980/81.

II. Individual District Contacts

In an attempt to determine more precisely the exact conditions under which Embark was applied in Fall 1980/Spring 1981, a questionnaire was composed and sent to all district environmentalists. The questionnaire concentrated primarily on rates of application, dates of spraying period, turf conditions at the time of application, herbicides mixed with the growth inhibitor, etc. It also provided an opportunity for evaluations of the growth suppression results (rated excellent - poor) and any additional comments by the environmentalists. The results of this survey are summarized in Table No. 2.

Rates of Embark application during Fall 1980 application varied from 1 pt/acre to 1½ pt/acre in the five districts using the inhibitor, with

application dates ranging from October through mid-December. All these districts reported favorable turf conditions at the time of application. With the exception of Bristol District, Embark was mixed with 2,4-D compounds (Salem District also adding Banvel 4WS), and nonionic surfactants in some cases. No turf injury was reported. Embark efficacy was rated to be poor in three of the five districts, with Suffolk and Fredicksburg Districts reporting good results. These results exhibit no consistent correlation between dates and/or rates of application.

Embark was applied in all districts except Richmond in the Spring 1981 at 1 pt/acre (with the exceptions of Culpeper District at 2 pt/acre and Staunton District at 1½ pt/acre). All districts reported favorable growing and turf conditions at time of application. Spraying periods ranged from mid-March through the last of June, with Embark being applied in conjunction with 2,4-D, Banvel, and Banvel 4WS. Nonionic spreader/sticker was also applied in the Bristol and Salem Districts. Turf injury was noted only in the Suffolk District, which also had significant yellowing. Embark was rated good in growth suppression in three of seven districts (though Culpeper District results should be discounted due to excessive application rates), with the remainder reporting unsatisfactory performance. Again, no positive correlation is shown between the various factors and the growth inhibitor's results.

These Embark performance evaluations indicate an inconsistent growth suppression pattern over the Virginia State Highway System. Contributing to this pattern of inconsistency may be the variance in rates of application, mixing of herbicides with Embark, and particularly the wide variance in timing of the spraying periods.

III. VEGETATIVE GROWTH

Unusual climatic patterns of drought and early temperature warming trends in late-winter/early-spring in the state of Virginia, and in the western portion of the state in particular, may have contributed to unseasonable vegetative growth rates in 1980/81. While no vegetation growth data was analyzed, early warming in late February and early March 1981, along with the synergistic effect with inadequate precipitation, may have caused an early and foreshortened period of turf growth. This early period may have included early formation of the seedhead shoot followed by reduced developmental growth due to moisture stress.

The extreme drought conditions may also have reduced the KY-31 fescue stand to such an extent that large clumping remained, resulting in poor penetration of the growth inhibitor spray during the application periods. Dry conditions may also have resulted in late/poor germination of seeds in the Fall 1979. Fescue seedlings from this late germination period would not have been treated in the Fall 1980 Embark application.

These factors of climatological conditions and vegetative growth patterns may account for the poor results of Embark in turf growth suppression in the western and central portions of Virginia. The coastal plain region (represented by the Suffolk and Fredericksburg Districts), under the more moderate influence of maritime climatic conditions of temperature and precipitation, exhibited uniformly satisfactory performance.

IV. TESTING

Due to the many variables represented in the previous discussions, it is evident that further testing and comparison is necessary in turf growth suppression with Embark. While this can in no way reduce the poor results experienced in the 1981 application, testing to reduce the variables and determine more precisely the most effective rates and periods of application is essential.

Test plots have been located in several highway districts during the fall of 1981, utilizing Embark, Eptam 10G, and Slo-gro (MH-30) applied at various rates and periods and spring 1982 plots are planned for comparison evaluations. Locations have been selected to allow the spring 1982 comparison plots to be placed immediately adjacent, thus allowing for seasonal application efficacy evaluations

It is hoped that this testing will produce results which may aid the districts on an individual basis with more accurate recommendations concerning the use of Embark Plant Growth Inhibitor.

V. SUMMARY AND RECOMMENDATIONS

The 1981 application results of Embark proved to be generally unsatisfactory over the Virginia State Highway System, despite the acceptable performance in the coastal plain region. Many factors, acting independently or in conjunction, may have contributed to this variable performance. While no one, individual cause may be singled out, those of anomalous climatic conditions, rates of application, and period of applications appear to be most significant.

Further testing and evaluation to determine the proper rates of application for best suppression results utilizing comparison analysis is currently underway. Appropriate time periods ("windows") of application may be more critical with Embark than with compounds utilized in the past, and may be keyed to biological or climatological factors. Again, further testing and data analysis is necessary. It is apparent from contact with other states, however, that best turf growth suppression is obtained with Embark at the 1½ pt/acre rate applied before April 15th.

While attempting to answer some of the questions concerning the performance of Embark on the Virginia State Highway System, this report has no doubt created others. Further testing and evaluations in the coming year are necessary to resolve this issue.

NOTE!! Some of you may have heard that certain forms of MH have been suspended. One that is still cleared for turf is "Royal Slo Grow". A copy of this label is attached.

CAUTION KEEP OUT OF REACH OF CHILDREN.

HAZARDS TO HUMANS

Avoid contact with skin, eyes or clothing. In case of contact immediately flush eyes or skin with plenty of water. Get medical attention if irritation persists.

ENVIRONMENTAL HAZARDS

Keep out of lakes, ponds, or streams. Do not contaminate water by cleaning of equipment or disposal of wastes.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

PESTICIDE DISPOSAL — Pesticide, spray mixture or rinse water should be disposed of in a landfill approved for pesticides buried in a safe disposal site. Do not contaminate water by cleaning of equipment of disposal of wastes.

EQUIPMENT CLEANING — ROYAL SLO-GRO is not corrosive to spray equipment. Following applications all spray equipment should be thoroughly rinsed with water.

CONTAINER STORAGE AND HANDLING — The active ingredient in ROYAL SLO-GRO will separate from the surfactant at temperatures above 134°F. If containers are exposed to excessive heating, the contents can be remixed by lowering the temperature of the entire formulation below 134°F. and applying agitation. Always shake or stir well before use.

CONTAINER DISPOSAL — Triple rinse (or equivalent) and dispose in an incinerator or landfill approved for pesticides containers, or bury in a safe place.

ROYAL SLO-GRO®

GROWTH RETARDANT — WITH SORBATRAN*
CONTROLS GROWTH OF GRASS, TREES, SHRUBS AND IVY

COMPOSITION

Active Ingredient: (% by weight)	
Potassium salt of 1,2-dihydro-3, 6-pyridazinedione	21.7%
Inert Ingredients:	78.3%
Total:	100.0%

(One gallon contains 1.5 pounds as maleic hydrazide).
U.S. Patent No. 3,503,729

GENERAL INFORMATION

ROYAL-SLO-GRO growth retardant is an improved version of standard SLO-GRO. The advantage of the new product is a formulation improvement which allows a lower rate of active ingredient to achieve results equivalent to standard SLO-GRO used at a higher rate. ROYAL-SLO-GRO is a water based formulation which goes into solution readily. After initial mixing or stirring with dilution water, the spray solution requires no additional agitation.

The growth regulant action is systemic in nature. The chemical must first be absorbed into the growing plant. It then moves to the active growing site where it stops new growth thereby reducing the need for frequent mowing, pruning or clipping.

The following precautions should be observed to obtain best results with ROYAL-SLO-GRO.

1. Apply only to **green, vigorous** plants.
2. Do not use if vegetation is wilted or druing periods of extended drought as absorption will be poor and results will be unsatisfactory.
3. Time treatment to allow a minimum rainfree period of **at least 12 hours** after application to insure complete absorption of the chemical.
4. Spraying on relatively calm days (wind velocity under 15 mph) with equipment that will apply the product uniformly is essential for best results.
5. All turf areas treated should contain well established perennial grasses at least three years old.
6. Do not add any extra wetting agents or commercial spray adjuvants to ROYAL-SLO-GRO spray solutions.

*Trademark of UNIROYAL, Inc.

EPA Reg. No. 400-94 11-15-80

UNIROYAL CHEMICAL - Division of UNIROYAL, Inc.
NAUGATUCK, CONNECTICUT 06770

DIRECTIONS FOR USE ON GRASS

ROYAL SLO-GRO is used mostly as a substitute for mechanical mowing on various commerical turf locations such as hard-to-mow areas along highways, airports property, industrial areas and golf course roughs. It can be used for grass inhibition on all turf areas except those under heavy foot traffic (such as golf course fairways and greens, except for Poa annua control) and fine lawns whre esthetic appearance is more important than reducing a maintenance chore.

On grass areas where broadleaf weed growth is a problem, ROYAL SLO-GRO may be used in a tank-mix combination with low volatile ester or amine formulations to 2,4-D. One pound of 2,4-D per acre should be used with ROYAL SLO-GRO in most spring applications. Follow dosage and precautionary information on the 2,4-D label. If weeds have not emerged at time of SLO-GRO application a separate, later spray of 2,4-D is recommended to control these weeds.

SPECIES RESPONSE: Perennial grasses effectively retarded by ROYAL SLO-GRO are: bluegrass, fescues, bromegrass, orchard grass, quackgrass and perennial rye. Bent grass can be inhibited, but often shows discoloration effects. ROYAL SLO-GRO will injure St. Augustine grass and **should not be used on this species.**

MODE OF ACTION: The growth regulant action prevents seed head formation and slows down leaf growth. If the application is timed properly, no significant growth will occur for several weeks after the treatment. As the effect gradually "wears off," the turf may grow to 6-12 inches in height by the end of the growing season. One or more mechanical mowings may be required if grass height must be kept under 6 inches.

TIMING: One application per year either Spring or Fall should be used. At either time, the area to be treated must be green and actively growing. Turf to be treated must be free of leaf cover or other debris which would prevent direct contact of the spray with the grass.

SPRING TREATMENTS

This is the best time to use a ROYAL SLO-GRO application when dandelion and forsythia are in full bloom. Application (usually in April when the new grass growth is green and 2-3 inches high) will curtail the normal spring flush of growth and eliminate the need to mow for at least several weeks. If the time or weather does not permit early application and grass is 6 inches or more in height, the product should be applied and the area mowed about 7 days later. This procedure helps to prevent "stretching" of the seed head in the treated area. Under no conditions, should the turf be mowed to a height under 3-4 inches to avoid "scalped" appearance of the retarded grass.

DOSAGE: Use 1½ to 2 gallons of ROYAL SLO-GRO in 30-50 gallons of water per acre. Application may be made with standard booms or off-center nozzles systems. Calibrated nozzles and accurate low speed speedometers should be used to insure proper dosage. Spraying should not be done on excessively windy days. All reasonable care should be taken to apply the product uniformly for best results.

AUTUMN TREATMENTS

ROYAL SLO-GRO may also be applied late in the growing season to reduce grass growth the following spring. Treatment should be made while grass is still green but before it becomes dormant (usually during October). An additional benefit of Fall treatment is control of wild onion, garlic and biennial type weeds such as dandelion and plantain. Since grass growth is inhibited the following spring, the area will "green up" about two weeks later than untreated turf.

DOSAGE: Use 3 gallons of ROYAL SLO-GRO in 30-50 gallons of water. Application procedures are similar to those used for spring treatment. Do not spray if there is a cover of fallen leaves or non-uniform results will be obtained.

SPECIAL NOTE: Do not apply ROYAL SLO-GRO during the summer or other times when the permanent grasses are dormant under drought conditions.

SPECIAL GRASS AREAS

GOLF COURSE FAIRWAYS: ROYAL SLO-GRO may be used to reduce **Poa annua** (annual bluegrass) in golf course fairways. Recommended procedure is to first mow area twice in normal sequence (usually 5 to 6 days apart). When the third mowing is needed and **before** first **Poa annua** seed heads appear - spray 2 quarts of ROYAL SLO-GRO in 30-40 gallons per acre. Do not use over 40 gallons per acre as effectiveness may be reduced. The effect of this treatment should be evident in 8-10 days showing up as a reduction in **Poa annua** reseeding with little retardation of desirable grass growth.

HOME LAWNS: ROYAL SLO-GRO is not recommended as an over all treatment for prime lawns or other fine turf areas.

ROYAL SLO-GRO can be used as a band or edge treatment of lawns where it is difficult to trim mechanically. Examples are: Along walls, around trees, rocks, etc.

Small area applications are made in the spring with conventional compressed air tank sprayers or hose-end attachments. Dosage rate is 5 tablespoons of ROYAL SLO-GRO per gallon of water to treat a 400 sq. ft. area.

SPECIAL NOTE: Because of the difficulties in applying ROYAL SLO-GRO at a uniform rate and dosage to small areas, some color modification may occur. Any slightly abnormal color of the treated area is a temporary effect. At times, the treated grass may be a greener color than untreated turf.

DIRECTIONS FOR USE ON TREES, SHRUBS AND IVY

ROYAL SLO-GRO is used to suppress excessive vegetative growth and reduce the need to mechanically prune or shear. Best procedure is to apply to plants that have been previously pruned into the desired shape. Some regrowth should be allowed before treatment to hide fresh cut ends of limbs or stems to prevent a barren appearance of the treated plant. ROYAL SLO-GRO should only be used on vigorous, healthy plants.

The following **trees** can be treated with ROYAL SLO-GRO:

Acacia, Black	Liquid Amber (Sweet Gum)
Alder	Linden
Ash	Madrone
Bay (California Laurel)	Manzanita
Birch	Maple
Box-Elder	Mulberry
Buckeye, California	Pine, Monterey
Catalpa	Plane (Sycamore)
Cypress Monterey	Poplar
Dogwood, Pacific	Redbud, Western
Elderberry	Redwood
Elm	Walnut
Eucalyptus	Wax-Myrtle, California
Fir, Douglas	Willow, Black
Grevillea (Silk Oak)	Oak

ROYAL SLO-GRO will effectively retard excessive vegetative growth on the following **shrubs:**

Cissus	Pittosporum
Eugenia	Privet
Fosythia	Pyracantha
Honeysuckle	Viburnum
Myrtus	Xylosoma

ROYAL SLO-GRO may be used to inhibit the growth of **Hahn** and **Algerian Ivy.** A special use for ROYAL SLO-GRO is for weed control in **Ice Plant.** It may be used for both emerged broadleaf weed and annual grass control without injury to the herbaceous growth.

DOSAGE: ROYAL SLO-GRO is recommended for all uses at a rate of 1½ to 2 gallons per 100 gallons of water. This rate is equivalent to 4 to 5 tablespoons (2-2½ fl. ozs.) per gallon for small sprayers or hose-end at-

tachments.

PROCEDURES: All areas to be inhibited should be sprayed to drip-point covering all surfaces of leaves and stems. If only one section of a tree is to be controlled, spray just that section and normal growth will continue in the unsprayed sections.

Best results are obtained when spray is applied to green, vigorous, new growth. On trees, new leaves should be **fully expanded** when the treatment is made. ROYAL SLO-GRO should be used once a year - in spring, after new growth has started, or in early summer - usually after pruning when new regrowth is about 2 to 4 inches in length.

WARNINGS AND PRECAUTIONS

1. ROYAL SLO-GRO should be used only for grass, tree and shrub inhibition. Do not use on tobacco, potatoes, onions, citrus or agricultural crops.
2. Do not pasture livestock in, or cut hay from treated areas.
3. ROYAL SLO-GRO can be used along highways, airports, military installations, roughs of golf courses (except Poa annua control fairways) and similar areas. Do not use on home lawns except along edges.
4. At recommended application rates ROYAL SLO-GRO does not normally affect the color of grass. Under conditions of optimum absorption, color modification for a period of several weeks may be encountered. At times treated grass may be a greener color than untreated grass. It may also remain greener for a longer period under drought conditions. No adverse effects on color have been observed from Fall application. Some delay in spring "green up" is normal.
5. Do not spray on trees when wind velocity exceeds 15 mph. Even though ROYAL SLO-GRO is nonvolatile, no drift should be permitted onto nearby crops.
6. Observe all cautions and limitations on labeling of all products used in mixtures.

FOR RETARDING THE GROWTH OF TREES BY INJECTION

DIRECTIONS FOR USE

TO RETARD GROWTH OF TREES BY INJECTION

GENERAL INFORMATION

ROYAL-SLO-GRO may be used to retard growth of certain broadleaf tree species along utility rights-of-way, city streets, parks, and other areas where there is need for reducing the frequency of manual pruning. For control of growth, solutions of ROYAL-SLO-GRO are injected into the tree trunk as described below.

MIXING

Pour the amount of ROYAL-SLO-GRO indicated into a partially filled tank, then add the necessary quantity of water to complete the desired volume of solution for injection.

EQUIPMENT

Best results are obtained when the total volume of injected ROYAL SLO-GRO is distributed evenly throughout the tree. The pressurized injection system as developed by the United States Department of Agriculture, Nursery Crops Research Laboratory, Delaware, Ohio (G.K. Brown - 1978 Journal of Arboriculture 4:7-13) has proven effective for injection of ROYAL SLO-GRO.

APPLICATION TECHNIQUE

Trees that are 6 to 16 inches DBH (diameter breast height) require 3 injections holes equally spaced around the tree trunk about 40 inches above the ground. Trees greater than 16 inches DBH require 6 injection holes. Drill injection holes horizontally into the trunk, so that growth regulator will be injected into the outer sapwood to facilitate rapid uptake. Injection holes should not penetrate the wood more than 2½ inches and drill size should not exceed 7/32 inch. Use injection pressures of 100 to 200 psi to achieve rapid uptake of solution. Do not exceed pressure of 200 psi.

CONCENTRATION

Species	Pints of ROYAL SLO-GRO in 1 gallon of water	ml of ROYAL SLO-GRO in 1 liter of water
Sycamore (Platanus occidentalis)	3	368
London plane tree (Platanus acerfolia)	3	368
Silver maple (Acer saccharinum)	3	368
Eucalyptus (Eucalyptus spp.)	3	368
Cottonwood (Populus deltoides)	4½	546
Big leaf maple (Acer macrophyllum)	5	614

VOLUME

The volume of ROYAL-SLO-GRO solution injected is dependent upon the tree size. The total injection volume (TIV) of ROYAL-SLO-GRO solution is determined by measuring the diameter of the tree at breast height (DBH) and utilizing one of the following formulas:

	Number of injection holes required	Total Injection Volume in ml (TIV)	Volume per injection hole
For trees 6-16 inches DBH	3	$TIV = (DBH)^2 \times 1.59$	$\frac{TIV}{3}$
For trees greater than 16 inches DBH	6	$TIV = DBH \times 25.45$	$\frac{TIV}{6}$

TIMING

On deciduous trees, best results are obtained when winter trimmed or untrimmed trees are injected with ROYAL-SLO-GRO solution after the first flush of leaves is ¾ to fully developed and before shoot growth begins. Broadleaf evergreens may be treated during seasonal flushes of growth.

NOTES:

1. **Do not inject ROYAL-SLO-GRO into drought stressed trees or trees that do not appear healthy.**
2. **Do not inject ROYAL-SLO-GRO into bearing fruit or nut trees or sugar maple trees tapped for sugar.**

IMPORTANT NOTICE — Seller warrants that this product conforms to its chemical description and is reasonably fit for the purposes stated on the label when used in accordance with the directions and instructions specified on the label under normal conditions of use, **but neither this warranty nor any other warranty of merchantability or fitness for a particular purpose, express or implied, extends to the use of this product, contrary to label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to seller and buyer assumes the risk of any such use.**

3-4-81

NOTE: ALWAYS STIR OR SHAKE WELL BEFORE USING.

CLIMATOLOGICAL DATA-PRECIPITATION

TABLE NO. 1

PRECIPITATION

Month	YEAR	TOT	NORM	% NORM	TOT	NORM	% NORM	TOT	NORM	% NORM
		WYTHEVILLE			LYNCHBURG			FREDICKSBURG		
June	1979	5.10	3.08	166%	5.28	3.43	154%	3.15	3.14	100%
July	1979	6.80	4.48	152%	4.50	4.05	111%	4.91	4.40	112%
August	1979	3.40	3.84	88%	3.42	4.05	84%	2.68	4.79	56%
September	1979	5.98	3.01	199%	9.22	3.30	279%	9.32	3.24	288%
October	1979	2.96	2.40	123%	3.77	2.60	145%	5.73	3.05	188%
November	1979	4.01	2.34	171%	3.18	2.66	120%	2.74	2.92	94%
December	1979	1.39	2.75	51%	1.13	3.21	35%	1.23	3.18	39%
January	1980	2.66	2.63	101%	4.63	2.77	167%	3.97	2.79	142%
February	1980	.51	2.75	19%	1.07	2.79	38%	1.26	2.53	50%
March	1980	4.26	3.29	129%	5.03	3.46	145%	4.83	3.55	136%
April	1980	4.06	2.89	140%	3.99	2.73	146%	3.16	2.81	112%
May	1980	2.11	3.51	60%	3.03	3.22	94%	3.37	3.45	98%
June	1980	2.02	3.08	66%	.65	3.43	19%	.73	3.14	23%
July	1980	7.41	4.48	165%	3.61	4.05	89%	3.65	4.40	83%
August	1980	1.59	3.84	41%	1.34	4.05	33%	1.37	4.79	29%
September	1980	3.28	3.01	109%	1.79	3.30	54%	1.01	3.24	31%
October	1980	3.07	2.40	128%	2.35	2.60	90%	3.99	3.05	131%
November	1980	1.69	2.34	72%	2.85	2.66	107%	2.87	2.92	98%
December	1980	.77	2.75	28%	.56	3.21	17%	1.49	3.18	47%
January	1981	.89	2.63	34%	.49	2.77	18%	.34	2.79	12%
February	1981	2.70	2.75	98%	3.81	2.79	137%	3.28	2.53	130%
March	1981	2.15	3.29	65%	1.81	3.46	52%	.99	3.55	28%
April	1981	1.53	2.89	88%	2.44	2.73	89%	2.69	2.81	96%
May	1981	6.32	3.51	180%	1.66	3.22	52%	3.73	3.45	108%

EMBARK QUESTIONNAIRE SUMMARY

TABLE NO. 2

	BRISTOL	SALEM	LYNCBURG	SUFFOLK	FREDICKSBURG	CULPEPER	STAUNTON	RICHMOND
(1) Did you use Embark in Fall 1980?	YES	YES	YES	YES	YES	NO	NO	NO
(1a) If so, at what rate?	1½ pts	1½ pts	1 pt	1 pt	1 pt	/	/	/
Dates of application? START	10/7/80	11/2/80	10/6/80		10/23/80	/	/	/
FINISH	11/13/80	11/25/80	12/19/80	10/80	11/21/80	/	/	/
(1b) Was Embark mixed with a herbicide?	NO	YES	YES	YES	YES	/	/	/
If so, what product?	/	2,4-D Ban 4WS	2,4-D	2,4-D	2,4-D	/	/	/
Was Embark tank mixed with a spreader/sticker?	YES	YES	NO	NO	NO	/	/	/
If so, was it anionic, cationic, or nonionic?	NON	NON	/	/	/	/	/	/
(1d) What was the condition of the grass prior to application?	Growing	Growing	Good	Growing	4"-6"	/	/	/
Date of last previous mowing?	9/80	10/15/80	10/80	/	9/80	/	/	/
(2) Effectiveness rating of Fall 1980 application (Excellent - Poor)	POOR	POOR	POOR	GOOD	GOOD	/	/	/

	BRISTOL	SALEM	LYNCBURG	SUFFOLK	FREDICKSBURG	CULPEPPER	STAUNTON	RICHMOND
(2a) At stated application rate, was there turf injury?	NO	NO	NO	YES	NO	/	/	/
Significant brownout?	NO	NO	NO	YES	NO	/	/	/
(3) Did you use Embark in the Spring 1981?	YES	YES	YES	YES	YES	YES	YES	/
(3a) If so, at what rate?	1 pt	1 pt	1 pt	1 pt	1 pt	2 pt	1½ pt	/
Dates of application? START	4/2/81	3/31/81	3/24/81		3/31/81	3/23/81	4/1/81	/
FINISH	5/14/81	5/12/81	6/29/81	3/81	5/1/81	4/29/81	4/15/81	/
(3b) Was Embark mixed with a herbicide?	YES	YES	YES	YES	YES	YES	YES	/
If so, what product?	2,4-D	2,4-D BANVEL	2,4-D	2,4-D	2,4-D	2,4-D	BANVEL 4WS	/
Was Embark tank mixed with a spreader/sticker?	YES	YES	NO	NO	NO	NO	NO	/
If so, was it anionic, cationic, or nonionic?	NON	NON	/	/	/	/	/	/
(3d) What was the condition at time of application?	ACTIVELY GROWING	SLOW GROWTH	GOOD	GROWING	6"-10"	GROWING	2"	/
Was the seedhead shoot visible at time of application?	NO	NO/YES	YES	NO	NO/YES	NO	NO	/

	BRISTOL	SALEM	LYNCBURG	SUFFOLK	FREDICKSBURG	CULPEPPER	STAUNTON	RICHMOND
(4) Effectiveness rating of Spring 1981 application (Excellent-Poor)	POOR	POOR	POOR	V. GOOD	GOOD	AVE.	POOR	/
(4a) At stated application rate, was there turf injury?	NO	NO	NO	YES	NO	NO	NO	/
Significant brownout?	NO	NO	NO	YES	NO	NO	NO	/