32 Weakening the Grip of Air Potato

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Abstract

Air potato (*Dioscorea bulbifera* L.) is a non-indigenous invasive plant that reduces biological diversity and degrades the ecological integrity of natural ecosystems. This tuberous-rooted plant has twining vines that displace native flora and can create a monoculture of impenetrable vegetation. An investigation was conducted in 1997 to evaluate selected herbicides for the control of air potato and study growth and development of the aerial bulbils. The investigation was conducted in Buckingham, Florida, in a cabbage palm and hardwood hammock. Herbicide treatments included Finale (25%), Roundup (25%), Remedy (25%), Garlon 3A (25 and 50%), Weedmaster (25%), Banvel (25%), and a check. Herbicides were applied using a CO_2-propellent backpack sprayer with a single, flat fan nozzle. Plots consisted of individual palm trees that contained numerous air potato vines (30-40 ft tall). The herbicides were sprayed to a height of 6 ft with all vines around the tree being sprayed. Plant injury was visually evaluated at 2, 5, 8, and 13 weeks after treatment (WAT). Experimental design was a randomized complete block with three replications. No treatment provided greater than 90% control at 5 WAT. Roundup, Remedy (two treatments), and 50% Garlon 3A provided 95-100% control at 13 WAT and no aerial bulbils were observed at 8 WAT for these treatments. From August to October, the diameters of randomly selected bulbils increased from 13 to 31 mm. By late November, many of the bulbils had fallen off the plants and were scattered on the ground. Bulbils collected in November were planted in potting soil; sprouting was observed in March and April of 1998. In the spring season of 1998, the number of new vines and plant vigor were less in plots that were chemically treated the previous summer compared to the check.

Introduction

Air potato (*Dioscorea bulbifera* L.) is a herbaceous or sometimes woody, tuberous-rooted twining vine found in natural areas of Florida. Stems twine counterclockwise and bear axillary bulbils that are six inches in diameter or wider (Bailey and Bailey 1976). In southwest Florida, bulbils form in August and drop to the ground from November to December. During the fall season, the foliage begins a natural die-back with leaf senescence completed by December. In the spring (March-April), new vines sprout from below-ground tubers and grow using the old vines for climbing. Vines can reach heights of 60 ft and can completely smother and kill a tree.

Current control measures call for the basal stem application of Garlon 4 or a basal bark treatment of 10% Garlon 4 or 50% Garlon 3A (Bodle 1996). Application of 10% Garlon 4 to stems emerging from tubers in the spring has been successful. Information is lacking on the efficacy of herbicides (other than triclopyr) for controlling air potato and the effects of herbicides on aerial bulbil production and subsequent stem sprouting the following spring season. An investigation was conducted to (1) evaluate the effects of herbicides on the control of air potato, (2) study the effect of these herbicides on aerial bulbil production, and (3) evaluate the effect of these herbicides on stem sprouting during the following spring season.

Methods

A study was conducted at the Buckingham Community Center in Lee County, Florida, during 1997. The study site was a cabbage palm (*Sabal palmetto* (Walter) Schultes & Schultes f.) hammock densely covered with air potato. Herbicides tested were 25% Finale (glufosinate), 25% Roundup (glyphosate), 25% Remedy (triclopyr), 25% & 50% Garlon 3A (triclopyr), 25% Banvel (dicamba), and 25% Weedmaster (2,4-D + dicamba). A non-ionic surfactant (0.1%) was added to the Roundup and Remedy treatments, and JLB Oil Plus was added to the Garlon 3A, Banvel, and Remedy treatments. All treatments were applied using a CO_2-propellent, backpack sprayer with a single flat fan nozzle. Herbicides were broadcast applied (on August 1), to the point of runoff, to the lower 6 ft of all air potato vines. Plots consisted of several vines located on an individual palm tree. These vines were 30-40 ft in height at the time of treatment.

At 2, 5, 8, and 13 weeks after treatment (WAT), all plots were visually scored for percent control of the above-ground, treated foliage. During each rating period, non-treated air potato vines were observed for foliage damage from pathogens or insects. In addition, at 5 and 8 WAT, the presence of aerial bulbils was recorded. In the spring (April) of 1998, at 37 WAT, the number and height of new air potato vines that sprouted from tubers was recorded as an indication of the herbicide's impact on plant regeneration and vigor. Experimental design was a randomized complete block with three replications. Treatment means were compared for each rating period with the LSD procedure (SAS Institute 1982).

Results and Discussion

In the check plots, no foliage damage was recorded on non-treated vines up to 8 WAT; foliage die-back was observed at 13 WAT. During the fall season, air potato foliage began to senescence, and by early December, all of the leaves had fallen to the ground and the vines were brown in color.

Finale controlled 72% of air potato compared with only 25% for Banvel at 2 WAT (Table 1). Only Finale, Roundup, and Garlon 3A provided 50% control or higher. These herbicides had translocated greater distances within the plant compared with the other treatments. Control at 5 WAT was greater than 70% for Finale, Roundup, and Remedy, while Weedmaster and Banvel provided less than 30% control (Table 1). At 13 WAT, Roundup, Remedy, and 50% Garlon 3A all provided significantly higher (100%) control of air potato compared to Weedmaster

Table 1. Effect of selected herbicides on control of air potato vines.

Treatments[1]	Percent control of air potato			
	2 WAT	5 WAT	8 WAT	13 WAT
Finale (25%)	72a[2]	77ab	82ab	81ab
Remedy (25%) + Kinetic (0.1%)	38bc	73ab	76ab	100a
Remedy (25%) + JLB Oil Plus	44bc	77ab	85ab	100a
Garlon 3A (25%) + Kinetic (0.1%)	38bc	45bc	45bc	73ab
Garlon 3A (50%) + Kinetic (0.1%)	50abc	70ab	78ab	100a
Weedmaster (25%) + JLB Oil Plus	25c	20c	22c	32b
Banvel (25%) + JLB Oil Plus	25c	28c	32c	57ab
Roundup (25%) + Kinetic (0.1%)	58ab	83a	95a	100a

[1] Treatments were applied August 1, 1997.
[2] Within columns, means followed by the same letter are not significantly different by an ANOVA protected LSD test ($P \leq 0.05$).

(32%). Non-target plant damage was not observed with any of the herbicides used in this study.

Presence of aerial bubils was noted for all treatments during the 5 and 8 WAT rating periods (Table 2). No estimate of the numbers of aerial bulbils per vine was taken. No aerial bulbils were present at 5 WAT from the Finale treatment. Aerial bulbils were present for the Weedmaster, Banvel, Remedy with JLB oil, and the check. No aerial bulbils were present at 8 WAT for the Finale and Remedy (with Kinetic and JLB Oil Plus) treatments. A relationship was seen between presence of aerial bulbils and herbicide control of air potato: plants treated with herbicides that had high plant mortality tended not to have aerial bulbils at 8 WAT. These results could be significant from a management perspective. Chemically treating air po-

Table 2. Effect of selected herbicides on aerial bulbil production.

Treatment[1]	Presence of aerial bulbils[2]		Stem number	Stem height (in)
	5 WAT	8 WAT		
Finale (25%)	0.0b[3]	0.0b	2.7b	44.0b
Remedy (25%) + Kinetic (0.1%)	1.0ab	0.0ab	6.0b	7.0b
Remedy (25%) + JLB Oil Plus	1.0ab	0.0ab	2.3b	16.0b
Garlon 3A (25%) + Kinetic (0.1%)	0.7ab	0.7ab	2.7b	36.0b
Garlon 3A (50%) + Kinetic (0.1%)	0.7ab	0.7ab	4.7b	22.0b
Weedmaster (25%) + JLB Oil Plus	1.0a	1.0a	10.0b	75.0b
Banvel (25%) + JLB Oil Plus	1.0a	1.0a	13.7ab	104.0ab
Roundup (25%) + Kinetic (0.1%)	0.3ab	0.3ab	3.0b	28.0b
Check	1.0a	1.0a	26.0a	196.0a

[1] Treatments were applied August 1, 1997.
[2] Absence of aerial tubers = 0, presence = 1.
[3] Within columns, means followed by the same letter are not significantly different by an ANOVA protected LSD test ($P \leq 0.05$).

tato prior to or shortly after the initiation of aerial tubers can arrest tuber production and reduce the plant's ability to spread. Research is needed to determine the optimum time to chemically treat air potato so high plant mortality occurs and aerial tuber production is eliminated.

In April of 1998, all plots had initiated new vines (Table 3). However, there was a reduction in the number of vines from the herbicide treated plots compared to the check plots. Numbers of new vines from all the herbicide treated plots, except Banvel, were significantly lower than the check. No measurement of below-ground tubers was recorded to determine possible effects from the herbicide treatments. In addition, stem height was significantly less for the treated plots, except Banvel, compared to the check (Table 3). Overall, there were fewer vines from tubers in the herbicide treated areas and those vines were less vigorous compared to the check areas. Reasons for this decline are not known. It is possible that the herbi-

Table 3. Effect of selected herbicides on air potato stem production from tubers during the spring season.

Treatment[1]	Stem number[2]	Stem height (in)
Finale (25%)	2.6b[3]	44b
Remedy (25%) + Kinetic (0.1%)	6.0b	7b
Remedy (25%) + JLB Oil Plus	2.3b	16b
Garlon 3A (25%) + Kinetic (0.1%)	2.6b	36b
Garlon 3A (50%) + Kinetic (0.1%)	4.6b	22b
Weedmaster (25%) + JLB Oil Plus	10b	75b
Banvel (25%) + JLB Oil Plus	13.6ab	104ab
Roundup (25%) + Kinetic (0.1%)	3.0b	28b
Check	26.0a	196a

[1] Treatments were applied August 1, 1997.
[2] Stem measurements were recorded at 37 WAT.
[3] Within columns, means followed by the same letter are not significantly different, by an ANOVA protected LSD test ($P \leq 0.05$).

cide resulted in mortality of the below-ground tubers, thus reducing the "tuber bank."

Aerial bulbils were collected from August through October to document development (size). In early August, the average bulbil diameter was 13.3 mm. At the last collection period in October, the average diameter was 31 mm. Aerial bulbils were noticed dropping to the ground in November and December. A subset of bulbils was planted in pots containing potting mix. Pots were irrigated as needed in the greenhouse and sprouting from the bulbils was recorded. Most sprouting did not occur until the following spring season (March-April). In the field, sprouting of new vines from below-ground tubers was observed to occur in early April. No sprouting was observed from November through March. The cause of early spring season sprouting may be related to temperature or photoperiod.

Summary

Successful (95%) control of air potato resulted from the application of Roundup, Remedy, and Garlon 3A. Vines treated with Remedy did not have any aerial tubers by 8 WAT. Production of new vines the following spring season tended to be less in herbicide treatments that provided high (95%) control. Land managers should choose a herbicide that provides high plant mortality, arrests aerial bulbil production, and reduces the production of new vines from below-ground tubers the following growing season. In this study, Remedy performed the best relative to plant mortality and impacts on reproduction and spread. Herbicide applications over a two to three year period will likely be required to remove air potato. Additional research is needed to evaluate different rates and time of application of Remedy and Garlon 3A to provide economical control while minimizing non-target damage to desirable plants.

Literature Cited

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