Update On Copper Root Control[1]

Mark A. Crawford[2]

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The benefit of using of copper salts in a latex carrier to control root development in containers has been well documented in the literature and has gained widespread use in forestry with the introduction of pretreated styrofoam growing trays in the early 1990's. Using copper to control root growth in containers to eliminate root spiraling first began in forest seedling production in the 1960's and has increased to where greater than 90% of lodgepole pine produced in British Columbia are grown in copper-treated containers. Horticultural researchers who were also looking for ways to eliminate root circling in container landscape trees became interested in this practice. Researchers at Ohio State University demonstrated the benefits of controlling roots in container-grown red oak (*Quercus rubra*) which caught the attention of Griffin Corporation, a major producer of copper fungicides. In 1994, Griffin introduced Spin Out® Root Growth Regulator to ornamental nurseries, the first EPA registered product for controlling plant root growth in containers.

Spin Out was specifically formulated as a stable, ready to use product to be applied to the inner surfaces of growing containers to control undesirable root growth and produce plants with high root regeneration potential. The active ingredient in Spin Out is copper hydroxide. Copper hydroxide has been used for over 30 years for disease control on crops throughout the world and is considered the best source of copper for copper-based fungicides/bactericides. Spin Out has been formulated to adhere to plastic nursery containers and styroblocks and holds the copper hydroxide in place to control root growth only along the container wall. It is easily applied to the inner surfaces of new and used containers using conventional spray paint equipment . It was also formulated to reduce the problems of copper-induced iron chlorosis associated with home brewed mixtures of latex paint and copper carbonate and the Canadian pretreated styrofoam blocks. When root tips reach the sides of the container, the Spin Out coating inhibits root elongation and deflection and stimulates root branching. As the plant produces new roots, they in turn will be pruned, resulting in a very fibrous root system. Spin Out prevents the "cage root" condition where roots are only present on the outside of the root ball. Instead, the roots explore and utilize all the available potting media. An improvement in root distribution can lead to an improvement in the nutrient status and health of the plant which will support quicker growth when upcanned or transplanted. With the absence of circled and matted roots, no mechanical root pruning is required at transplanting resulting in decreased sites where root diseases can enter the plant. Also, root heat stress associated with black nursery containers is reduced in Spin Out-treated containers. In a typical black nursery container, 80% of the roots are within one inch of the container wall. Spin Out will cause the root system to be distributed more evenly through the soil thereby reducing the mass of roots

which come in contact with the plastic that are subject to temperature extremes. Better root distribution can also increase the nutrient status of roots since the plant is able to utilize all the available soil in the container. An increase in flowering has been demonstrated with lantana grown in Spin Out-treated containers during greenhouse production (Table 1). Spin Out also makes removal of plants from containers easier since the roots do not adhere to the plastic or styrofoam.

Table 1. Influence of Spin Out-treated pots used during propagation on root length of *Evolvulus* and *Lantana*, and on the number of flowers 1 month after transplanting from propagation pots into hanging baskets.

Species	Spin Out®	Total root length (mm)	Length of longest root	Number Flowers	% Flower Increase
Evolvulus glomeratus	+	0.46	61	26.3	98
	-	0.55	102	13.3	
E. tenuis	+	0.31	54	13	55
	-	0.33	121	8.4	
Lantana camara	+	0.31	55	19.7	56
	-	0.33	119	12.6	
L. montevidensis	+	0.51	66	23.7	160
	-	0.6	109	9.1	
Significant (P>F)		*	**	**	

Most of the research with Spin Out has been on ornamental trees, shrubs, and herbaceous annuals and perennials grown in large containers ranging in size from 1 to 100 gallons. Initially, Spin Out was developed as a user-applied coating where growers apply the product to containers at the nursery. Growers found the product very effective but they were resistant to the time and inconvenience of application. This lead to Griffin and Lerio Corp., a container manufacturer, forming a partnership in 1996 to supply pretreated pots and propagation trays to the market. Pretreated propagation trays are produced by a patented process where flat polystyrene sheet is coated with Spin Out and then formed into a tray. This represents a significant reduction in the cost and time to produce a treated tray and the coating rate is specific to cell size. At this time, plastic trays with cells less than 3 inches deep are available from Lerio and in 1998, Lerio plans to introduce trays with deep cells used for forest and landscape tree seedlings (Figure 1).

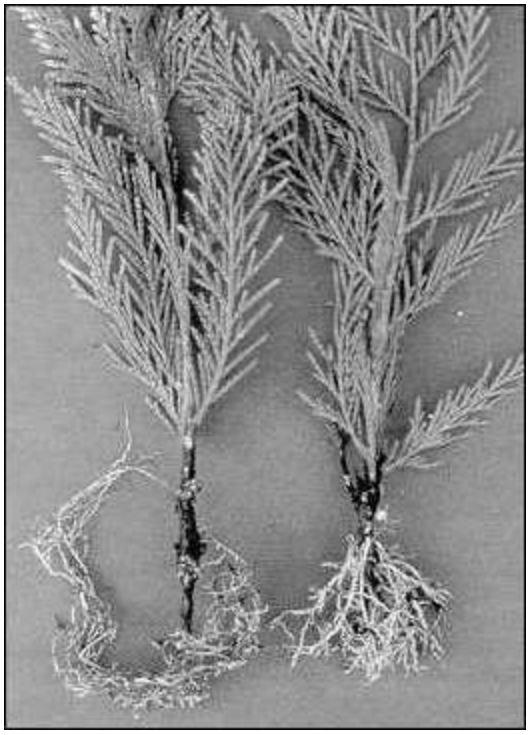

Figure 1. Cuttings of leyeland cypress (XCupressocyparis leylandii) rooted in a Spin Out-treated propagation tray.

In addition to rigid plastic containers, Griffin has developed polybags pretreated with Spin Out (Figure 2). Polybags are currently being tested on numerous forestry and nursery crops in several countries as a cost effective way to solve root problems associated with polybag culture. First year results are very encouraging on *Pinus montezume* (Table 2).

The development of Spin Out has lead to many other uses for root and pest management in nurseries, greenhouses, and in the landscape. Spin Out can be applied to woven and non-woven geotextile fabrics to provide root control for different situations.

Figure 2. Waxmyrtle (Myrica cerifera) grown in Spin Out-treated polybags

(HDPE) for 11 months.

Table 2. Morphological characteristics for *Pinus montezume* and *P. pseudostrobus* nursery produced seedlings grown in polybags with and without Spin Out® treatment.

Species	Treatment	Stem Diameter (mm)	Stem Ht. (cm)	Stem Wt. (g)	Root Wt (g) .	Root: Shoot ratio
P. montezume	Spin Out	9.97	-	4.36	1.83	0.39
	Untreated	8.29	-	3.49	1.53	0.41
	Significance	***	-	***	**	ns
P. pseudostrobus	Spin Out	4.75	19.41	5.31	1.21	0.22
	Untreated	3.86	17.64	4.10	0.77	0.18
	Significance	***	*	***	***	**

Data provided by R. Phillips, CEFORA, NMSU 1997

Weeds growing in a decorative mulch used to cover a fabric groundcover in a landscape are very difficult to remove because the roots grow through the small openings in the fabric. Spin Out-treated geotextile fabric will prevent weeds from becoming established by controlling roots that attach and grow through the fabric. This concept has been modified where Spin Out-treated non-woven fabric is cut into circles or discs and placed on the tops of pots to control weeds as an alternative to herbicides (Figure 3).

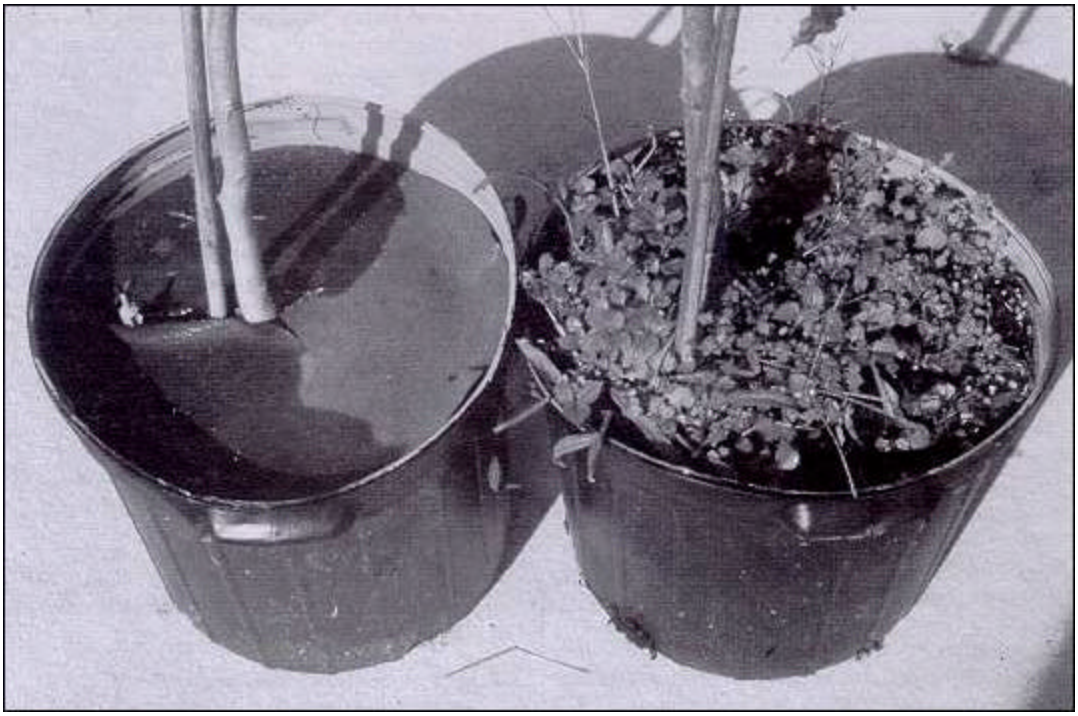

Figure 3. Tex-R Geodiscs used for weed control in nursery containers.

When weed seeds germinate, the roots are pruned, preventing weed establishment and the seedling dies. Water is able to pass through the fabric since coated fabrics remains porous. Without the coating, weed seed can germinate and roots can grow through the small pores in the fabric. Spin Out-treated geotextile fabrics can also be used to replace air pruning under styroblocks and plastic propagation trays by pruning roots as they emerge from the drain holes. Treated fabrics can also be used to cover capillary sandbeds to control roots growing from the drainage holes of containers, weeds, liverworts, and several types of algae. In England, the use of sandbeds was declining when herbicides used to control root egress into the sand were discontinued due to groundwater issues. The commercial introduction of two pretreated fabrics, Supercover Plus™ and Tex-R® fabric, have saved the use of sandbeds. Continued research in England has demonstrated that treated fabrics will control zoospores of *Phytophthora crytogea* and reduce the spread of disease from infected to noninfected plants on a sandbed. Capillary mats used for irrigation of greenhouse crops remain free of algae growth when treated with Spin Out. Other research in Oregon, Hawaii and Canada has demonstrated that slugs and snails are repelled by the Spin Out coating on fabrics. It may be possible to keep plants free of slugs and snails by placing containers on treated fabric or by coating the surface under containers. Griffin has teamed up with Texel, Inc. of Quebec, Canada to provide fabrics pretreated with Spin Out.

Spin Out treated fabric (Tex-R) can be used between the socket and growing pots of the pot-in-pot growing system to control rooting-out. This is a problem where roots grow out of the drain holes of the growing pot into the socket pot and then into the surrounding soil, thus preventing the plant from being hand harvested. Spin Out treated fabric provides a physical and chemical barrier to reduce these escaped roots.

Other novel products are Spin Out-treated burlap for control of root growth in beds used to hold field dug trees during summer. This was found be highly effective, but is not commercially available due to the development of treated geotextiles. In Japan, paper sheets are treated with Spin Out and placed under the soil in flats used to grow rice seedlings for transplanting. This treatment eliminates the root mat on the bottom of seed flats and decreases the time to separate the small rice plants. Over 1 million flats of rice will use Spin Out-treated paper in 1998. Spin Out is also registered for use as a tree wound and pruning paint.

Spin Out is also available in a dry formulation for incorporation into fiber pots made from recycled paper. Fiber pots have been used for nursery plant production for many years, but are limited to regions with cool climates like the Pacific Northwest and the northeast. In the southeast , fiber pots cannot be used for plant production because they decompose within 4-6 weeks and become too soft to pick up. When Spin Out is incorporated into fiber pots it extends the life of the pots for up to 2 years by slowing down the decomposition. One of the primary advantages of fiber pots in hot climates is they are porous and provide a cooler root environment compared to standard black plastic nursery pots. Plants sensitive to high root temperatures, like conifers and herbaceous perennials, are more easily grown in fiber pots. Spin Out also prevents root growth into the fiber making it easy to remove the pot for transplanting. Henry Molded Products in Lebanon, Pennsylvania is marketing these containers.

Spin Out is being developed to control undesirable root growth on root control barriers used in the landscape around pavement, foundations, curbing and retaining walls (hardscape). Undesirable root growth is a major problem and expense in the urban environment where arborists try to maintain a healthy urban forest. Rigid plastic barriers are currently used to divert roots under sidewalks and other hardscape to prevent root related damage as the trees grow, but are often ineffective or the effect is short term. Spin Out applied to these rigid barriers modifies the root system along the barrier and prevents large roots from deflecting along the barrier, growing down and then under the base of the barrier. By modifying the root system along the barrier, the life of the barrier is extended and the root system is more effectively redirected under the hardscape. Spin Out treated fabric is also being evaluated as a porous root diversion barrier that will not restrict the movement of water in the landscape.

All of the products discussed so far are for professional growers. Griffin has developed an aerosol formulation of Spin Out for the home gardener. This product is EPA registered and expected to be marketed in the United States in 1999. At this time it is only sold in Japan.

In summary, Spin Out was developed as a ready-to-use copper coating to help nursery growers control root growth in containers, but has been found to provide many other benefits depending on the substrate it is applied to and the problem the grower wants to solve. Providing pretreated pots, propagation trays, fabric and paper has made Spin Out very versatile and easy for the grower to use.

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[2]*Griffin Corporation, PO Box 1847, 2509 Rocky Ford Rd., Valdosta, GA 31602-1847; Tel: 912/249-5271; Fax: 912/244-5978; e-mail: (mark.crawford@griffincorp.com).*

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