New Technology for Rainfastness in Aquatic Weed and Vegetation Management

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Introduction

A common problem encountered in aquatic and vegetation management is the wash-off of treatments caused by rain, dew, spray mist or wakes from airboats. In humid climates, an applicator may spray a treatment only to have rainfall a few hours later wash the materials off the spray site. In the summertime, some areas of the South may get over 22 inches of rainfall per month and products are needed to hold the treatment on the vegetation. This property of keeping treatments from washing-off readily is called rainfastness.

Some herbicides, such as glyphosate, are highly water-soluble and are prone to be diluted off the foliage by rains, sprays or other types of irrigation. Other herbicides that are not so water-soluble may be formulated in a product that contains high amounts of solvent and surfactants to get the active ingredient to disperse. In situations such as these, rainfastness becomes an important factor of making the product stay on the vegetation that is being sprayed.

In this study, we examine a new technology for rainfastness called TopFilm™, a microsponge suspoemulsion adjuvant. Microsponge adjuvants differ from surfactant adjuvants in that they are not soap or detergent based. Surfactants (whether non-ionic, anionic or cationic) are detergent based compounds with a polar headgroup and a non-polar chain, which gives them the ability to mix oil and water, lowering the surface tension. The new technology uses residual cereal grain materials to make microsponges that absorb the treatment in the tank mix and provide rainfastness by sticking to the vegetation. These microsponges, called Biocar® (US Patent #5,888,500), absorb the treatment, coat the vegetation and provide a protective film on the foliage that reduces wash-off and dilution. Since the microsponges are made from natural cereals, they provide no phytotoxicity to highly delicate foliage and are being used in the ornamental, landscape, and golf course markets.

In Aquatic Vegetation Management

When the dry microsponges were first introduced into the aquatic market, no one wanted to add solid particulates into a spray tank because of the mixing and dispersion problems. To overcome the dispersion problems, a suspoemulsion (suspension-emulsion system) of

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the microsponges was developed in a liquid adjuvant form. The microsponge adjuvant allowed the spray applicator to tank mix the treatment with the added benefit of forming a protectant film that minimized the wash-off due to rain.

The first trials in aquatics with the rainfast adjuvant were done by Joe Jernigan (Alabama Department of Wildlife and Freshwater Fisheries), by Tom Broadwell (Georgia Power) and by other biologists from an agency. They began testing herbicide microsponge mixtures on hyacinth, cutgrass, water lotus, *Scirpus cubensis*, *Nelembo ludia*, and *Salvinia minima*. Weed control was obtained two weeks after treatment.

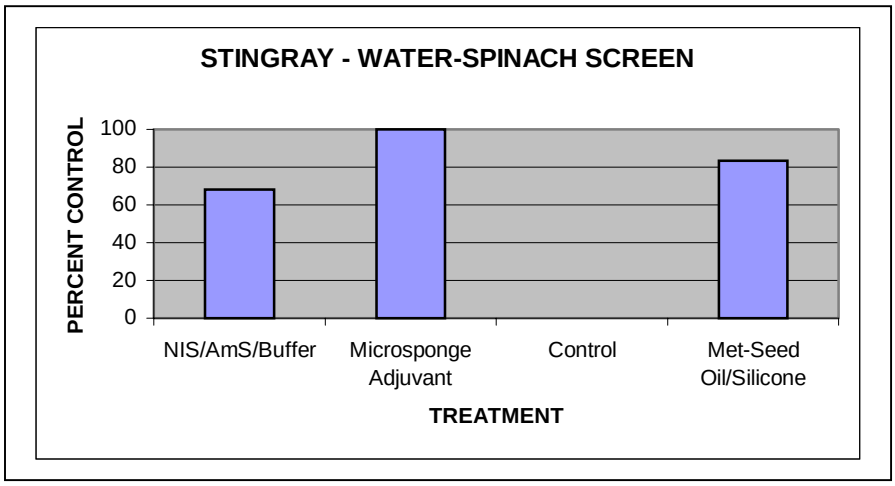
One of the researchers from vegetation management department in the power industry sent this comment:

> "We have used the microsponge system for rainfastness several times just before rainfall events. At one of our sites, a rainwater detention basin, it started misting as I finished spraying the herbicide/microsponge application on emergent aquatic weeds, and then it rained hard about an hour later. I had doubts about how well this application would work, but 2 weeks later the plants sprayed were brown and dying."

The results were presented at the Mid South Aquatic Plant Management Society Meeting in 2002.

Water Spinach (*Ipomoea aquatica*) Studies

The microsponge system for rainfastness was tested for effectiveness as an adjuvant with carfentrazone-ethyl (STINGRAY Aquatic Herbicide) against water spinach (*Ipomoea aquatica*). The objective of the trial was to evaluate effectiveness of carfentrazone against water spinach and determine impact of different adjuvant types on efficacy. In addition to microsponge adjuvant, treatments included a nonionic surfactant containing ammonium sulfate with buffering agents, and a methylated seed oil containing silicone surfactants. All adjuvants were applied at a rate of 0.75% volume to volume of total pesticide mix with a single 0.3 lb a.i./acre rate of STINGRAY. At approximately 40 days after treatment, the microsponge adjuvant for rainfastness resulted in 100% control of water spinach. Control of water spinach was 83% for the treatment containing methylated seed oil and silicone surfactants, and was 68% for the treatment containing nonionic surfactant with ammonium sulfate and buffering agents.



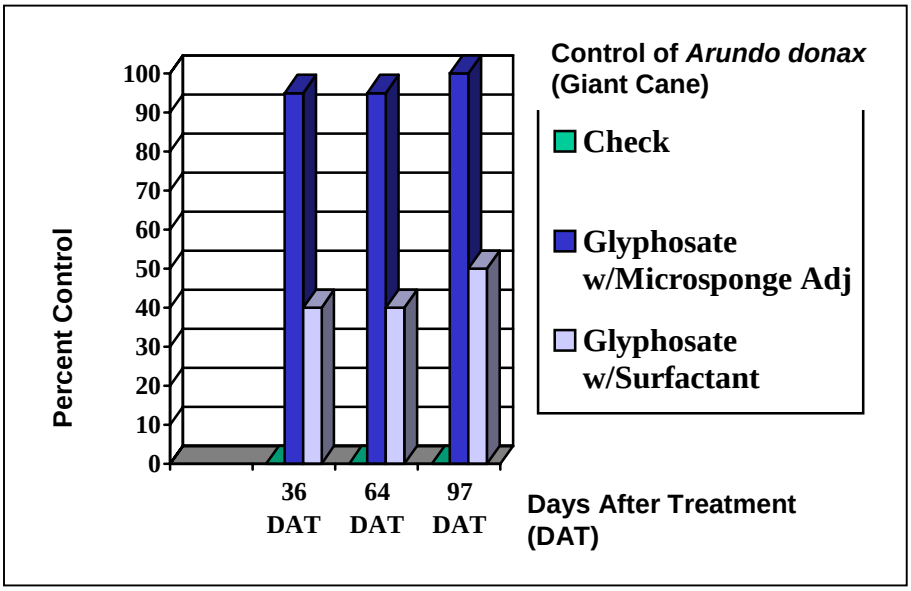
Studies Compliment of FMC using STINGRAY® Herbicide

The results indicated that the microsponge system maximized the carfentrazone treatment for water spinach and prevented re-growth of the exotic weed species. These studies were presented at the Weed Science Society Meeting in Boston in 2004.

Giant Cane (*Arundo donax*) Studies

Along the Rio Grande River in Texas, the invasive weed *Arundo donax* or giant cane captures 400 contiguous miles of territory along the river. The 20-foot tall cane consumes a significant amount of water that is used for irrigation in the highly productive region of the Rio Grande.

Glyphosate studies were performed by another government agency on giant cane infestation on the Navasota River near the Houston area, where significant rainfall occurs during the summer months. In this study, the microsponge adjuvant for rainfastness was compared to their standard surfactant adjuvant in combination with the glyphosate herbicide. The results showed that the rainfastness properties of the microsponge system maximized the herbicide control to 95-100% weed control, and provided weed control for up to 3 months after treatment. The standard surfactant with glyphosate yielded 40% to 50% control of Arundo at 36 days, 64 days and 97 days after treatment (DAT).



Data Reported in the 2003 Annual Report, Texas DOT

Alligator Weed (*Alternanthera philoxeroides*) Studies

Recently, vegetation management work by Alabama Department of Wildlife and Freshwater Fisheries (Alabama DNR) on alligator weed (*Alternanthera philoxeroides*) demonstrated that the microsponge adjuvant's coating properties can be used on hard to control weeds such as alligator weed that demand full coverage of the application on the vegetation.

Since 2002, at the Coffeeville Reservoir, Tombigbee River in Alabama, biologists at Alabama DNR had a severe problem trying to control alligator weed, *Scirpus cubensis*. Alligator weed, being an emersed plant with long branched stems and simple elliptical leaves, is hard to coat for complete coverage in order to obtain herbicide control. Researchers had tried several herbicide/surfactant treatments: diquat/surfactant, which killed everything, but exhibited quick regrowth; glyphosate/surfactant, which gave slow control of alligator weed to the first node, so slow regrowth occurred; and 2,4-D/surfactant which burned alligator weed down to the first node. The best success in controlling alligator weed was triclopyr/diquat combinations with TopFilm™ (results below).

Alligator Weed Infestation in 2002
Coffeville Reservoir, Tombigbee River, Alabama

Aquatic Weed Control in 2004
Coffeville Reservoir, Tombigbee River, Alabama - Microsponge adjuvant was applied with emergent herbicide treatment

Pictures Compliment of Alabama Department of Wildlife and Freshwater Fisheries

Benefit to the Aquatic and Vegetation Management Applicator

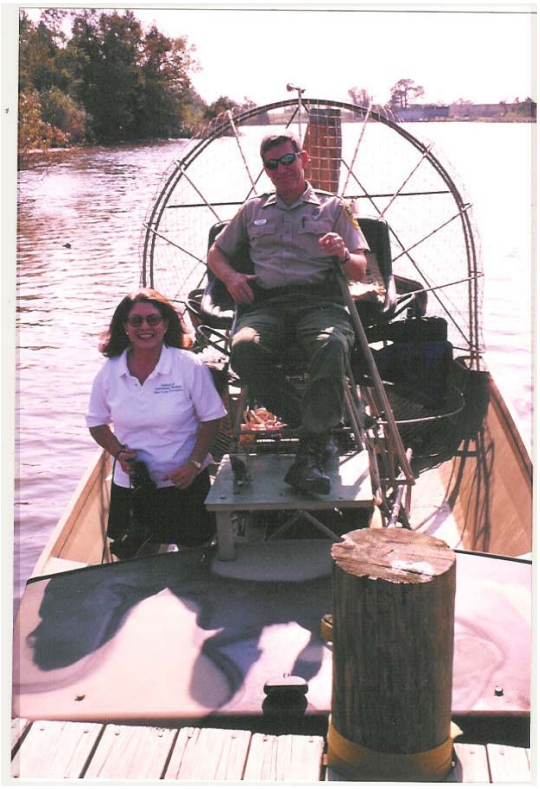
Current technology in adjuvants uses primarily surfactants to aid the spreading, conditioning and coverage of the application. Since surfactants are soap-based chemistries, the addition of surfactants tends to wash treatments off the vegetation.

Using the microsponge rainfastness technology, aquatic applicators minimizes the chances of application treatments going to waste in the event of rainfall or misting. Since the new technology does not require the use of surfactants, the herbicide treatment tends to stay on the foliage, allowing the herbicide to be translocated across the cuticle. As the microsponges dry, the treatment gets coated on the vegetation and can re-hydrated with the morning dew. The object is to keep the treatment on the leaves without sealing the stoma, so that the plant can continue its metabolism of the herbicide. Unlike with quick burn-down surfactants, which often shut the translocation of the herbicide (encouraging re-growth of the weed), the microsponges stay on the surface of the vegetation without causing contact injury. Since cereal grain materials contain organic nitrogen in the form of amino acids, the plant receives the organic nitrogen from the microsponge system, which stimulates the metabolism translocating the herbicide into the plant cellular

physiology (mimicking a “weed and feed” type of activity). Also, the re-hydration effect of the microsponge maintains the transpiration and translocation action required by plant cellular metabolism.

The ultra-low use rates of the microsponge adjuvant (i.e., 8 oz to 16 oz per acre), as compared to the standard surfactants (i.e., 2 quarts to 1 gallon per acre) means less bulk and storage for the applicator. This application rate also translates to less chemical load on the environment, as well as carrying less application volumes to the field.

Finally, the greatest benefit of the microsponge adjuvant for rainfastness to the applicator is helping insure weed control. To eliminate extended labor, fuel costs and chemical costs, the applicator wants to make sure that the treatment that is applied has the best chance in controlling weeds the first time that it is applied. The applicator does not want to have to re-treat an area because of rainfall, irrigation or excess humidity.



L. Marshall and Thad Holmes (Alabama DNR)
Mobile Delta, Mid South APMS Meeting 2004

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