ACTIVITY OF DIFFERENT RATES OF BENZOBICYCLON ON COMMON LOUISIANA RICE WEED SPECIES

Benjamin M. McKnight[1], Eric P. Webster[2], Samer Y. Rustom[3], Gustavo M. Telo[4], L. Connor Webster[5], Matthew J. Osterholt[6]

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INTRODUCTION

Benzobicyclon is an HPPD inhibiting herbicide that is currently being registered for use in U.S. rice production. Bleached white plant tissue followed by necrosis and death are typical symptoms following benzobicyclon application on susceptible weed species (Komatsubara et al. 2009). Sekino et al. (2008) observed control past eight weeks on certain weeds occurring in Japan, indicating this herbicide has residual properties. Benzobicyclon must undergo a hydrolysis reaction to render the active herbicide, benzobicyclon-hydrolysate (Komatsubara et al. 2009). Past research at LSU has indicated that benzobicyclon must be applied directly into the permanent flood for optimum herbicide activity and control of susceptible weeds (McKnight et al. 2014). The scope of this research was to evaluate the activity of benzobicyclon herbicide on common Louisiana rice weed species.

MATERIALS AND METHODS

In this field study, 91-cm diameter by 30-cm deep galvanized metal rings were installed randomly near the center of 1.5 by 5.2 m^2 plots for benzobicyclon treatment containment. No rice was planted in this study to encourage a maximum infestation of naturally occurring weeds in the area. The time of herbicide application was immediately after ducksalad [*Heteranthera limosa* (Sw.) Willd.] plants produced a first elongated leaf. Other weeds present in this study included barnyardgrass (*Echinochloa crus-galli* L.), yellow nutsedge (*Cyperus esculentus* L.), false pimpernel [*Lindernia dubia* (L.) Pennell var. dubia], Indian toothcup [*Rotala indica* (Willd.) Koehne], and purple ammannia (*Ammannia coccinea* Rottb.). Benzobicyclon was applied at 31, 62, 123, 185, 246, 493, 739, 986, and 1232 g ai ha^{-1} utilizing a CO_2-pressurized backpack sprayer calibrated to deliver 140-L ha^{-1} spray solution at 190 kPa. At the conclusion of the study weeds were hand-harvested from each ring and separated by species for fresh weight determination.

RESULTS AND DISCUSSION

Barnyardgrass, false pimpernel, and yellow nutsedge control did not exceed 50% when treated with any rate of benzobicyclon (Table 1). Benzobicyclon controlled ducksalad 58% with a 123 g ai ha^{-1} application rate, indicating this weed is more susceptible than barnyardgrass, yellow nutsedge, and false pimpernel. Ducksalad treated with 493 g ai ha^{-1} was 83% and no differences were observed with rates of 493 to 1232 g ai ha^{-1}. An evaluation timing interaction was observed on barnyardgrass, yellow nutsedge, ducksalad, and false pimpernel (Table 2). Control of barnyardgrass and yellow nutsedge, averaged across all herbicide rates, was reduced at later evaluation timings compared with the initial evaluation timing, 14 days after treatment (DAT). Ducksalad and false pimpernel control increased at later evaluation timings compared with the initial 14 DAT evaluation, indicating benzobicyclon provides residual activity to 42 DAT on these species. The biomass of ducksalad treated with 31 g ai ha^{-1} was not reduced compared with the nontreated; however,

[1] Research Associate, LSU AgCenter, 104 Sturgis Hall, Baton Rouge, LA 70808 bmmcknight@agcenter.lsu.edu
[2] Professor, LSU AgCenter, 104 Sturgis Hall, Baton Rouge, LA 70808
[3] Graduate Assistant, LSU AgCenter, 104 Sturgis Hall, Baton Rouge, LA 70808
[4] Post-Doctoral Researcher, LSU AgCenter, 104 Sturgis Hall, Baton Rouge, LA 70808
[5] Graduate Assistant, LSU AgCenter, 104 Sturgis Hall, Baton Rouge, LA 70808
[6] Graduate Assistant, LSU AgCenter, 104 Sturgis Hall, Baton Rouge, LA 70808

ducksalad biomass was reduced compared with the nontreated following treatment with 62 g ai ha^{-1} (Table 3). Ducksalad fresh weight biomass was similar following benzobicyclon treatment with 185 to 1232 g ai ha^{-1}. Indian toothcup fresh weight biomass was similar when treated with benzobicyclon at 246 to 1232 g ai ha^{-1}.

Table 1. Control of barnyardgrass, yellow nutsedge, ducksalad, and false pimpernel with benzobicyclon applied at different rates across all evaluation timings.

Benzobicyclon	Barnyardgrass	Yellow nutsedge	Ducksalad	False pimpernel
g a.i. ha^{-1}	% Control			
31	2 gh	1 f	12 fg	48 c
62	5 fgh	4 ef	33 e	94 b
123	12 efg	7 e	58 d	98 a
185	15 def	14 d	69 cd	96 ab
246	17 de	18 d	79 bc	98 a
492	25 cd	29 c	83 ab	99 a
738	35 bc	36 b	89 ab	99 a
984	44 ab	45 a	93 a	99 a
1230	50 a	50 a	93 a	99 a

Table 2. Control of barnyardgrass, yellow nutsedge, ducksalad, and false pimpernel at three evaluation timings, averaged across benzobicyclon rates.

Evaluation Timing	Barnyardgrass	Yellow nutsedge	Ducksalad	False pimpernel
DAT	% Control			
14	27 a	22 a	56 b	___
28	15 c	21 a	63 a	12 b
42	19 b	18 b	64 a	21 a

Table 3. Fresh weight biomass of ducksalad and false pimpernel with benzobicyclon applied at different rates.

Benzobicyclon	Ducksalad	False pimpernel
g a.i. ha^{-1}	grams	
0	3298 a	785 a
31	2952 a	702 ab
62	1791 b	549 abc
123	1371 bc	414 abc
185	874 bcd	271 bc
246	425 cd	177 bcd
492	200 d	133 cd
738	110 d	74 cd
984	34 d	90 cd
1230	44 d	29 d

CONCLUSION

This field study demonstrates the activity of benzobicyclon on common Louisiana rice weed species. Currently, no HPPD inhibiting herbicides are labeled for use in U.S. rice production and the utility of this herbicide can enhance herbicide resistance management strategies through the addition of a new mode of action for rice production. Other field studies conducted at LSU have demonstrated that benzobicyclon must be applied directly into permanent flood irrigation water for activity on susceptible weed species. Because of the unique water activity of this compound, benzobicyclon will have a fit in Louisiana water-seeded rice plantings which accounted for approximately 35% of the total planted hectares in the state in 2016 (Harrell 2016). Often, ducksalad can become a troublesome early season weed in water-seeded rice. The activity of benzobicyclon on ducksalad when applied directly into flood water will provide a means of early-season control of this weed without additional flood water manipulation or draining prior to herbicide application.

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