NUTSEDGE (CYPERUS SPP.) CONTROL PROGRAMS IN SUGARCANE

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ABSTRACT

Field studies were conducted to evaluate purple and yellow nutsedge control in sugarcane with herbicides applied preemergence at planting in August or September, postemergence in September or October (prior to the winter dormant period), or postemergence in March (after the winter dormant period). In the first study, herbicides were applied either immediately after sugarcane was planted or when nutsedge was 15 to 25 cm and sugarcane was 35 to 45 cm in height. By 10 weeks after treatment (WAT), nutsedge (purple and yellow combined) was controlled preemergence 33 to 43% with sulfentrazone at 280, 350, and 420 g ai/ha and halosulfuron at 35.8, 53.7, and 71.6 g ai/ha. When herbicides were applied postemergence in October, halosulfuron at 53.7 and 71.6 g ai/ha controlled nutsedge 74 and 79% 3 WAT, respectively, and control was greater than for all rates of sulfentrazone. At one location, nutsedge control in April of the following year was 73 to 80% when sulfentrazone at 420 g ai/ha and halosulfuron at 35.8, 53.7, and 71.6 g ai/ha were applied postemergence in October of the previous year. In a second study, herbicides were applied postemergence 35 days after planting in September when nutsedge was 10 to 15 cm and sugarcane was 20 to 25 cm in height. Nutsedge control 6 WAT with halosulfuron alone at 53.7 or 71.6 g ai/ha or with 2,4-D or dicamba was equivalent and averaged 77%. Control 6 WAT with trifloxysulfuron alone at 10.5 and 15.7 g ai/ha or with 2,4-D averaged 68%. In March of the following year when sugarcane emerged after the winter dormant period, nutsedge control with halosulfuron applied alone or with 2,4-D or dicamba at one location averaged 74% compared with an average of 44% for the trifloxysulfuron treatments. Differences in nutsedge control were not reflected in higher early season sugarcane shoot population or in late season stalk height and population. In a third study, halosulfuron and trifloxysulfuron treatments were applied postemergence in March after sugarcane (25 to 30 cm in height) and nutsedge (5 to 10 cm in height) had emerged from the winter dormant period. At 5 WAT nutsedge control averaged 79% for halosulfuron at 53.7 and 71.6 g ai/ha and for trifloxysulfuron at 15.7 g ai/ha. Sugarcane height in May and July and stalk population in July where nutsedge was controlled as much as 79% were no greater than for the nontreated. In regard to sugarcane injury, significant foliar discoloration and stunting were observed 2 to 3 WAT where sulfentrazone or trifloxysulfuron was applied postemergence but sugarcane growth later in the growing season was not affected. Halosulfuron did not injure sugarcane.

INTRODUCTION

Sugarcane (Saccharum spp. hybrids) is a perennial crop and in Louisiana four to six harvests are typically made from a single planting. Under Louisiana growing conditions sugarcane is planted in August and September to allow the crop to establish before the winter
dormant period. New growth occurs usually in March of the following year. Weed problems are
addressed prior to planting with preplant application of glyphosate and/or timely tillage
operations to control weeds during the spring and summer fallow period (Anonymous 2009). At
planting, preemergence herbicide is applied to prevent weed establishment and competition with
the crop. Over the past few years, sugarcane growers in Louisiana have experienced an increase
in purple (*Cyperus rotundus* L.) and yellow nutsedge (*Cyperus esculentus* L.). Proliferation of
nutsedge is likely due to the poor control obtained with glyphosate applied during the summer
fallow period combined with expanded use of the dinitroaniline herbicides, trifluralin and
pendimethalin, which reduce grass competition but provide little control of nutsedge (Dotray et
al. 2001; Grichar and Nester 1997; Webster and Coble 1997).

Purple and yellow nutsedge are herbaceous perennials that are among the world’s worst
weeds (Stoller and Sweet 1987). Holm et al. (1997) listed purple nutsedge as the world’s worst
weed. This status is related to its perennial nature, longevity of viable tubers, and prolific tuber
production (Bariuan et al. 1999). Purple nutsedge is capable of producing tubers 21 to 23 days
following shoot emergence (Hauser 1962; Smith and Fick 1937). A plant germinating from one
tuber produced 64 and 99 tubers in 90 days under greenhouse (Doll and Piedrahita 1982) and
field (Rao 1968) conditions, respectively. Leon et al. (2001) reported in greenhouse experiments
that initial purple nutsedge tuber densities of more than 180/m² reduced fresh weight of cotton
(*Gossypium hirsutum* L.) and soybean (*Glycine max* L. Merr.). Also, purple nutsedge was found
to have superior competitive ability compared to corn (*Zea mays* L.) (Tour and Froud-Williams
2002). Furrow-irrigated cotton yield was reduced when yellow nutsedge was allowed to compete
for periods of four or more weeks (Keeley and Thullen 1975). They further reported a 34% decrease in yield of seed cotton when yellow nutsedge was allowed to compete season long
compared to the weed-free control.

In general, both purple and yellow nutsedge are relatively tolerant to many herbicides
registered in agronomic crops (Webster and Coble 1997). Several acetolactate synthase (ALS)-
inhibiting herbicides control purple and yellow nutsedge, including chlorimuron (Reddy and
Bendixen 1988), imazapic (Richburg et al. 1994), imazaquin (Nandihalli and Bendixen 1998),
imazethapyr (Richburg et al. 1993), and pyrithiobac (Wilcut 1998). None of these herbicides is
currently labeled for use in sugarcane (Anonymous 2009). Halosulfuron, a ALS-inhibiting
herbicide, effectively reduced purple nutsedge regrowth to less than 5% of the nontreated
following soil and/or foliar applications (Vencill et al. 1995). In corn, a foliar application of
halosulfuron at 72 g ai/ha controlled purple nutsedge more than 90% 58 days after planting
(Webster and Coble 1997), but new shoots had emerged by 120 days after planting. In a
greenhouse study, trifloxysulfuron, another ALS-inhibiting herbicide applied at 24.7 g ai/ha
decreased purple and yellow nutsedge shoot number by 40 and 52% 58 days after treatment
(McElroy et al. 2003). Halosulfuron, trifloxysulfuron, and sulfentrazone, a protoporphyrinogen
oxidase inhibitor, are currently labeled for use in sugarcane (Anonymous 2009). The objectives
of this research were to evaluate purple and yellow nutsedge control and sugarcane response to
sulfentrazone and halosulfuron applied preemergence at planting; sulfentrazone, halosulfuron,
and trifloxysulfuron applied postemergence in the fall (before winter period); and halosulfuron
and trifloxysulfuron applied postemergence in the spring (after winter period).
MATERIALS AND METHODS

At Planting Preemergence/Postemergence Study.

Field experiments were conducted in 2004 near St. James, LA, and Whitecastle, LA. Field sites were selected due to heavy infestations of nutsedge including both purple and yellow identified during the fallow period. The sugarcane variety ‘LCP 85-384’ was planted using sectioned stalks (billets) at the St. James site on August 26 and using whole stalks at the Whitecastle site on September 14. Soil type at St. James was a Commerce silty clay loam (fine-silty, mixed, superactive, non-acid, thermic Fluvaquentic Endoaquepts) with 0.89% OM and a pH of 7.3. The soil type at Whitecastle was also a Commerce silty clay loam (fine-silty, mixed, superactive, non-acid, thermic Fluvaquentic Endoaquepts) with 0.98% OM and a pH of 6.93. The experimental design was a randomized complete block with 14 treatments (7 preemergence and 6 postemergence treatments, and a nontreated control) with 4 replications. Experimental plots consisted of two 12.2 m long sugarcane rows spaced 1.8 m apart. Pendimethalin at 2240 g ai/ha was applied PRE to the entire experimental area, except where the premix of hexazinone plus diuron was applied, to control annual grasses.

Preemergence treatments consisted of sulfentrazone$^1$ at 280, 350, and 420 g ai/ha, halosulfuron$^2$ at 35.8, 53.7, and 71.6 g ai/ha, and hexazinone at 590 g ai/ha plus diuron at 2100 g ai/ha$^3$, applied the day after planting on August 27 at St. James and on September 15 at Whitecastle. Postemergence treatments consisted of sulfentrazone and halosulfuron each applied at the same rates previously described when average sugarcane canopy height was 35 to 45 cm and nutsedge was 15 to 25 cm in height on October 19 at St. James and on October 26 at Whitecastle. Nonionic surfactant$^4$ at 0.25% (v/v) was added to all postemergence treatments. All treatments were applied using a tractor-mounted compressed-air sprayer calibrated to deliver 93.5 L/ha at a spray pressure of 140 kPa. Visual estimates of nutsedge control (purple and yellow combined) and sugarcane injury were made 7 and 10 weeks after treatment (WAT) for the preemergence applications and at 3 WAT for the postemergence applications based on a scale of 0 to 100% with 0 = no control or injury and 100 = no new plants emerged or all plants present at application dead. An additional rating for nutsedge control was made at the Whitecastle site on April 25, 2005. Visual sugarcane injury was not observed for the preemergence applications and data are not presented. All plots at each location during the 2005 growing season received standard weed control programs and cultural practices depending on grower preference.

Fall Postemergence Study.

Field experiments were conducted in 2005 and 2006 near New Roads, LA, and Vacharie, LA. Specific locations were selected due to heavy infestations of nutsedge species that had emerged with the sugarcane crop after planting on August 5, 2005, at New Roads and August 8, 2005, at Vacharie. All plots were planted with sugarcane variety LCP 85-384 either as whole

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1 Authority, FMC Corporation, Agricultural Products Group, 1735 Market Street, Philadelphia, PA 19103.
2 Permit, Gowan Company, 370 Main Street, Yuma, AZ 85364.
3 DuPont K4, Dupont Crop Protection Walker’s Mill, Barley Mill Plaza Wilmington, Delaware 19880-0038.
stalks (New Roads) or sectioned stalks (billet) (Vacharie) depending on grower preference and machinery available. At the New Roads location the soil type was a Commerce silty clay loam (fine-silty, mixed, superactive, non-acid, thermic Fluvaquentic Endoaquepts) with 1.5% OM and a pH of 5.7. The soil type at Vacharie was also a Commerce silty clay loam (fine-silty, mixed, superactive, non-acid, thermic Fluvaquentic Endoaquepts) with 1.5% OM and a pH of 6.2. The experimental design was a randomized complete block with 8 treatments and a nontreated control with 4 replications. Experimental plots consisted of three 15.2 m long sugarcane rows spaced 1.8 m apart. At each site clomazone at 1400 g ai/ha plus diuron at 2240 g ai/ha was applied preemergence at planting to control annual grasses and broadleaves and the predominant weeds were a mixture of purple and yellow nutsedge.

Treatments consisted of halosulfuron at 53.7 and 71.6 g ai/ha, halosulfuron at 53.7 g ai/ha plus 2,4-D\textsuperscript{5} at 1870 g ai/ha, a premix of halosulfuron plus dicamba\textsuperscript{6} at 71.6 g ai/ha plus 270 g ai/ha and 107.4 g ai/ha plus 410 g ai/ha, trifloxsulfuron\textsuperscript{7} at 10.5 and 15.7 g ai/ha, and trifloxsulfuron at 10.5 g ai/ha plus 2,4-D at 1870 g ai/ha. Treatments were applied when average sugarcane height was 20 to 25 cm and nutsedge was 10 to 15 cm in height on September 9, 2005, at New Roads and September 12, 2005, at Vacharie. Nonionic surfactant\textsuperscript{4} at 0.25% (v/v) was added to all treatments. Herbicide treatments were applied using a tractor-mounted compressed-air sprayer calibrated to deliver 93.5 L/ha at a spray pressure of 140 kPa. Visual estimates of nutsedge control (purple and yellow combined) and sugarcane injury were made 2, 4, and 6 WAT based on a scale of 0 to 100% with 0 = no control or injury and 100 = all plants present at application dead and no new plants emerged. An additional rating for nutsedge control was made March 24, 2006, only at the New Roads location. At both locations sugarcane shoot population was determined 6 WAT in 2005 and in March 2006. Sugarcane stalk height, measured from the soil surface to the collar of the youngest leaf on ten randomly selected stalks, was recorded in June and August 2006. Millable stalk population was also determined in August 2006. All plots within each location during the 2006 growing season received standard weed control programs and cultural practices depending on grower preference.

**Spring Postemergence Study.**

Field experiments were conducted in 2005 near Loreauville, LA and in 2006 near Franklin, LA. Specific locations were selected due to heavy infestations of purple and yellow nutsedge that had emerged with sugarcane after planting the previous year and that were still present the following spring. The sugarcane variety ‘HoCP 96-540’ was present at both locations and was planted as whole stalks. At Loreauville, the soil type was a Loreauville silt loam (fine-silty, mixed, thermic Udolic Ochraqualfs) with 1.5% OM and a pH of 6.4. The soil type at Franklin was a Baldwin silty clay loam (fine, smectitic, hyperthermic Chromic Vertic Epiqualfs) with 1.3% OM and a pH of 6.1. The experimental design at Loreauville was a randomized complete block with 4 treatments and a nontreated control with 4 replications. The experimental design at Franklin was a randomized complete block with 9 treatments and a nontreated control with 4 replications. Experimental plots consisted of three 15.2 m long sugarcane rows spaced 1.8 m apart. Clomazone at 1400 g ai/ha plus diuron at 2240 g ai/ha were

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\textsuperscript{5} 2,4-D LV4, Agriliance, LLC, P.O. Box 64089, St. Paul, MN 55164-0089.

\textsuperscript{6} Yukon, Gowan Company, 370 Main Street, Yuma, AZ 85364.

\textsuperscript{7} Envoke, Syngenta Crop Protection, Inc., P.O. Box 18300, Greensboro, NC 27419-8300.
applied at planting in 2004 at Loreauville and metribuzin at 1680 g ai/ha was applied at planting in 2005 at Franklin.

Treatments at both locations included halosulfuron at 53.7 and 71.6 g ai/ha, trifloxysulfuron at 10.5 and 15.7 g ai/ha, and a nontreated. At Franklin additional treatments included halosulfuron at 35.8 g ai/ha, trifloxysulfuron at 5.3 g ai/ha, halosulfuron at 53.7 g ai/ha plus dicamba at 200 g ai/ha and 71.6 g ai/ha plus 270 g ai/ha, and 2,4-D at 1870 g ai/ha. Treatments were applied when average sugarcane height was 25 to 30 cm and nutsedge was 5 to 10 cm in height March 24, 2005 at Loreauville and March 8, 2006, at Franklin. Nonionic surfactant at 0.25% (v/v) was added to all treatments, except for 2,4-D. All treatments were applied using a tractor-mounted compressed-air sprayer calibrated to deliver 140 L/ha at a spray pressure of 183 kPa. Treatments were applied on a band which covered a 91 cm area of the row top and the row shoulders and middles were tilled. Visual estimates of nutsedge control (purple and yellow combined) and sugarcane injury were made 3 and 5 WAT based on a scale of 0 to 100% with 0 = no control or injury and 100 = all plants present at application dead and no new plants emerged. An additional rating for nutsedge control was made 8 WAT, only at Loreauville. Sugarcane shoot population was determined 5 WAT, only at Franklin. Sugarcane stalk height, measured from the soil surface to the collar of the youngest leaf on ten randomly selected stalks, was recorded in May and July at both locations. Millable stalk population was also determined in July, only at Franklin. At both locations standard weed control programs and cultural practices depending on grower preference were implemented.

Statistical Analysis.
For each experiment conducted, attempts were made to evaluate purple and yellow nutsedge control separately, but control levels for the weeds were very similar. Therefore, nutsedge control ratings represented both species. Additionally, the halosulfuron, sulfentrazone, and trifloxysulfuron labels do not distinguish between purple and yellow nutsedge in regard to herbicide rate. All experiments were conducted in grower fields where whole stalks or billets were used for planting. Analysis of individual experiments showed consistent nutsedge control levels and sugarcane injury regardless of planting method.

Data for each study were analyzed using the Mixed Procedure of SAS (SAS Institute 2007). Data for the spring postemergence study for the five treatments in common at both locations (Loreauville and Franklin, LA) also were subjected to the Mixed Procedure in SAS. Years or locations, replications (nested within year or locations), and all interactions containing either of these effects were considered random effects (Carmer et al. 1989). All other variables (application timings and treatments) were considered fixed effects. Considering year or location as environmental or random effects permits inferences about treatments to be made over a range of environments (Carmer et al. 1989; Hager et al. 2003). Least square means were calculated, and mean separation was performed using $P \leq 0.05$. Letter groupings were converted using the PDMIX800 macro in SAS (Saxton 1998). Data collected at only one location for the at planting/postemergence study and for the fall postemergence study and for data collected for the spring postemergence study only at Franklin, LA in 2006 were subjected to analysis of variance (ANOVA) and means were separated using Fisher’s protected LSD test at the 0.05 significance level.
RESULTS AND DISCUSSION

At Planting Preemergence/Postemergence Study.

Herbicides were applied preemergence immediately after sugarcane was planted and postemergence when sufficient growth of both nutsedge and sugarcane warranted application. At 7 WAT, halosulfuron applied preemergence at 71.6 g ai/ha controlled nutsedge (purple and yellow combined) 72% (Table 1). Control with halosulfuron at 53.7 g ai/ha was 55% and equivalent to that of sulfentrazone at 280, 350, and 420 g ai/ha and of the hexazinone plus diuron standard. By 10 WAT, nutsedge control was no more than 43% for any of the preemergence herbicide treatments and sulfentrazone and halosulfuron were generally no more effective than hexazinone plus diuron.

When halosulfuron was applied postemergence at 53.7 and 71.6 g ai/ha (55 days after planting at St. James and 73 days at Whitecastle) nutsedge was controlled 74 and 79% 3 WAT, respectively, and control was greater than for all rates of sulfentrazone (Table 1). With postemergence application, injury to sugarcane consisting of foliage discoloration and stunting was observed for sulfentrazone (18 to 21%) 3 WAT, but injury was not observed for halosulfuron (Table 1). In April 2005 at Whitecastle (223 days after preemergence application), sulfentrazone and halosulfuron applied preemergence controlled nutsedge no more than hexazinone plus diuron (61% control). In April 2005 at Whitecastle (146 days after postemergence application), nutsedge control was equivalent for sulfentrazone at 420 g ai/ha and for all rates of halosulfuron (73 to 80%). Nutsedge control in April 2005 can also be compared between the preemergence and postemergence application timings. Sulfentrazone at 420 g/ha was more effective when applied postemergence than preemergence (79 vs. 43%). Halosulfuron at all rates was also more effective postemergence than preemergence (average of 77% vs. 54%).

Fall Postemergence Study.

Herbicides were applied in September, 5 weeks after planting, when nutsedge and sugarcane were present. Both halosulfuron and trifloxysulfuron were applied alone and with a low-volatile ester 2,4-D formulation. 2,4-D can be used at this time of the year to control broadleaf weeds and there is sentiment in the industry that ester 2,4-D is effective on nutsedge. Additionally, a commercially available premix of halosulfuron plus dicamba was evaluated. At 2 WAT, nutsedge (purple and yellow combined) was controlled with the halosulfuron and trifloxysulfuron treatments no more than 44% (Table 2). Nutsedge control with halosulfuron applied alone or with dicamba was equivalent and averaged 80% 4 WAT and 77% 6 WAT. In corn, halosulfuron applied preemergence at 72 g ai/ha to 5 to 8 cm tall purple nutsedge reduced shoot population 86% 26 days after treatment (Webster and Coble 1997). Control with the trifloxysulfuron treatments in the present study averaged 74% 4 WAT and 68% 6 WAT (Table 2). In March 2006 at New Roads, nutsedge control with the halosulfuron treatments averaged 74% compared with an average of 44% for the trifloxysulfuron treatments (Table 2). Dicamba or 2,4-D applied with halosulfuron or 2,4-D applied with trifloxysulfuron did not improve nutsedge control compared with halosulfuron or trifloxysulfuron applied alone at the same rates.

For the halosulfuron treatments, sugarcane injury was no more than 4% at 2, 4, and 6 WAT (Table 2). For the trifloxysulfuron treatments, sugarcane was injured an average of 31% 2 WAT and 13% 4 WAT, but injury was minimal 6 WAT. Although nutsedge was controlled 64
to 79% with the halosulfuron and trifloxsulfuron treatments 6 WAT (Table 2), sugarcane shoot population 6 WAT was not increased (data not shown). In March of the following year differences in sugarcane shoot populations were also not observed (P=0.064) (Table 2). There were also no differences among the halosulfuron and trifloxsulfuron treatments in sugarcane height in June or August or sugarcane stalk population in August of the year following application (data not shown).

**Spring Postemergence Study.**

Halosulfuron and trifloxsulfuron were applied in March to sugarcane planted in August of the previous year. Application was made to sugarcane and nutsedge that had emerged from the winter dormant period. Due to a mild winter some of the nutsedge was not winter killed. Nutsedge (purple and yellow nutsedge combined) control for herbicide treatments included both years averaged 80 and 77% 3 WAT for halosulfuron at 71.6 g ai/ha and trifloxsulfuron at 15.7 g ai/ha, respectively (Table 3). For both herbicides a decrease in nutsedge control occurred when rate was reduced. By 5 WAT for the two years, nutsedge control averaged 79% for halosulfuron at 53.7 and 71.6 g ai/ha and trifloxsulfuron at 15.7 g ai/ha. At 8 WAT, nutsedge was controlled in 2005 in Loreauville 70% for halosulfuron at 53.7 g ai/ha and control was as much as 61% for the trifloxsulfuron.

In 2006 additional treatments were included and at 3 WAT all rates of halosulfuron and of halosulfuron plus dicamba provided equivalent nutsedge control and averaged 80% (Table 3). Trifloxsulfuron at 10.5 and 15.7 g ai/ha controlled nutsedge 74 and 79% 3 WAT, but control decreased to 66% at 5.3 g ai/ha. At 5 WAT in 2006, halosulfuron at 53.7 and 71.6 g ai/ha applied alone or with dicamba provided equivalent control and averaged 81%. Control for the lower rate of halosulfuron was 64% 5 WAT. Trifloxsulfuron at 10.5 and 15.7 g ai/ha controlled nutsedge 5 WAT 71 and 81%, respectively, but control was 53% when applied at 5.3 g ai/ha. 2,4-D ester provided 36% nutsedge control 3 WAT and 30% control 5 WAT.

Sugarcane injury averaged over two years was as high as 24 and 10% 3 and 5 WAT, respectively, for trifloxsulfuron, but injury was not observed for halosulfuron treatments (Table 3). In 2006 when additional treatments were evaluated, sugarcane injury at 3 and 5 WAT increased as trifloxsulfuron rate increased from 5.3 to 15.7 g ai/ha. For the highest rate of trifloxsulfuron sugarcane was injured 36% 3 WAT and 20% 5 WAT. Sugarcane was not injured with any of the halosulfuron treatments. Injury associated with trifloxsulfuron included white banding on leaves that were present in the whorl when application was made and also some stunting. Sugarcane injury with trifloxsulfuron and nutsedge control was not reflected in shoot population 5 WAT, in sugarcane height in May or July or stalk population in July of the following year (data not shown). Results suggest that application of halosulfuron or trifloxsulfuron for nutsedge control in the spring as sugarcane is emerging from the winter dormant period would not be economical due to the ability of sugarcane to adequately compete with nutsedge at that time of the year.

In planning weed control programs for nutsedge, whether purple or yellow, the goal should be to reduce the ability of nutsedge to reestablish and produce a heavy tuber population. Previous research has shown that tuber population can increase rapidly under good growing conditions (Doll and Piedrahita 1982; Etheredge et al. 2006; Hauser 1962; Rao 1968; Smith and
Etheredge et al. (2006) reported that in a pot study conducted outside under a drip irrigation watering system that at 64 days after planting, 37 purple nutsedge tubers/pot were produced following an initial tuber density of 1/pot compared with 186 tubers/pot where the initial tuber density was 16/pot.

Nutsedge control programs in sugarcane should be first implemented during the fallow period using glyphosate programs to help reduce the tuber population and to prevent weeds from removing moisture from the seedbeds and causing problems in opening of rows and in covering of planted sugarcane (Anonymous 2009). Multiple applications of glyphosate during the fallow period, however, have not been effective in controlling nutsedge (Etheredge and Griffin 2008). Standard herbicides used in sugarcane and applied to the soil at planting are mostly ineffective on nutsedge (Anonymous 2009). In this study, sulfentrazone and halosulfuron applied preemergence controlled nutsedge no more than 43% 10 WAT and control was no greater than for the hexazinone plus diuron standard.

Other control alternatives for nutsedge would be to apply herbicide in the fall after nutsedge and sugarcane have emerged after planting or to wait until the following spring after nutsedge and sugarcane emerge from the winter dormant period. When sulfentrazone and halosulfuron were applied postemergence in the fall, nutsedge control the following April was around 60% for sulfentrazone and around 80% for halosulfuron, greater than when the herbicides were applied preemergence at planting (around 50% control). Trifloxysulfuron applied postemergence in the fall controlled nutsedge around 68% 6 WAT compared with around 76% for halosulfuron. By March of the following year nutsedge control with halosulfuron had not changed appreciably compared with 6 WAT, but control with trifloxysulfuron had decreased to around 44%. A reduction in the ability of nutsedge to reestablish a significant underground tuber population in the fall will allow sugarcane to establish a stable root system (Etheredge et al. 2006; Etheredge and Griffin 2008). This will help sustain the sugarcane plant through the wet and cool winter dormant period and will promote development of buds that will affect shoot emergence in the spring. When halosulfuron and trifloxysulfuron were applied in the spring, nutsedge control was around 80%. 2,4-D ester controlled nutsedge no more than 36%. Even though differences in control were observed, sugarcane emerging from the winter dormant period was able to compete with nutsedge and sugarcane growth was not affected. When trifloxysulfuron was applied to sugarcane in the fall or spring injury occurred but recovery was complete.

Findings from this research show that for best results sulfentrazone, halosulfuron, and trifloxysulfuron should be applied in the fall when nutsedge is around 15 cm tall. Growers should be aware that injury to sugarcane can occur with sulfentrazone and trifloxysulfuron. Based on nutsedge control observed the spring following application, halosulfuron was more effective that sulfentrazone and trifloxysulfuron.

**ACKNOWLEDGMENTS**

Partial funding for this research was provided by the American Sugar Cane League.
REFERENCES CITED


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Table 1. Nutsedge control and sugarcane injury following herbicides applied preemergence at sugarcane planting in August or September and postemergence in October at two locations in 2004.1

<table>
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<tr>
<th>Treatment</th>
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<th>Postemergence</th>
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<td>0 e</td>
<td>0 g</td>
<td>0 b</td>
</tr>
</tbody>
</table>

1 Preemergence applications were made August 27 and September 15, 2004 the day after sugarcane was planted at St. James and Whitecastle, LA, respectively. Postemergence applications were made October 19 and 26, 2004, respectively, when yellow and purple nutsedge were 15 to 25 cm tall and sugarcane was 35 to 45 cm. Postemergence herbicide treatments were applied with a nonionic surfactant at 0.25% v/v. WAT = weeks after treatment.

2 Pendimethalin at 2.24 kg ai/ha was applied at planting across the entire experimental area except where the hexazinone + diuron treatment was applied.

3 Data for nutsedge (purple and yellow together) and sugarcane represent an average across two locations with the exception of the April 2005 nutsedge control ratings which represent only the Whitecastle, LA location.

4 Treatment means within columns followed by the same letter are not significantly different according to the t test on least square means at P=0.05. Nutsedge control means for April, 2005 can be compared for preemergence and postemergence treatments.
Table 2. Nutsedge control and sugarcane injury following herbicides applied postemergence in September in newly planted sugarcane at two locations in 2005.  

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (g ai/ha)</th>
<th>2 WAT Nutsedge Control</th>
<th>4 WAT Nutsedge Control</th>
<th>6 WAT Nutsedge Control</th>
<th>March 2006 Nutsedge Control</th>
<th>2 WAT Sugarcane Injury</th>
<th>4 WAT Sugarcane Injury</th>
<th>6 WAT Sugarcane Injury</th>
<th>March 2006 Sugarcane Shoot Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halosulfuron</td>
<td>53.7</td>
<td>40 ab</td>
<td>79 ab</td>
<td>75 abc</td>
<td>78 a</td>
<td>4 b</td>
<td>3 b</td>
<td>0 a</td>
<td>19.1 a</td>
</tr>
<tr>
<td>Halosulfuron + 2,4-D</td>
<td>71.6</td>
<td>44 a</td>
<td>81 a</td>
<td>78 ab</td>
<td>76 ab</td>
<td>1 b</td>
<td>2 b</td>
<td>0 a</td>
<td>22.0 a</td>
</tr>
<tr>
<td>Halosulfuron + dicamba</td>
<td>53.7 + 1870</td>
<td>43 ab</td>
<td>81 a</td>
<td>76 ab</td>
<td>78 a</td>
<td>0 c</td>
<td>1 b</td>
<td>0 a</td>
<td>21.4 a</td>
</tr>
<tr>
<td>Halosulfuron + dicamba</td>
<td>71.6 + 270</td>
<td>39 b</td>
<td>80 a</td>
<td>75 abc</td>
<td>68 b</td>
<td>2 bc</td>
<td>4 b</td>
<td>0 a</td>
<td>19.8 a</td>
</tr>
<tr>
<td>Halosulfuron + dicamba</td>
<td>107.4 + 410</td>
<td>43 ab</td>
<td>80 a</td>
<td>79 a</td>
<td>71 ab</td>
<td>1 bc</td>
<td>4 b</td>
<td>0 a</td>
<td>19.9 a</td>
</tr>
<tr>
<td>Trifloxysulfuron</td>
<td>10.5</td>
<td>39 b</td>
<td>73 c</td>
<td>64 d</td>
<td>43 c</td>
<td>30 a</td>
<td>13 a</td>
<td>1 a</td>
<td>19.4 a</td>
</tr>
<tr>
<td>Trifloxysulfuron</td>
<td>15.7</td>
<td>41 ab</td>
<td>74 bc</td>
<td>68 cd</td>
<td>45 c</td>
<td>31 a</td>
<td>14 a</td>
<td>1 a</td>
<td>20.1 a</td>
</tr>
<tr>
<td>Trifloxysulfuron + 2,4-D</td>
<td>10.5 + 1870</td>
<td>43 ab</td>
<td>76 abc</td>
<td>71 bc</td>
<td>45 c</td>
<td>31 a</td>
<td>13 a</td>
<td>0 a</td>
<td>22.9 a</td>
</tr>
<tr>
<td>Nontreated</td>
<td>-</td>
<td>0 c</td>
<td>0 d</td>
<td>0 e</td>
<td>0 d</td>
<td>0 c</td>
<td>0 c</td>
<td>0 a</td>
<td>16.3 a</td>
</tr>
</tbody>
</table>

1 Postemergence herbicide applications were made 5 weeks after sugarcane planting on September 9 and 12, 2005 at New Roads, LA, and Vacharie, LA, respectively, when nutsedge (yellow and purple combined) was 10 to 15 cm tall and sugarcane was 20 to 25 cm. All herbicides were applied with a surfactant at 0.25% v/v. WAT = weeks after treatment.

2 2,4-D formulation used was a low volatile ester with 0.8 kg ai/L.

3 Data for nutsedge (purple and yellow nutsedge together) and sugarcane represent an average across two locations with the exception of the March 2006 nutsedge control ratings which represent only the New Roads, LA location.

4 Treatment means within columns followed by the same letter are not significantly different according to the t test on least square means at P=0.05.
Table 3. Nutsedge control and sugarcane injury following herbicides applied in March in 2005 and 2006.\(^1\)

<table>
<thead>
<tr>
<th>Treatment(^2)</th>
<th>Rate (g) ai/ha</th>
<th>Nutsedge species control(^3)</th>
<th>Sugarcane injury(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halosulfuron</td>
<td>35.8</td>
<td>-</td>
<td>76 ab</td>
</tr>
<tr>
<td>Halosulfuron</td>
<td>53.7</td>
<td>73 b(^4)</td>
<td>83 a</td>
</tr>
<tr>
<td>Halosulfuron</td>
<td>71.6</td>
<td>80 a</td>
<td>80 ab</td>
</tr>
<tr>
<td>Trifloxysulfuron</td>
<td>5.3</td>
<td>-</td>
<td>66 c</td>
</tr>
<tr>
<td>Trifloxysulfuron</td>
<td>10.5</td>
<td>68 c</td>
<td>74 b</td>
</tr>
<tr>
<td>Trifloxysulfuron</td>
<td>15.7</td>
<td>77 ab</td>
<td>79 ab</td>
</tr>
<tr>
<td>Halosulfuron +</td>
<td>53.7 + 200</td>
<td>-</td>
<td>79 ab</td>
</tr>
<tr>
<td>dicamba</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Halosulfuron +</td>
<td>71.6 + 270</td>
<td>-</td>
<td>83 a</td>
</tr>
<tr>
<td>dicamba</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,4-D</td>
<td>1870</td>
<td>-</td>
<td>36 d</td>
</tr>
<tr>
<td>Nontreated</td>
<td>-</td>
<td>0 d</td>
<td>0 e</td>
</tr>
</tbody>
</table>

1 Postemergence herbicide applications were made March 24, 2005 and March 8, 2006 at Loreauville, LA, and Franklin, LA, respectively, when nutsedge (yellow and purple combined) was 5 to 10 cm tall and sugarcane was 25 to 30 cm. All herbicides were applied with a surfactant at 0.25% v/v except 2,4-D. WAT = weeks after treatment.

2 2,4-D formulation used was a low volatile ester with 0.8 kg ai/L.

3 Data for nutsedge (purple and yellow nutsedge together) and sugarcane represent an average across two years and for only 2006 when low rates of halosulfuron and trifloxysulfuron, the premix of halosulfuron plus dicamba, and 2,4-D were also included.

4 Treatment means within columns followed by the same letter are not significantly different according to the \(t\) test on least square means at \(P=0.05\).