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Weed Management—Techniques

Early Postemergence Control of Yellow Woodsorrel (*Oxalis stricta*) with Residual Herbicides

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Three experiments were conducted to evaluate early POST control of yellow woodsorrel using PRE-applied herbicides. In experiment 1, yellow woodsorrel was seeded at two dates in a commercial pine-bark substrate and grown until reaching either the cotyledon–one-leaf (C-1L) or two- to four-leaf (2-4L) growth stage. The herbicides isoxaben, indaziflam, and dimethenamid-p were applied at these growth stages. Two rates of isoxaben and indaziflam provided yellow woodsorrel control ($\geq$ 80% reduction in fresh weight [FW]) when applied at the C-1L stage; however, once yellow woodsorrel reached the 2-4L stage, indaziflam was the only herbicide that provided effective control at both rates tested. Experiments 2 and 3 were similar to experiment 1, except two labeled rates of dithiopyr were also evaluated. In experiment 2, all herbicides evaluated provided $\geq$ 90% reduction in FW of yellow woodsorrel at the C-1L stage. Although no differences in FW were observed among any of the herbicide treatments when yellow woodsorrel were treated at the 2-4L stage, control ratings indicated that indaziflam provided the most effective yellow woodsorrel control. Experiment 3 results also indicated that isoxaben, indaziflam, and dithiopyr controlled yellow woodsorrel ($\geq$ 95% reduction in FW) when treatments were applied at the C-1L stage, whereas dimethenamid-p reduced shoot FW 70%. When yellow woodsorrel was treated after reaching the 2-4L stage, indaziflam provided the greatest control of any herbicide evaluated.

Nomenclature: Dithiopyr; isoxaben; indaziflam, N-[(1R,2S)-2,3-dihydro-2,6-dimethyl-1H-inden-1-yl]-6-[(1RS)-1-fluoroethyl]-1,3,5-triazine-2,4-diamine); yellow woodsorrel, *Oxalis stricta* L.

Key words: Container-grown plants, dimethenamid-p, dithiopyrindaziflam, isoxaben, nursery crops, weed control.

Se realizaron tres experimentos para evaluar el control POST temprano de *Oxalis stricta* usando herbicidas aplicados PRE. En el experimento 1, *O. stricta* se sembró en dos fechas en un sustrato comercial de corteza de pino y se dejó crecer hasta alcanzar los estados de desarrollo de cotiledón-una hoja (C-1L) o dos a cuatro hojas (2-4L). Los herbicidas isoxaben, indaziflam, y dimethenamid-p fueron aplicados en estos estados de desarrollo. Ambas dosis de isoxaben e indaziflam proveyeron control de *O. stricta* (≥80% reducción del peso fresco [FW] cuando se aplicó en el estado C-1L); sin embargo, una vez que *O. stricta* alcanzó el estado 2-4L, indaziflam fue el único herbicida que brindó control efectivo con ambas de las dosis evaluadas. Los experimentos 2 y 3 fueron similares al experimento 1, excepto que dos dosis de etiqueta de dithiopyr fueron también evaluadas. En el experimento 2, todo los herbicidas evaluados causaron ≥90% reducción de FW de *O. stricta* en el estado C-1L. Aunque no se observaron diferencias en FW entre ninguno de los tratamientos de herbicidas cuando *O. stricta* se trató en el estado 2-4L, las evaluaciones de control indicaron que indaziflam brindó el control más efectivo de esta maleza. Los resultados del experimento 3 indicaron que isoxaben, indaziflam, y dithiopyr controlaron *O. stricta* (≥95% reducción de FW) cuando los tratamientos fueron aplicados en el estado C-1L, mientras dimethenamid-p redujo el FW de la parte aérea 70%. Cuando *O. stricta* se trató después de alcanzar el estado 2-4L, indaziflam brindó el mayor control entre los herbicidas evaluados.

Container-grown nursery crops must be kept weed-free to be marketable. Not only are weed-free plants more aesthetically pleasing, growth of containerized nursery crops can be significantly reduced by weeds (Fretz 1972). Yellow woodsorrel, often referred to as oxalis, is one of the most common perennial weeds in container nurseries and can thrive year round in the southeastern United States. Yellow woodsorrel can be difficult to control because it can spread by rhizomes and stolons, as well as by seed. The seed has no dormancy requirement so it will quickly germinate (Neal and Derr 2005). Yellow woodsorrel is primarily controlled with PRE-applied herbicides, but for PRE herbicides to be effective, pots must be weed-free at the time of application (Judge and Neal 2006). Small weeds are often missed during hand-weeding and not controlled with PRE-applied herbicides. In addition, the cost of hand-weeding is continuing to rise.

Container nursery production is far less mechanized than other agricultural sectors, and hand labor is a major production cost for many nursery growers. Labor costs are continually increasing due to labor shortages (Martin and Calvin 2010). Recent immigration reform legislation passed in Alabama and other states has caused many nursery growers to lose a large amount of their labor force (Johnson 2011). There are many selective POST-applied herbicides marketed for agronomic and turf grass production, but few herbicidal options for POST control in container-grown crops (Altland

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et al. 2000). Therefore, it is important to find PRE herbicides that provide some degree of POST weed control.

Previous research has shown success in controlling hairy bittercress (*Cardamine hirsuta* L.) and spotted spurge (*Chamaesyce maculata* L.) using PRE herbicides. Studies by Altland et al. (2000) indicated that small hairy bittercress (0.5 to 3 cm) can be controlled with POST applications of isoxaben. Judge and Neal (2006) showed hairy bittercress and spotted spurge can be controlled successfully with the herbicides flumioxazin, oxyfluorfen + pendimethalin, and isoxaben + trifluralin at the cotyledon to one-leaf stage of growth. Spotted spurge has also been successfully controlled in the cotyledon to one-leaf stage of growth with applications of herbicides including sulfosulfuron, dimethenamid-P + pendimethalin, pendimethalin, and dimethenamid-p (Marble et al. 2011). Indaziflam is a new active ingredient in the alkylazone chemical class recently released from Bayer CropScience, and controls weeds by inhibiting cellulose biosynthesis (Anonymous 2009). Indaziflam provides effective PRE control of grass and broadleaf weeds (Myers et al. 2009) and has been shown to provide early POST control of common weeds in turf grass (Brosnan et al. 2011, 2012). The objective of this research was to evaluate POST efficacy of isoxaben, indaziflam, dimethenamid-p, and dithiopyr when applied to yellow woodsorrel at two growth stages: the cotyledon to one-leaf stage (C-1L) and the two- to four-leaf (2-4L) stage.

Materials and Methods

Three similar but separate experiments were conducted in 2011 to evaluate herbicide efficacy on yellow woodsorrel in the early stages of development after seed germination. Herbicides tested included dithiopyr (Dimension 2EW, Dow AgroSciences LLC, Indianapolis, IN), isoxaben (Gallery 75DF, Dow AgroSciences LLC), indaziflam (Indaziflam SC, Bayer Environmental Science, Research Triangle Park, NC 27709), and dimethenamid-p (Tower 6.0EC, BASF Corporation, Research Triangle Park, NC 27709). Dithiopyr, isoxaben, and dimethenamid-p were selected based upon the broad spectrum of PRE weed control provided and labels, which include many commonly container-grown ornamental crops (Anonymous 2010a, 2010b, 2011). Indaziflam is projected to be labeled for use in the landscape and nursery market in 2013 and was chosen to evaluate weed control in comparison with currently labeled herbicides for nursery crop production.

The following procedures apply to all experiments: Containers (3.0 L) were filled with pine-bark : sand (6 : 1 v/v) substrate that had previously been amended with 8.31 kg m^{-3} of 17–2.2–9.1 Polyon (Harrell's Fertilizer Inc., Sylacauga, AL) control-release fertilizer (10- to 12-mo), 3.0 kg m^{-3} of dolomitic limestone, and 0.9 kg m^{-3} Micromax (Everris International B.V., Geldermalsen, The Netherlands). Approximately 50 yellow woodsorrel seeds were surface-sown to each container by hand at two separate dates resulting in yellow woodsorrel at two different stages of growth at the time of treatment. Containers were placed under a shade structure (30%) and received two separate overhead irrigations of 0.6 cm on a daily basis. Herbicides were applied to dry foliage and did not receive irrigation for 3 h following treatment. Experiments 1 and 2 were conducted under a shade structure (with no sides) while experiment 3 was placed inside a retractable-roof structure (30% shade, sides were open during treatment). Herbicides were applied using a CO_2-backpack sprayer with an 8004 flat fan nozzle (TeeJet Technologies, Wheaton, IL. 60187) at 172.4 kPa calibrated to deliver 187 L ha^{-1}. Containers were arranged by growth stage (C1-L or 2-4L) in a completely randomized block design with 11 single-container replications per treatment in each growth stage. A nontreated control group was included for each growth stage in each experiment. Control ratings were taken visually (scale of 0 to 10, 0 = no control, 10 = complete death) and recorded at 1, 2, 4, and 8 wk after treatment (WAT). Shoot fresh weights (FWs) were recorded at 8 WAT. At 8 WAT, shoots were clipped at the soil surface and weighed. Percentages of shoot FW, relative to the nontreated, were calculated in the following way: [((nontreated − treated)/nontreated) × 100]. All data were subjected to Tukey's Honest Significance test. In all cases, differences were considered significant at $P \leq 0.05$.

Experiment 1. On May 31, 3.0-L containers were filled with substrate, irrigated (0.6 cm), and overseeded as described above, and at 18 d yellow woodsorrel had reached the 2-4L stage. Additional containers were filled, irrigated (0.6 cm), and overseeded on June 7, and at 10 d had reached the C-1L stage. Treatments were applied on June 18, 2011 (22 C, overcast, 94% relative humidity, winds south at 10 km h^{-1}). Treatments consisted of the following herbicides at two rates each: isoxaben (0.6 and 1.1 kg ai ha^{-1}), indaziflam (0.05 and 0.1 kg ai ha^{-1}), and dimethenamid-p (1.1 and 1.7 kg ai ha^{-1}).

Experiment 2. Containers were filled with substrate, irrigated (0.6 cm), and overseeded on July 6. The 2-4L stage was reached 23 d later. Additional containers were filled, irrigated (0.6 cm), and overseeded on July 18; the C-1L stage was reached 11 d later. Treatments were applied on July 29, 2011 (32 C, clear, 55% relative humidity, winds west at 10 km h^{-1}). Treatments were the same as those in experiment 1 with the addition of dithiopyr at the labeled rate (0.6 kg ai ha^{-1}) and twice the labeled rate (1.1 kg ha^{-1}).

Experiment 3. Containers were filled with substrate, irrigated (06 cm), and overseeded on October 7. The 2-4L stage was reached 33 d later. Additional containers were filled, irrigated (0.6 cm), and overseeded on October 19; the C-1L stage was reached 21 d later. Treatments, which were identical to experiment 2, were applied on November 9, 2011 (19 C, clear, 73% relative humidity, winds south at 13 km ai h^{-1}).

Results and Discussion

C-1L Stage. In experiment 1, indaziflam provided the highest level of POST control of any herbicide at 1 and 2 WAT, followed by isoxaben and then dimethenamid-p, with no differences among rates of each herbicide (Table 1) By 4 WAT, isoxaben (high rate) provided similar control (9.0) to both rates of indaziflam (both 10.0). Yellow woodsorrel

Table 1. Yellow woodsorrel control with selected herbicides applied early POST as influenced by growth stage; experiment 1.

Treatment		Control ratings[a]				FW reduction[b]
		1 WAT[c]	2 WAT	4 WAT	8 WAT	8 WAT
Herbicide	Rate	June 24, 2011	June 30, 2011	July 14, 2011	August 11, 2011	August 11, 2011
	kg ai ha^{-1}					%
Cotyledon to one-leaf stage						
Isoxaben	0.60	7.7 b[d]	9.0 b	7.2 b	1.8 c	80 a
Isoxaben	1.10	8.3 b	9.0 b	9.0 a	3.5 b	95 a
Indaziflam	0.05	9.4 a	10.0 a	10.0 a	10.0 a	100 a
Indaziflam	0.10	9.7 a	10.0 a	10.0 a	10.0 a	100 a
Dimethenamid-p	1.10	6.7 c	6.5 c	2.3 c	0.0 d	53 b
Dimethenamid-p	1.70	5.8 c	6.6 c	1.0 cd	0.0 d	46 b
Nontreated	—	0.0 e	0.0 d	0.0 d	0.0 d	0 c
Two- to four-leaf stage						
Isoxaben	0.60	0.3 c	2.4 c	1.8 d	0.0 b	2 b
Isoxaben	1.10	1.9 b	5.0 b	3.3 c	0.0 b	29 b
Indaziflam	0.05	6.6 a	8.3 a	9.1 b	10.0 a	100 a
Indaziflam	0.10	7.0 a	8.7 a	10.0 a	10.0 a	100 a
Dimethenamid-p	1.10	2.1 b	0.3 d	0.2 e	0.0 b	12 b
Dimethenamid-p	1.70	2.4 b	0.0 d	0.0 e	0.0 b	18 b
Nontreated	—	0.0 c	0.0 d	0.0 e	0.0 b	0 b

[a] Control ratings taken on a scale of 0 to 10: 0 = no injury, 10 = complete kill.

[b] FW reduction = percentage of fresh weight reduction, relative to nontreated. Mean FW (g pot^{-1}) for nontreated yellow woodsorrel was 91.8 and 113.4 g in the cotyledon to one-leaf and two- to four-leaf stages, respectively.

[c] WAT = weeks after treatment. All pots treated on June 18, 2011.

[d] Means separated using Tukey's Honest Significance test. Differences were considered significant at $P < 0.05$.

treated with the low rate of isoxaben and both rates of dimethenamid-p had begun to recover and control ratings decreased when compared to control observed at 1 and 2 WAT. Control ratings at 8 WAT show that yellow woodsorrel were recovering in all herbicide treatments with the exception of those treated with indaziflam; both rates provided control ratings of 10.0. FWs showed the greatest control was achieved with indaziflam (100% reduction at both rates) and isoxaben

Table 2. Yellow woodsorrel control with selected herbicides applied early POST as influenced by growth stage; experiment 2.

Treatment		Control Ratings[a]				FW reduction[b]
		1 WAT[c]	2 WAT	4 WAT	8 WAT	8 WAT
Herbicide	Rate	August 5, 2011	August 12, 2011	August 29, 2011	September 23, 2011	September 23, 2011
	kg ai ha^{-1}					%
Cotyledon to one-leaf stage						
Isoxaben	0.60	6.5 bc[d]	8.3 ab	7.9 bc	4.0 c	93 a
Isoxaben	1.10	8.6 ab	9.6 a	9.6 ab	6.9 b	98 a
Indaziflam	0.05	10.0 a	10.0 a	10.0 a	10.0 a	100 a
Indaziflam	0.10	10.0 a	10.0 a	10.0 a	10.0 a	100 a
Dimethenamid-p	1.10	7.8 ab	8.3 ab	8.6 abc	7.6 ab	99 a
Dimethenamid-p	1.70	5.6 bc	7.3 b	7.6 c	7.7 ab	97 a
Dithiopyr	0.60	3.4 c	9.2 ab	9.6 ab	10.0 a	100 a
Dithiopyr	1.10	5.8 bc	9.7 a	9.8 a	10.0 a	100 a
Nontreated	—	0.0 d	0.0 c	0.0 d	0.0 d	0 b
Two- to four-leaf stage						
Isoxaben	0.60	4.2 bc	5.9 b	4.8 c	1.1 de	77 a
Isoxaben	1.10	5.4 b	8.2 ab	7.8 ab	3.5 cd	93 a
Indaziflam	0.05	8.5 a	9.8 a	9.9 a	10.0 a	100 a
Indaziflam	0.10	8.6 a	9.8 a	10.0 a	10.0 a	100 a
Dimethenamid-p	1.10	3.5 bc	3.4 c	3.2 cd	2.1 cde	70 a
Dimethenamid-p	1.70	1.6 de	2.2 cd	2.1 de	1.8 de	68 a
Dithiopyr	0.60	2.9 cd	6.6 b	7.3 b	4.5 bc	90 a
Dithiopyr	1.10	4.0 bc	7.0 b	7.8 ab	6.6 b	98 a
Nontreated	—	0.0 e	0.0 d	0.0 e	0.0 e	0 b

[a] Control ratings taken on a scale of 0 to 10: 0 = no injury, 10 = complete kill.

[b] FW reduction = percentage of fresh weight reduction, relative to nontreated. Mean FW (g pot^{-1}) for nontreated yellow woodsorrel was 20.3 and 52.2 g in the cotyledon to one-leaf and two- to four-leaf stages, respectively.

[c] WAT = weeks after treatment. All pots treated on July 29, 2011.

[d] Means separated using Tukey's Honest Significance test. Differences were considered significant at $P < 0.05$.

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Table 3. Yellow woodsorrel control with selected herbicides applied early POST as influenced by growth stage; experiment 3.

Treatment		Control ratings[a]				FW reduction[b]
		1 WAT[c]	2 WAT	4 WAT	8 WAT	8 WAT
Herbicide	Rate	November 16, 2011	November 23, 2011	December 28, 2011	January 6, 2012	January 6, 2012
	kg ai ha^{-1}					%
Cotyledon to one-leaf stage						
Isoxaben	0.60	1.5 d[d]	5.3 c	8.1 b	7.5 c	99 a
Isoxaben	1.10	2.3 cd	6.5 b	8.1 b	8.4 bc	99 a
Indaziflam	0.05	6.3 a	8.7 a	9.9 a	10.0 a	100 a
Indaziflam	0.10	6.6 a	9.1 a	10.0 a	10.0 a	100 a
Dimethenamid-p	1.10	2.5 bcd	4.7 cd	5.6 c	2.1 d	73 b
Dimethenamid-p	1.70	3.7 b	5.3 c	5.8 c	2.3 d	69 b
Dithiopyr	0.60	2.8 bc	4.4 cd	7.4 b	9.0 ab	100 a
Dithiopyr	1.10	3.0 bc	4.1 d	7.8 b	9.2 ab	100 a
Nontreated	—	0.0 e	0.0 e	0.0 d	0.0 e	0 c
Two- to four-leaf stage						
Isoxaben	0.60	1.8 cd	2.9 bc	4.2 c	3.1 c	85 a
Isoxaben	1.10	2.6 c	3.6 b	5.5 b	5.5 b	97 a
Indaziflam	0.05	6.7 b	7.8 a	8.6 a	9.8 a	100 a
Indaziflam	0.10	7.6 a	8.4 a	8.9 a	9.6 a	100 a
Dimethenamid-p	1.10	0.9 e	1.6 d	1.8 d	0.0 d	39 b
Dimethenamid-p	1.70	1.7 de	2.2 cd	1.9 d	0.0 d	46 b
Dithiopyr	0.60	1.9 cd	3.1 bc	4.2 c	6.2 b	94 a
Dithiopyr	1.10	2.1 cd	2.7 bc	4.5 bc	6.4 b	95 a
Nontreated	—	0.0 f	0.0 e	0.0 e	0.0 d	0 c

[a] Control ratings taken on a scale of 0 to 10: 0 = no injury, 10 = complete kill.

[b] FW reduction = percentage of fresh weight reduction, relative to nontreated. Mean FW (g pot^{-1}) for nontreated yellow woodsorrel was 20.4 and 57.5 g in the cotyledon to one-leaf and two- to four-leaf stages, respectively.

[c] WAT = weeks after treatment. All pots treated on November 9, 2011.

[d] Means separated using Tukey's Honest Significance test. Differences were considered significant at $P < 0.05$.

(80 and 95% reduction at the 0.6 and 1.1 kg ha^{-1} rates, respectively). Dimethenamid-p provided only marginal control (53 and 46% reductions at the 1.1 and 1.7 kg ha^{-1} rates, respectively).

Indaziflam completely controlled yellow woodsorrel throughout experiment 2 (Table 2). Although isoxoben and dimethenamid-p provided control similar to indaziflam at times, control began to decrease in these treatments after 4 WAT as plants began to recover. In contrast, control from dithiopyr increased, and both rates had a rating of 10.0 at 8 WAT. Fresh weight data showed that all herbicides were equally effective ($\geq$ 93% reduction) at all rates tested. In experiment 3, indaziflam (both rates) provided greater control than any other herbicide at 1, 2, and 4 WAT (Table 3). Similar to results observed in experiment 2, in experiment 3 dithiopyr control ratings increased at each evaluation date and provided control similar to that of indaziflam at 8 WAT. FWs in experiment 3 showed that both rates of isoxaben (99% reduction), indaziflam (100% reduction), and dithiopyr (100% reduction) provided greater control than dimethenamid-p (73 and 69% reduction at 1.1 and 1.7 kg ha^{-1}, respectively).

2-4L Stage. Both rates of indaziflam provided effective control of yellow woodsorrel in the 2-4L stage in experiment 1 (Table 1) Isoxaben and dimethamid-p had little to no effect on any evaluation date. Yellow woodsorrel treated with either rate of indaziflam had 100% reduction in FW compared to 2 and 29% reductions when treated with isoxaben (at 0.6 and 1.1 kg ha^{-1}, respectively), and had 12 and 18% reductions when treated with dimethenamid-p (at 1.1 and 1.7 kg ha^{-1}, respectively).

Indaziflam provided higher control ratings than any other herbicide at 1 and 8 WAT in experiment 2 (Table 2) and on all evaluation dates in experiment 3 (Table 3). FWs in experiment 2 were reduced 68% or greater in all herbicide treatments with no significant differences among treatments. In experiment 3, only isoxaben (85 and 97% reduction at the 0.6 and 1.1 kg ha^{-1} rates, respectively), indaziflam (100% reduction at both rates), and dithiopyr (94 and 95% reduction at 0.6 and 1.1 kg ha^{-1}, respectively) provided effective control.

Isoxaben treatments reduced yellow woodsorrel FW when treated at the C-1L stage (reductions $\geq$ 80% at 0.6 kg ha^{-1} and $\geq$ 95% at 1.1 kg ha^{-1}) in all three experiments; however, lower control ratings at 8 WAT in experiment 1 show plants were recovering. Although isoxaben performed similarly to indaziflam in FW reduction, yellow woodsorrel treated with isoxaben appeared healthy (although smaller and stunted) and some plants were flowering. If left unattended, these plants would have likely produced seed in a nursery setting. Greater yellow woodsorrel control was seen in experiments 2 and 3 than in experiment 1. This is likely because milder weather conditions in experiment 1 (treated June 18) were more conducive to yellow woodsorrel growth, which thrives in spring and fall (Neal and Derr 2005). Temperatures were much warmer during most of experiment 2, which was treated in the middle of summer (July 29) and much cooler throughout experiment 3 (treated November 9). Due to

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unfavorable growing conditions, the yellow woodsorrel was likely unable to recover in the latter two experiments, suggesting that these maybe good times for growers to apply these treatments to enhance control.

Isoxaben had little to no effect on yellow woodsorrel in the 2-4L stage in experiment 1, but FWs were significantly reduced when compared to the nontreated yellow woodsorrel in experiments 2 and 3. This may be due to more vigorously growing yellow woodsorrel in experiment 1 being able to recover almost completely following application. Isoxaben has been shown to provide POST control of hairy bittercress primarily by root absorption rather than by foliar contact (Wehtje et al. 2006). Therefore, isoxaben would likely provide better POST control of smaller plants (C-1L stage) with root systems near the surface of the container substrate for greater herbicide absorption.

Both rates of indaziflam provided excellent control of yellow woodsorrel in both growth stages and achieved 100% reduction in FW in all three experiments. These results were consistent with previous research in which indaziflam effectively controlled annual bluegrass (*Poa annua* L.) as well as smooth crabgrass (*Digitaria ischaemum* Schreb.) at rates of 35 to 70 g ai ha^{-1} when applied early POST (one to two leaves) (Brosnan et al. 2011, 2012). Although most of the previous research detailing POST activity of indaziflam has focused on monocot species, our results show that indaziflam also provides control of yellow woodsorrel, a broadleaf species. Although 2-4L yellow woodsorrel treated with isoxaben (both rates) and dithiopyr (both rates) had similar FWs to those in containers treated with indaziflam in experiments 2 and 3, control ratings had begun to decline by 8 WAT, indicating that, although yellow woodsorrel were small, they were beginning to recover and would likely reach maturity if left unattended. In general, dimethenamid-p did not control yellow woodsorrel as well as the other herbicides, especially at the 2-4L stage. Dimethenamid-p was more effective in experiment 2 where FWs were similar among all herbicide treatments. Similar to the results seen with isoxaben applications, it appears yellow woodsorrel were able to recover during experiments 1 and 3 due to more favorable growing conditions.

Both rates of dithiopyr provided $\geq$ 90% reduction in FW of yellow woodsorrel in both growth stages. It should be noted that the high rate of dithiopyr (1.1 kg ha^{-1}) was twice the manufacturer's labeled rate (0.6 kg ha^{-1}) and was evaluated for experimental purposes only. In this case, no greater yellow woodsorrel control was observed when applying the higher rate; this rate could, however, increase crop injury. Dithiopyr has shown to provide excellent POST control of crabgrass (*Digitaria* spp.) when applied early (McCullough 2010; Reicher et al. 1999). Based upon results from this study, dithiopyr appears to be able to also provide early POST control to some broadleaves, similar to indaziflam.

Although indaziflam provided control of yellow woodsorrel in the 2-4L stage, best results will be achieved when making herbicide applications to emerging weeds as early as possible, as with applications of isoxaben, dithiopyr, and dimethenamid-p. No herbicide evaluated in this study is labeled for early POST control of broadleaf weeds, and the best control will always be achieved by making timely PRE applications to weed-free containers. However, there is a need for early POST options in container production because it is difficult to see and remove newly germinated weeds by hand. This is becoming increasingly important as labor becomes more expensive and more difficult to find. It should be noted that greater POST control of weeds may indicate a higher risk of injury to nursery crops, and applicators should follow the manufacturer's label recommendations.

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