Southern Region Small Fruits Consortium Final report- 2009

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Title: Evaluation and cost benefit analysis of chemical mowing strategies for fescue grass groundcovers in southeast small fruits.

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Objectives:

To evaluate various combinations of herbicides at reduced rates alone in combinations with and in comparison to plant growth regulators for suppression of fescue grass suppression in southeastern orchards. The cost of these programs will be evaluated in comparison to the cost of mowing programs in these same areas.

Justifications and Descriptions:

There are many challenges associated with growing high quality small fruits, especially when considering the limited choices producers have available for low-cost and environmentally friendly production practices. In addition, to the challenges associated with finding low cost solutions for a variety of pest management issues (insects, fungi, wildlife, and weeds), there are now significant issues related to the management of grass groundcovers in these orchards. Typically groundcovers are managed by mowing, however mowing is not only done just to manage the height and tidiness of groundcovers, but is done to augment conditions in the entire orchard ecosystem. Mowing can actually aid in preventing or reducing orchard damage from wildlife (i.e. rodents), disease (by reducing moisture in the orchard), insects, and certain weed populations (Toth et al. 2004). Even though there are several positives associated with mowing there are challenges associated with the fluctuating cost of fuel and labor inputs needed to properly mow grass groundcovers over an entire growing season. Since mowing these groundcovers in orchards is actually done around 5 times during the growing season it is obvious that mowing involves a significant commitment to labor and fuel expenditures (Toth et al. 2004). As far back as 1999, it was estimated that mowing costs were $10/acre (Doan's 1999). Given the current trends in fuel and labor costs it is clear that the cost of mowing is much higher today than in the past and the costs associated with this technique in the future will likely remain volatile (EIA 2008).

Groundcovers have also been managed through applications of reduced rates of systemic herbicides, like glyphosate, which reduce growth of these groundcovers over a 1 to 3 month time period (Futch and Singh 2008). Typically, once groundcovers reach at least 6 inches in height these reduced rate glyphosate applications are made in order to initiate this growth cessation (Sidebottom et al. 1998). However, the use of these reduced rates of glyphosate in groundcover management has led to openings in the groundcover canopy which has allowed for the germination and establishment of several perennial weeds (McGourey and Elmore 2007). However, there is little research available that has evaluated these reduced rates of glyphosate in combinations with a variety of turf growth regulators or herbicides with growth regulating properties for suspension of ground cover growth and weed control in small fruit production. The benefit of these evaluations could lead to new and better one time spray applications that could eliminate the need for costly mowing events for southeast small fruit producers.

Materials and Methods:

Three field studies and one greenhouse study (repeated in time) were conducted in 2009 to evaluate chemical mowing with herbicides at reduced rates alone and in mixture to tall fescue (*Festuca arundinacea*) in grape (*Vitis spp.*) row middles. Trial sites were established at the Highland Rim Research & Education Center and the Plateau Research & Education Center in Tennessee and an additional site was located at Three Sister's Vineyard & Winery in Georgia. All treatments were applied postemergence (POST) to tall fescue infested with weeds such as buckhorn plantain (*Plantago lanceolata*), dandelion (*Taraxacum officinale*), and white clover (*Trifolium repens*) and all species were 2 to 9 cm in height at the time of application. Field plots were 3 by 6 meters and arranged in a randomized complete block design with three replications. Herbicide treatments in all three trials included: sethoxydim at 131 g ai/ha + carfentrazone at 9 g ai/ha, sethoxydim at 131 g ai/ha + carfentrazone at 18 g ai/ha, glyphosate at 110 g ai/ha + carfentrazone at 9 g ai/ha, glyphosate at 110 g ai/ha + carfentrazone at 18 g ai/ha, sethoxydim at 131 g ai/ha + glyphosate at 110 g ai/ha, glyphosate at 110 g ai/ha, sethoxydim at 131 g ai/ha, carfentrazone at 9 g ai/ha, carfentrazone at 18 g ai/ha, glufosinate at 234 g ai/ha, glufosinate at 234 g ai/ha + sethoxydim at 131 g ai/ha, glufosinate at 234 g ai/ha + carfentrazone at 9 g ai/ha, and glufosinate at 234 g ai/ha + carfentrazone at 18 g ai/ha). All treatments were applied with a CO_2 powered backpack sprayer calibrated to deliver 23 gal/A. All treatments contained crop oil concentrate at 1% v/v.

Greenhouse studies were initiated at the University of Tennessee in Knoxville, TN. Similar herbicides from the field trial were evaluated at multiple rates in the greenhouse. Tall fescue, white clover, buckhorn plantain, and dandelion were started by planting seeds in 9.5 by 9.5 cm pots filled with a high organic matter commercial potting mix. Plants were watered and fertilized as needed to facilitate maximum plant growth and vigor. Herbicides were applied in the same manner as described in the field studies. In addition to similar active ingredient applied in the field studies, other herbicides registered for use in grapes were included for comparisons (i.e. rimsulfuron and oxyfluorfen). Herbicide treatments in these greenhouse trials included: sethoxydim at 66 g ai/ha + glyphosate at 110 g ai/ha, sethoxydim at 66 g ai/ha + glyphosate at 220 g ai/ha, sethoxydim at 131 g ai/ha + glyphosate at 110 g ai/ha, sethoxydim at 131 g ai/ha + glyphosate at 220 g ai/ha, glyphosate at 110 g ai/ha + rimsulfuron at 9 g ai/ha, glyphosate at 110 g ai/ha + oxyfluorfen at 1120 g ai/ha, sethoxydim at 131 g ai/ha + rimsulfuron at 9 g ai/ha, sethoxydim at 131 g ai/ha + oxyfluorfen at 1120 g ai/ha, sethoxydim at 131 g ai/ha + rimsulfuron at 9 g ai/ha + glyphosate at 110 g ai/ha, and sethoxydim at 131 g ai/ha + oxyfluorfen at 1120 g ai/ha + glyphosate at 110 g ai/ha. All herbicides were also applied alone at the aforementioned rates in which they were applied in mixtures together. All treatments were applied with a CO_2 powered backpack sprayer calibrated to deliver 23 gal/A. All treatments included COC at 1% v/v.

All field and greenhouse trials were arranged in a randomized complete block design with three replicates. Weed control and fescue suppression were evaluated at 7, 14, 28, and 56 days after treatment (DAT) in the field and heights and stand counts were also taken at 56 DAT. In the greenhouse, heights and dry weights of plant biomass were taken at 28 DAT. Weed control and grass suppression were evaluated on a scale from 0 to 100 where 0= no crop injury or weed control and 100= complete death of the crop or the weed evaluated. Data were subjected to analysis of variance (ANOVA) and means were separated using Fisher's protected LSD (P=0.05). More detailed information regarding these trials can be found in the site description sections for each data set in the corresponding Appendix file (pages 1 to 32).

Results and Conclusions

By 28 DAT in both field studies in Tennesse, sethoxydim applied alone or in combinations with glufosinate, glyphosate or carfentrazone provided the greatest suppression of tall fescue (72 to 79%) (Complete results can be found in the attached Appendix). Glyphosate and glufosinate alone and in combinations with carfentrazone provided 30 to 53% supression of tall fescue by 28 DAT. Carfentrazone alone did not provide adequate suppression of tall fescue. By 56 DAT, tall fescue was still suppressed with treatments containing glyphosate and or sethoxydim in comparison to the untreated control; however heights were greater than a commercially acceptable range (24-31 inches). In addition, no treatment evaluated in these studies provided sufficient control of buckhorn plantain, dandelion or white clover. No grape injury was observed with any treatment.

In the greenhouse, we followed up sexthoxydim herbicide treatments as this herbicide provided the most consistent suppression of tall fescue in our field studies. We incorporated mixtures of this herbicides with two additional herbicides (rimsulfuron and oxyfluorfen) registered for use in grape production and an increased rates of glyphosate in hopes of improving broadleaf weed control. Oxyfluorfen provided the greatest reductions in heights and dry weights of clover, dandelion, and buckhorn plantain in comparison to all treatments. Increases in glyphosate rate to 220 g ai/ha did not allow for commercially acceptable height and dry weight reductions of these broadleaf weed species. Rimsulfuron at 9 g ai/ha provided similar reductions in heights and dry weights of clover and dandelion in comparison to oxyfluorfen but was not as active on buckhorn plantain. Both rimsulfuron and oxyfluorfen need to be evaluated further alone and in mixtures with sethoxydim and glyphosate on more mature broadleaf weeds in the field as these species are likely more difficult to control under field conditions.

Impact Statement: This work clearly demonstrates the value of sethoxydim, glyphosate, rimsulfuron, and oxyfluorfen in chemical mowing of tall fescue and control of key weeds in grass row middle groundcover between grape plantings. Additional research is needed to find exact rates and timings of these mixtures for greater than 4 week suppression/control of tall fescue and weeds in order for these applications to be more economically viable in comparison to mowing.

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