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Weed Spectrum and Size Influence on Control in Rice Following Florpyrauxifen-Benzyl Spray-Applied and Coated On Urea

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Abstract

Following the commercial launch of florpyrauxifen-benzyl, complaints and concerns surrounding the off-target movement of florpyrauxifen-benzyl to soybean arose. Consequently, research was initiated to evaluate an application method to alleviate damage from off-target movement and retain weed control in rice. Field and self-contained tub experiments were conducted in 2020 and 2021 to determine if coating florpyrauxifen-benzyl or mixtures containing florpyrauxifen-benzyl on urea would provide equivalent levels of weed control as spray applications. In the tub experiment, florpyrauxifen-benzyl sprayed at 30 g ae ha^{-1} and a mixture of florpyrauxifen-benzyl at 24 g ae ha^{-1} plus penoxsulam at 41 g ai ha^{-1} coated on urea resulted in 100% visible control, mortality, and no biomass production for yellow nutsedge, barnyardgrass, and] ض p m T l ҿ ў l Mexperiment, coating florpyrauxifen-benzyl or the mixture containing penoxsulam visible ducksalad control than spray applications at 5 WAT. However, coated urea applications containing florpyrauxifen-benzyl were less effective than the spray and provided 50% and 76% visible California arrowhead and yellow nutsedge control, respectively. Coating either herbicide on urea resulted in 80% or less yellow nutsedge control compared to 96% or greater control following spray applications when applied to ~25-cm rice fatsedge. Coating florpyrauxifen-benzyl on urea provided comparable hemp sesbania, rice fatsedge, and ducksalad control a spray application. Adding penoxsulam to florpyrauxifen-benzyl improved barnyardgrass and yellow nutsedge control when coated on urea.

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K d : A lica i me h d; A lica i ech l gy; Off- a ge m veme ; Rice; Weed c l

I d c

Rice i a a le f d g ai gl bally a d e f he m d c ive c i he mid- he U i ed S a e . Rice i g w i he U i ed S a e i he A ka a G a d P ai ie, Mi i i Del a, G lf C a , a d he Sac ame Valley f Calif ia (USDA-ERS 2022). A f 2021, ice i ec d ybea i A ka a c d c i i la ed hec a e a d ve all d c i val e (USDA-NASS 2022). I 2021, A ka a ice d ce ha ve ed a ima ely 483,000 hec a e f ice, val ed a ve $1 billi (USDA-NASS 2022) [1].

C l iva i g ice i cl de ma y diffe e i iga i y em : he w m c mm a e d-i iga ed a d f w-i iga ed. I 2020, a ima ely 83% f ice g w i A ka a wa d-i iga ed, wi h c ve i al levee c c ed mai ai di g h gh he ea , a d he emai i g ice wa f w-i iga ed (Ha dke 2021). E vi me al a d il c di i c ea ed by di g ice ca be c d cive he g wh a d d c i f a ic a d emia a ic weed (Smi h 1988). While ded c di i c ea e a c d cive e vi me f g wi g ice, weed ca al i h de he ame c di i . I i ial d e abli hme cc a a 5- 7.5-cm de h whe ice begi ille i g (f - ve-leaf g w h age) a d i mai ai ed il ha ve (He y e al. 2018). Addi i ally, d de h ca be i c ea ed 10 15 cm a mid ea aid di ea e e i (He y e al. 2018). Fl di g de h al i e ce weed eed ge mi a i , e abli hme , ival, a d g w h [2,3].

Acc di g a vey f A ka a ice weed i e i 2020, ba ya dg a a d C e . [ice a edge, yell w edge, mall we mb ella edge (*C d L*), a d whi e-ma gi ed a edge (*C a c M c .*) we e ide i ed a he m blema ic weed i ded ice (B e al. 2022). Addi i ally, B e al. (2022) a cia ed yield l e f 505 959 kg ha^{-1} wi h i e fe e ce ca ed by he i e ce f ba ya dg a . Al h gh ba ya dg a a d ice a edge a e blema ic weed i ded ice, a ge i g a malle , m e fav able weed ize c ld aid ve c l [4].

Weed ize a he ime f lica i ca al i e ce he bicide efficacy. I a e e ime c d c ed by Selle e al. (2009), he bicide efficacy dec ea ed a d gfe el [*E a ca* (Lam.) Small e P e & B i] heigh i c ea ed f m 36- 154-cm, ega dle f a e a d mi e f icl y , y , 2,4-D ami e, a d dicamba. Simila ly, bi y ibac- di m, fe a -e hyl + e h y lf , a d e lam + cyhal f we e le effec ive a c lli g eigh -

leaf ba ya dg a c m a ed f -leaf ba ya dg a (Cha ha a d Ab gh 2012). La e he bicide a lica i imi g ca be le efficaci d e la ge weed ize a he ime f a lica i [5]. Rega dle f he a e, gly h a e vided le c l f hem e ba ia a mid a d la e eme ge ce a lica i imi g c m a ed ea ly eme ge ce (J da e al. 1997).

A effec ive e d he bicide i i eeded wi h ded ice e vi me c d cive g wi g blema ic weed ch a ba ya dg a a d *C*

3.8-m la ed i ice a d 3.8-m ba e g d [11]. S il e e, i 2020, wa a Dewi il l am c i i g f 27% a d, 54% il , a d 19% clay wi h 1.8% ga ic ma e . S il e e, i 2021, wa a Call way il l am c i i g f 1% a d, 83% il , a d 16% clay wi h 2.3% ga ic ma e . Q izal f - e i a ice c l iva 'PVL01' (P vi ia® ech l gy, BASF, Fl ham Pa k, NJ 07932) wa la ed i 3 w a 72 eed e me e f he w wi h 76-cm w aci g A il 10, 2020, a d May 14, 2021. Rice wa la ed wi h 76-cm w aci g m e addi i al weed g w h be wee he ice w . All l eceived a eeme ge ce lica i f cl maz e (C mma d 3ME, FMC, Philadel hia, PA 19104) a 336 g ai ha-1 a la i g mi imize he eme ge ce f g a weed . Pl we e mai ai ed g a -f ee i g eme ge ce lica i f izal f (P vi ia®, BASF, Fl ham Pa k, NJ 07932) whe ece a y [12].

B h e e ime we e c d c ed a a a d mized c le e bl ck de ig wi h a w -fac fac ial ea me c e a d h ee lica i wi h he w fac bei g he bicide a d lica i me h d. e fac f he bicide i cl ded w he bicide : y a ife -be zyl a 30 g ae ha-1 a d a mi e f y a ife -be zyl l e lam a 24 a d 41 g ae/ai ha-1, e ec ively. e ec d fac f he lica i me h d i cl ded he bicide bei g ayed- lied a d c a ed ea. Fl y a ife -be zyl a d y a ife -be zyl l e lam we e c a ed 317 kg ha-1 ea a he af eme i ed a e ec a i g ce wa a de c ibed i he evi e e ime . Each bay wa mea ed de e mi e he he bicide-c a ed fe ilize e a i g he af eme i ed a e . Addi i ally, ea ed ea a 317 kg ha-1140 L317 kg ha

…el ed i 100% ba… ya…dg…a c … l. U like whe … y…a ife -be zyl wa…ay-a… lied a 30 g ae ha^{-1}, he he…bicide wa…m ch le… effec ive a c … lli g ba… ya…dg…a whe c a ed …ea a he ame …a e. Fl … y…a ife -be zyl a 30 g ae ha^{-1} c a ed …ea ly… vided 26% a d 27% ba… ya…dg…a c … l a 3 a d 4 WAT, …e… ec ively. e lack f ba… ya…dg…a c … l f… m … y…a ife -be zyl c a ed …ea… i he im… … a ce f f lia… he…bicide i e…ce… i f … he effec ive e… f … y…a ife -be zyl g…a c … l, like B…ave…ma (1995) f d whe c a i g i cl ac fe… ilize… [16].

A w -way i e…ac i be wee a… lica i me h d a d he…bicide wa… b e…ved f … b h ba… ya…dg…a …ela ive bi ma… a d m … ali y. A … evi …ly …a ed i Table 2, … y…a ife -be zyl a 30 g ae ha^{-1} …ay-a… lied a d he mi …e f … y…a ife -be zyl, b h …ay-a… lied a d c a ed …ea a 24 g ae ha^{-1} a d… e …lam a 41 g ai ha^{-1} all …vided 100% ba… ya…dg…a c … l. C …e e ly, he…evi ly me i ed …ea me …e… l ed wi h ba… ya…dg…a …ela ive bi ma… bei g 0%, a d ba… ya…dg…a m … ali y bei g 100%. H weve…, failed ba… ya…dg…a c … l f ll wi g … y…a ife -be zyl a 30 g ae ha^{-1} c a ed …ea ca ed diffe…e ce i …ela ive bi ma… a d m … ali y be wee he…bicide a d a… lica i me h d. Si ce all c mbi a i f fac … …vided 100% yell w …edge a d hem… e ba ia c … l, …ela ive bi ma… a d m … ali y a d e cl ded f… m Table 3. Diffe…e ce… i …ela ive bi ma… a d m … ali y we…e ly b e…ved f … ba… ya…dg…a … whe…e … y…a ife -be zyl wa…le… effec ive a c … lli g he weed …ecie… [17].

Ove…all, …ela ive ba… ya…dg…a bi ma… f ll wi g a i gle …ay a… lica i f … y…a ife -be zyl a 30 g ae ha^{-1} wa… 87% f he …ea ed …ela ive ba… ya…dg…a bi ma… (Table 3). A i ve… e …e… e i ba… ya…dg…a m … ali y wa… b e…ved c m… a…ed he …ela ive bi ma… Whe…e he…e wa… l we… …ela ive ba… ya…dg…a bi ma… a e… a… lyi g … y…a ife -be zyl a 30 g ae ha^{-1} c a ed , highe… ba… ya…dg…a m … ali y cc …ed. A lack f ba… ya…dg…a c … l…e… l ed i ba… ya…dg…a m … ali y bei g 24% whe c mbi ed be wee 2020 a d 2021. Si ce … y…a ife -be zyl a 30 g ae ha^{-1} c a ed …ea ligh ly dec…ea ed ba… ya…dg…a …ela ive bi ma… a d m … ali y, he…e… l i dica ed ha he he…bicide c a ed …ea had me ac ivi y ba… ya…dg…a b wa… limi ed. Ba… ya…dg…a i… c …e ly li…ed a a c … lled … a… …e ed weed f … a… lica i … f … y…a ife -be zyl c a ed …ea (A ym … 2021). He ce, … y…a ife -be zyl a 30 g ae ha^{-1} al e c a ed …ea h ld be e… ec ed c … l ba… ya…dg…a effec ively. Eve h gh … y…a ife -be zyl al e c a ed …ea failed … vide ade a e c … l f ba… ya…dg…a … y…a ife -be zyl c a ed …ea a 24 g ae ha^{-1} a d… e …lam a 41 g ai ha^{-1} … vided … mi i g…e… he… c … l he… blema ic weed while ilizi g he ew a… lica i me h d.

C a … a … -b … a c … a (10-c) c a d

While ly 3 … e…ce age… i … g… a…a ed he am f …ice a edge c … l a 4 a d 5 WAT, …e… ec ively, a ig i ca i e…ac i be wee a… lica i me h d wa… b e…ved. Whe …ayed …ea me c ai i g … y…a ife -be zyl wa… a… lied, …ice a edge wa… 100% c … lled a 4 a d 5 WAT. Whe … y…a ife -be zyl wa… c a ed …ea a d a… lied, ba… ya…dg…a c … l wa… 97% a 4 a d 5 WAT. Al h gh …a i…ically diffe…e , b h a… lica i me h d… ffe…ed high level… f …ice a edge c … l a 4 a d 5 WAT. Rice a edge c … l …a i g a …ice headi g elici ed a w -way i e…ac i be wee he…bicide a d a… lica i me h d whe…e … y…a ife -be zyl c a ed …ea … vided he l we… (90%) d ck alad c … l c m… a…ed whe he he…bicide wa… …ayed …mi ed wi h … e …lam i ei he… a… lica i me h d. Pe… Mille… a d N … w … hy (2018), … …ayed … y…a ife -be zyl a 30 g ae ha^{-1} … vided 94% c … l f …ice a edge, … b h a… lica i me h d … vided c m… a…able …e… l … …evi …e ea…ch [18].

A… lica i me h d wa… he ly fac … ha elici ed diffe…e ce… i Calif … ia a… whead c … l a he …ice headi g …a i g imi g. S… ayed a… lica i … c ai i g … y…a ife -be zyl … vided 31 … e…ce age… i … g…ea e… c … l f Calif … ia a… whead ha whe a y he…bicide …ea me wa… c a ed …ea. A …ice headi g, … ayed a… lica i … f … y…a ife -be zyl… vided 81% Calif … ia a… whead c … l, while c a i g he he…bicide …ea ly… vided 50% c … l. H weve…, a … i e effec f a… lica i me h d cc …ed f … d ck alad c … l. Whe … y…a ife -be zyl … a mi …e f … y…a ife -be zyl a d… e …lam wa… c a ed …ea, d ck alad wa… c … lled 19 … e…ce age… i … g…ea e… ha … ayed a… lica i … a 5 WAT, achievi g 94% vi ible d ck alad c … l. i… level f d ck alad c … l i… c m… a…able …e ea…ch by R m (2020), whe…e d ck alad wa… c … lled 89 99% wi h … y…a ife -be zyl a 11 29.5 g ae ha^{-1}. e i c…ea ed vi ible d ck alad c … l … gge… ha dec…ea ed f lia… i e…ce… i f … y…a ife -be zyl-c ai i g c a ed …ea …ea me all wed g…ea e… am f he…bicide bec me … e ded i he d, hi de…i g d ck alad g… w h a hi… … e d a… lica i which i… i ve… e f wha wa… e… ec ed.

H weve…, d ck alad a d Calif … ia a… whead a…e a a ic weed… ha ge…mi a ed la e… ha h … e a he… …e d imi g. Ty… ically, c… …

		Barnyardgrass			

Weed size influence on decreased herbicide activity from emerged herbicides

C c

Fi di g f m he e e ime i dica e ha c a i g y a ife -be zyl a 30 g ae ha^{-1} a mi e f y a ife -be zyl a 24 g ae ha^{-1} l e lam a 41 g ai ha^{-1} ea ha val e a a al e a ive ica i c l ice weed P e d ica i f ei he he bicide ea me c a ed ea vided c l f ice a edge, hem e ba ia, a d d ck alad c m a able ay ica i like e l d ced by Mille a d N w hy (2018). Simila ly, addi g e lam y a ife -be zyl vided a addi i al he bicide i e- f-ac i c l ce ible ba ya dg a acce i whe c a ed ea. H weve, y a ife -be zyl al e c a ed ea did ade a ely c l ba ya dg a i dica i g he eed f ve la i g ea ly- ea e id al he bicide wi h hi ica i i . C i e , effec ive yell w edge c l h ld be e ec ed f ll wi g he ica i f y a ife -be zyl c a ed ea, e ecially a weed i c ea e i ize (~25 cm). I i ec mme ded ha y a ife -be zyl c a ed ea be lied d (A ym 2021). e ed ec mme da i h ld i cl de ica i a he e- d imi g a ma y ae ial N ica i cc bef e di g, y a ife -be zyl h ld be eval a ed a h. e fe ilize c ld be m e ea ily lied d, b diffe e e l may be e ec ed. e e l f m hi e ea ch lead he c cl i ha c a i g y a ife -be zyl a mi e f y a ife -be zyl a d e lam ea a labeled a e ffe e ial f c l f me weed eval a ed he e b likely vide c i e , effec ive c l f ba ya dg a Weed ec m a d ize will la gely im ac whe he ica i f y a ife -be zyl c a ed ea a e cce f l. Addi i al e ea ch h ld be c d c ed eval a e he ff- a ge m veme e ial f hi ica i me h d.

Ac d

i e ea ch wa c d c ed i c e a i wi h C eva Ag i cie ce. C eva vided a ial e ea ch f di g a d y a ife -be zyl. Addi i al f di g f hi e ea ch wa vided by he A ka a Rice Check ff P g am admi i ed by he A ka a Rice Re ea ch a d P m i B a d. La ly, facili ie a d e me we e vided by he U ive i y f A ka a Sy em Divi i f Ag ic l e. N c ic f i e e have bee decla ed.

8.