# Polymers: Can They Work for You?

**By Dr. Tony Koski, Assistant Professor, Horticulture, Colorado State University**

To many, the word "polymer" evokes images of lush, green vegetables, flowers and lawns raised on little or no water in parts of the U.S. where yearly rainfall often totals less than 20 inches per year. Is it valid to expect what amounts to almost miraculous results claimed by some of the marketers of the many polymer products now available? Or should we temper our expectations and find less spectacular and more realistic uses for these potentially beneficial products?

Polymer technology has been around a long time. There are literally hundreds of uses for these materials, often called superabsorbents, which have the ability to absorb several hundred times their own weight in water or other liquids. One of the most familiar uses of polymers is for disposable diapers. Ideally, the polymers in a diaper do NOT release any absorbed moisture. Polymers used for growing plants, on the other hand, should release all (or nearly all) of the absorbed water to the plant when conditions warrant. Mixed into soil, superabsorbant polymers are supposed to provide extra plant-available moisture so as to reduce transplant shock of trees, shrubs or sod, enhance the survivability of windbreak plants under non-irrigated conditions and reduce the frequency of irrigation for any plant that requires regular watering to maintain its health, beauty or productivity.

### Polymer performance

The performance of polymers, both from water-retention and longevity perspectives, can be influenced by a number of factors. There are two basic types of polymers marketed for legitimate horticultural and agronomic use. One is the *starch-based* polymer. These types of polymers may absorb up to 1000 times their own weight in water. Their water-absorptive capability is not greatly affected by the quality (i.e. saltiness) of the water, a great advantage under field conditions throughout the Western U.S. where irrigation water is often slightly to highly saline. A potential drawback of the starch polymers is that they may last only 6 to 24 months in the soil, depending on the level of soil microbial activity and other environmental factors. This may not be a concern when their use is intended for annual crops, but poses an obvious disadvantage where polymers are to be used for long-lived, perennial plants such as trees, shrubs and turfgrasses.

The most widely-sold type of polymer, known as *cross-linked polyacrylamide* (hereafter, *CPA*), will greatly outlast starch-based polymers after soil-incorporation; some studies show that they retain their water-absorptive properties for at least 8-10 years after being placed in the soil. The water-absorptive capabilities of the CPAs will vary with the process used to produce them, ranging anywhere from 100 to 400 times their weight in *pure* (i.e., salt-free) water.

Pure, salt-free water is not encountered under conditions in which plants are grown. Nutrients supplied by the growing medium itself, in irrigation water, or by fertilizer additions are all forms of salt. As such, these salts reduce the ability of CPA crystals to absorb water. While rainwater is low in salts, a simple rainstorm will not significantly reduce the level of salts present in most soil conditions - and thus will not significantly increase the amount of water absorbed by CPA crystals already in the soil. For example, the irrigation water used at the Colorado State University Horticulture Research Center is only moderately salty, but it reduces the water absorptive capabilities of most CPA's from 400 times their own weight in water to between 50 and 100 times their weight. Though a dramatic reduction, the amount of water retained by these CPA is still significantly more than could be held by any other soil amendment. Additionally, there is no evidence to suggest that the polymers will permanently accummulate or store salts while in the soil, but will allow them to flow freely as water moves in and out of the swelled polymer crystal. Some scientists are now considering polymers as a tool to produce controlled-release fertilizers by "loading" the polymers with nutrients, followed by incorporation into the soil. The greatest potential use here would be on sandy soils in areas of high precipitation where nutrient leaching is a problem.

### But do they work?

Like many products marketed for horticultural use, there has been little independent research performed in order to assess valid expectations for polymers, much less protocols for using them. We have little knowledge concerning efficaceous use rates, incorporation depths or fertilization and irrigation techniques to be used in conjunction with polymers. Most of the present recommendations are likely based on "in-house" research and on testimonials from users in the field. While many of these experiences with polymers can be considered valid, the results can be confounded by all types of other factors. For example, the simple act of tilling polymers into the soil before seeding or sodding a lawn may significantly improve root zone conditions - enough so that the resulting turf may actually require less water than the previous one. The tillage (and not the polymers) may have caused the positive effect. Or perhaps the irrigation schedule was altered with the thought that the polymers would enhance drought resistance, but the turf might have been OVERIRRIGATED before, and is now doing fine with the proper amount of water! The lack of controlled, replicated and **published** research on polymers to demonstrate most of the benefits claimed for CPAs makes it difficult for university faculty and extension specialists throughout the country to recommend their use in many instances. Nevertheless, enough testimonial evidence exists from reliable industry experiences that research with polymers (especially CPAs) is continuing.

### Research at Colorado State University

At CSU we have concentrated on potential uses of CPA for turfgrass situations. We currently have two large studies under way in which we are trying to document any potential water savings associated with CPA use on Kentucky bluegrass and tall fescue lawns. In the oldest study (2 years old), we have not observed any potential to reduce irrigation levels or frequencies on either species. Our second study was begun in order to address concerns raised in the first study, namely to use a cleaner (low in salts) water source and to use smaller-sized crys-

*(Continued on Page 23)*

# Broadleaf Herbicide Timing Study

**By ZAC RELCHER, CLARK THROSSELL, JEFF LEFTON AND DAN WELSENBERGER**

Broadleaf weed control is most effective when herbicides are applied in the fall, but with new lawn care customers or areas that need a rescue treatment, broadleaf herbicides are often applied in the spring. A study, in its second year, was initiated to determine the effectiveness of spring broadleaf weed control, specifically to compare ester and amine formulations of a combination herbicide containing both 2,4-D and 2,4-DP. The ultimate objective of this study was to correlate weather conditions with weed control and develop a model to determine optimum timing for spring-applied amine and ester formulations of broadleaf weed herbicides.

Weedone DPC ester and Weedone DPS amine were applied weekly from 3 March through 11 May, 1989 and 3 March through 7 May, 1990 at 4 pts./A (0.925 lbs. al/A) in 80 gals. H20/A. This study was repeated at two locations each year, the Purdue University Jet Propulsion Laboratory and the Purdue Agronomy Research Center. Weed counts were taken in mid-April and mid-June of each year.

A number of conclusions can be drawn from the two years of data:

1) Very early spring treatments are not effective. The definition of early spring varies from year to year. Neither formulation gave adequate control when applied before 7 April 1989, but in 1990, neither formulation gave adequate control only when applied before 11 March.

2) The ester formulation is far superior to the amine formulation in the early spring. In 1989, the ester provided better control than the amine when applied from 7 April through 27 April. The ester provided better control than the amine when applied between 16 March and 28 March 1990.

3) After a certain date in the spring, control from an amine is equal to that of an ester. In 1989, this date was 28 April and in 1990, the date was 5 April.

The difference in the results from year to year demonstrate that herbicide application scheduling cannot always be based on the calendar. Rather, it should be based on a weather factor such as degree days, soil temperature, etc. With help from the National Weather Service and possibly a third year of data, a model will be developed to determine optimum timing of spring-applied broadleaf herbicides.

*—MRTF Newsletter*

# Polymers—

*(Continued from Page 6)*

tals in order to more uniformly distribute water in the turfgrass root zone. No "negatives" have been found with regard to CPA use, except where they are used at excessively high rates (more than 10 pounds of CPA per 1000 square feet per inch of depth to which it its incorporated). When too much is used, the ground becomes unstable and jelly-like. On the positive side, we have seen increased root production where CPA is used, as well as decreased soil compaction. The CPA materials also demonstrate great potential for enhancing the safety of high-use athletic fields by providing a cushioning effect for the athlete. Thus, we are optimistic that the CPAs and other polymers may provide important advantages for turfgrass culture, even if their use does not provide substantial water savings. However, at CSU, we continue to be optimistic about finding a way to utilize polymers as watersaving tools.

*Source: Ornamental & Turf Newsletter, Vol. 1, No. 1 April, 1992. Iowa State University Extension Horticulture Department.*