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GETTING THE MOST OUT OF HERBICIDES

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A continuously on-going program is necessary to get the most out of herbicides. Products are constantly being removed from or added to the market. Research projects are underway in many geographical areas and on many different products and combinations of products. I cannot begin to cover even our own experience in the allotted time, so I shall try to give some of the highlights in graphic form with slides and an attached table showing the products which have been most effective for us.

We started our chemical weed program in the 1950's with a few basic chemicals. In the years since then, we have added to the numbers of chemicals to develop an on-going program of application to a wide range of ornamental plant material on our 80 acres, including field plantings and some half a million containers. In the past, because of the risks and liability involved, I tried to do the major part of the application myself. Now, with a backlog of information and better new chemicals, this responsibility is gradually being delegated to others.

Along with field and container applications, each year we have run research and check plots to collect more information. We also cooperate with other growers, research stations and chemical companies to get more accurate evaluations. It is so very important to work with research and industry people, both

in an exchange of information and in support, to develop together workable programs for the whole geographical area.

Proper and Safe Use. In developing a weed control program, it is wise, first of all, to keep a healthy respect for the potential damage a chemical can cause, both to the applicator and to the crop, while it is hopefully killing the weeds. In setting up, provide a dry, safe storage area which can be locked and a facility for safe disposal. Measure accurately and carefully calculate the actual ingredients per acre (a.i.a.), taking into account the percentage of actual material as printed on the label. Read the entire label carefully and check the crop registration. State and Federal laws can vary as to application and exception by area. Get information on the actual applications made in your area from other growers and research facilities. Use a small scale application against a check block to test out new chemicals or to test different rates and combinations. Observe and try to measure any damage carefully. You may eventually need to make an economic tradeoff: accepting some predictable damage in preference to the additional costs of labor for hand hoeing and a loss of growth from competition with weeds.

Keeping Records. Keep accurate records of applications: date, rate, plant cultivar, weeds, soil mix, time of day, temperature of air and soil, rain or sun before and after, growth stage of the plants and weeds, and any other pertinent factors. The type of soil mix could have a bearing on possible root damage; this should be checked at intervals afterward, as it may not show up for awhile above the ground. Eventually, of course, root damage could result in considerable loss of overall growth and vigor. There can be a pronounced difference in plant reaction among cultivars of the same species. Some plants are even stimulated to increased growth by some herbicides. Cultural practices, especially as related to heat, light and water stress can make a big difference in reaction. An already stressed plant will show damage from the added stress of a chemical application much more quickly and severely than would a vigorous and healthy plant.

Records of application need to be carefully footnoted with results shown at subsequent periodic checks. The evaluation of the results are the key to planning the next applications. Unfortunately, you will soon realize that there is no single herbicide or rate of application which can be used for all nursery crops. Your own records are your best guideline for the most effective use of herbicides on your own nursery.

Some of the Problems. Sometimes the results seem dramatic on the first application of a herbicide. After a few years, you may note a serious build-up of some few weeds, which the

chemical is not reaching. Without the competition from a broad spectrum of many weeds, the few kinds not eradicated will increase at an alarming rate and require further measures of control. Sometimes a combination of chemicals in one application will give a broader control. Sometimes spot spraying or hand weeding is necessary to take out the most resistant ones. Other times, a special type of weed may be treated with a second application: for instance, apply Kerb to kill residual grasses, or use 2-4-D to kill broadleaf weeds in a block of conifers.

As you work along in your herbicide program, guard against a false sense of security when one problem seems to be solved and try to keep an open mind in considering new herbicides and possible substitutes. There is that constant threat that the herbicide you have come to rely on might someday be taken off the commercial market. For example, as new products have become available, we have changed our program to include some of the better ones such as Surflan, Devrinol and Ronstar. We keep trying more combinations and testing new chemicals — it must be a continuously on-going program.

Some Guidelines for Use. Following is a listing of the herbicides we have found most effective at our nursery. However, I want to caution you that these application rates are only the ones used for research at our nursery. They may not be suitable for your use. They should be considered only as guidelines and you should work out the proper rates for your own specific needs.

CHEMICALS USED IN WEED CONTROL PROGRAM AT BRIGGS NURSERY

Key: a.i.a. — amount of active ingredient to be applied per acre.
C — application on clean field.,
S — application on small weeds of two leaves or less.
E — application on established weeds.

ATRAZINE (atrex) (1 lb. aia) C, E	Used on weeds too large to kill with Simazine. Up to 5 lbs. on large Christmas trees. Toxic to many plants. Long residual in the soil. Avoid over-use.
AMINO TRIAZOLE (amitrole) (1-2 lbs. aia) S, E	This may be applied over the tops in the early spring on special plants before they start growth, but after the weeds have begun actively growing. It is a good clean-up during the winter, when most herbicides fail. Use only the powder and not the liquid form, as the oil in the liquid will cause burning. Do not use on dogwood or junipers.
CASORON G.4 (dichlobenil) (4 lbs. aia) C, S, E	Useful in both field and containers. Use only when needed, because it does build up in the soil. The only chemical we have for many weeds such as horsetail.

CASORON W (dichlobenil) (3 lbs. aia) C, S, E	Better coverage than Casoron G.4; more toxic. One of the best weed-killers in the winter and fall. Requires a great deal of water and cooling when used during summer. May damage firs, euonymus, <i>Cotoneaster dammeri</i> , <i>Viburnum davidii</i> , leucothoe, mugho pine and other low-growing shrubs. Do not use in a closed house.
CHLORO I.P.C. G.10 (chlorpropham) (6 lbs. aia) C, S E	Winter control only. No toxic effect in plastic houses. Best on grass and chickweed.
DACTHAL (chlorthal) (12 lbs. aia) C	A safe herbicide, but gives poor results in our climate.
DOWPON (dalapon) (8 lbs. aia) S, E	Used for grasses only. Useful in combinations: 8 lbs. + 4 lbs. Atrazine + lbs. Amino triazole for quack grass.
DEVRIKOL (napropamide) (4 lbs. aia) C	Strong on grass, but poor on some broadleaves. More effective in combination with Casoron, Simazine, Ronstar, or Tenoran.
DINITRO (dinoseb) (1-2 qts. per 30 gals. water) C, E	A contact killer. Needs warm temperatures. Hard to work with. Good on tender broadleaved weeds. Use in early spring on conifers for groundsel (<i>Senecio vulgaris</i>).
GOAL (oxyfluorfen) (1-4 lbs. aia) C, E	A new broadleaf weed killer. Gives excellent control on groundsel for up to six months.
LASSO (alachlor) (2-4 lbs. aia) C	Apparently used effectively in the Southeast U.S., but not as useful under our conditions here. Useful here only in combinations, giving poor to fair results.
LITHATE (95% 2-4-D. W.) (1-1½ lbs. aia) S, E	Used over the tops of conifers when they are not in active growth. Control for broadleaved weeds.
KERB (pronamide) (1-3 lbs. aia) C, S, E	Effective only in late fall and winter. Use over the tops for grass control. Use at heavy rate for quack grass. Useful in combination with other broadleaf herbicides.
PARAQUAT (Gramoxone S) (¼-½ oz/gal aia) E	A contact killer for spot spraying. Keep off ornamental tops. Not as effective on hot days or when the plant is under stress. Use spreader-sticker on hard-to-kill weeds. Use higher rates on cold days.
PRINCEP 4G (simazine) (2-3 lbs. aia) C, S	Still our most reliable chemical for the fields. Also used in combination in the field. For containers, use ½ lb. added to Surflan, Tenoran, Devrinol and others to increase the percent of total kill. Do not use around boxwood, euonymus, leucothoe, nandina, enkianthus or many of the deciduous plants. Only low rates are safe

	around evergreen and deciduous azaleas, forsythia and young magnolias.
ROUND UP (glyphosate) ($\frac{1}{2}$ -1 oz/gal aia) E	Useful in control of morning glory (<i>Convolvulus arvensis</i>) as spot spray. Use at least 2 times the concentrations of Paraquat. Needs at least 6 hours before a rain to work.
RONSTAR 4G (oxadiazon) (2-4 lbs. aia) C, S	The best new control for bittercress (<i>Cardamine oligosperma</i>). Foliage must be dry. Some damage to some broadleaves in tender growth. One of the more safe chemicals for small containers.
SINBAR (terbacil) (1 lb. aia) C, S, E	Use in combination with amitrole for a strong combination to use for non-selective killing.
SPIKE (2-3 lbs. aia) C	Non-selective killer for can lots and driveways. Avoid plant root systems. Long lasting. <i>Juniperus sabina</i> 'Tamariscifolia' is tolerant of this at low rates.
SURFLAN (Oryzalin) (3-5 lbs. aia) C, S	A better weed control than Treflan. Used mainly for grasses. Used in combination on containers.
TENORAN (chloroxoron) (3 lbs. aia) C, S, E	Good control on fireweed (<i>Epilobium angustifolium</i>), groundsel, and bittercress. Not very effective on grasses. On new plantings in the field, use 3 lbs Tenoran with 2 lbs Simazine and $1\frac{1}{2}$ lbs Kerb. On established weeds in the fall, use 3 to 4 lbs Tenoran with $1\frac{1}{4}$ lbs Atrazine; or 3 lbs Tenoran and $1\frac{1}{2}$ lbs Amino triazole. On containers, use in combination with $\frac{1}{2}$ lb Simazine and 3 lbs Tenoran on conifers and 2 to $2\frac{1}{2}$ lbs on broadleaves. Kerb at $1\frac{1}{2}$ lbs may be added for grasses in fall and winter. Causes some damage to broadleaves, especially when they are in new flush of growth. Reduce the concentration for use in plastic houses and during hot weather.
TOK (nitrofen) (2-4 lbs. aia) S	Our Pacific Northwest weather is usually too cool to use it effectively. Goal appears to be much superior for our use.
TREFLAN (trifluralin) (2-4 lbs. aia) C (incorporate)	Does not work very well in our weed control program.

NOTES ON PROPAGATION OF CERTAIN ACERS

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Much has been written and spoken over the past two decades on the propagation of "Japanese Maples." The indices of the IPPS Proceedings and of the *American Nurseryman* will re-