SFNMC Contact Meeting

Little Rock, Arkansas

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2023 Arkon™ Bareroot Pine Trial Results

2024 Arkon™ Bareroot Pine Trial Updates

Nina Dowling Payne

2023 Arkon™ Bareroot Pine Trial Results

Purpose

Methods

Results

Conclusions

Purpose of trial

- To test Arkon™ for its suitability for use in weed control in bareroot pine seedlings

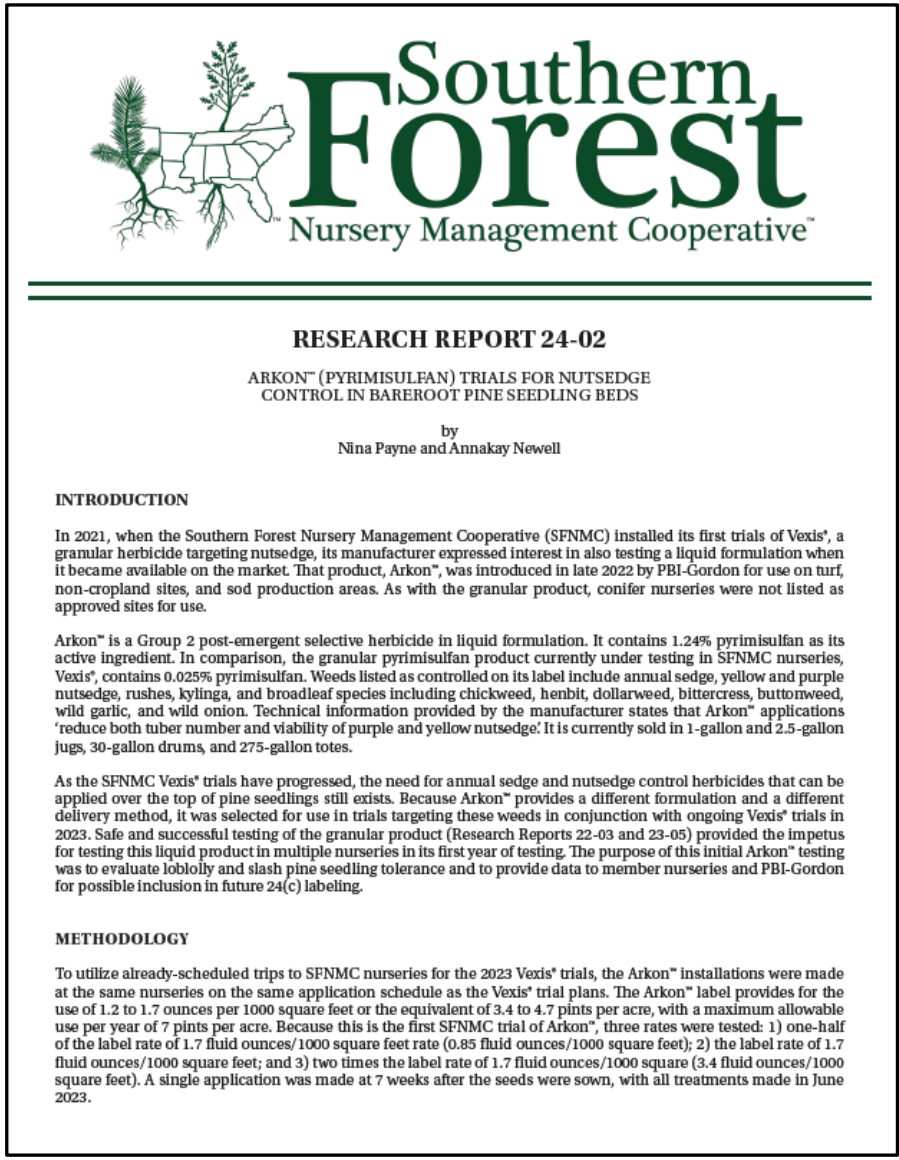
- Arkon™:
  - Liquid
  - 1.24% pyrimisulfan
  - Post-emergent
  - Annual sedge, purple and yellow nutsedge, rush, broadleaf weeds
  - Labeled for turf, sod production, non-cropland sites, *not conifer nurseries*

- SFNMC Arkon™ history:
  - First SFNMC trial in bareroot pine
  - Three years of testing Vexis® (0.025% pyrimisulfan) in bareroot pine (2021-2023)

Results of 2023 Arkon™ Bareroot Pine Trials

Methods

- Trials in ArborGen Shellman, GA Nursery, PRT-IFCO Pine Hill, AL Nursery and Weyerhaeuser Quail Ridge Nursery, Aiken, SC
- Trials in loblolly and slash pine
- 4 rates: 0, 1/2X, 1X, and 2X label rate
- Single applications made on each species at 7 weeks post-sowing
- 10-foot plots used for each rate; 5 replications per species
- Collected all seedlings within a 9-inch by 4-foot counting frame in each plot and took measurements of seedling quality
- Results in Research Report 24-02



Southern Forest Nursery Management Cooperative

RESEARCH REPORT 24-02

ARKON™ (PYRIMISULFAN) TRIALS FOR NUTSEDGE CONTROL IN BAREROOT PINE SEEDLING BEDS

by
Nina Payne and Annakay Newell

INTRODUCTION

In 2021, when the Southern Forest Nursery Management Cooperative (SFNMC) installed its first trials of Vexis®, a granular herbicide targeting nutsedge, its manufacturer expressed interest in also testing a liquid formulation when it became available on the market. That product, Arkon™, was introduced in late 2022 by PBI-Gordon for use on turf, non-cropland sites, and sod production areas. As with the granular product, conifer nurseries were not listed as approved sites for use.

Arkon™ is a Group 2 post-emergent selective herbicide in liquid formulation. It contains 1.24% pyrimisulfan as its active ingredient. In comparison, the granular pyrimisulfan product currently under testing in SFNMC nurseries, Vexis®, contains 0.025% pyrimisulfan. Weeds listed as controlled on its label include annual sedge, yellow and purple nutsedge, rushes, kylinga, and broadleaf species including chickweed, henbit, dollarweed, bittercress, buttonweed, wild garlic, and wild onion. Technical information provided by the manufacturer states that Arkon™ applications 'reduce both tuber number and viability of purple and yellow nutsedge.' It is currently sold in 1-gallon and 2.5-gallon jugs, 30-gallon drums, and 275-gallon totes.

As the SFNMC Vexis® trials have progressed, the need for annual sedge and nutsedge control herbicides that can be applied over the top of pine seedlings still exists. Because Arkon™ provides a different formulation and a different delivery method, it was selected for use in trials targeting these weeds in conjunction with ongoing Vexis® trials in 2023. Safe and successful testing of the granular product (Research Reports 22-03 and 23-05) provided the impetus for testing this liquid product in multiple nurseries in its first year of testing. The purpose of this initial Arkon™ testing was to evaluate loblolly and slash pine seedling tolerance and to provide data to member nurseries and PBI-Gordon for possible inclusion in future 24(c) labeling.

METHODOLOGY

To utilize already-scheduled trips to SFNMC nurseries for the 2023 Vexis® trials, the Arkon™ installations were made at the same nurseries on the same application schedule as the Vexis® trial plans. The Arkon™ label provides for the use of 1.2 to 1.7 ounces per 1000 square feet or the equivalent of 3.4 to 4.7 pints per acre, with a maximum allowable use per year of 7 pints per acre. Because this is the first SFNMC trial of Arkon™, three rates were tested: 1) one-half of the label rate of 1.7 fluid ounces/1000 square feet rate (0.85 fluid ounces/1000 square feet); 2) the label rate of 1.7 fluid ounces/1000 square feet; and 3) two times the label rate of 1.7 fluid ounces/1000 square (3.4 fluid ounces/1000 square feet). A single application was made at 7 weeks after the seeds were sown, with all treatments made in June 2023.

Results – loblolly pine

Table 1. Bareroot loblolly pine seedling characteristics treated with pyrimisulfan (Arkon™) at 7 weeks post-sowing on June 2, 2023, at Weyerhaeuser Quail Ridge Nursery, Aiken, SC.

Treatment	Rate (ounces/ 1000 ft^2)	Density (seedlings/ft^2)	Shoot height (cm)	Root collar diameter (mm)	Shoot dry weight (g)	Root dry weight (g) [1,2]
Control	0.0	31.7 ± 0.96	28.0 ± 0.26	4.45 ± 0.04	2.24 ± 0.10	0.42 ± 0.02 b
½ label rate	0.85	33.3 ± 0.97	28.0 ± 0.27	4.40 ± 0.05	2.25 ± 0.05	0.44 ± 0.02 ab
1X label rate	1.7	33.1 ± 0.66	27.8 ± 0.28	4.45 ± 0.04	2.35 ± 0.05	0.47 ± 0.02 ab
2X label rate	3.4	31.9 ± 0.62	28.0 ± 0.25	4.43 ± 0.05	2.39 ± 0.08	**0.50 ± 0.02** a
p>f		*0.422*	*0.938*	*0.850*	*0.389*	*0.044*

[1]Bold within a seedling characteristic indicates significant difference between that rate and control.
[2]Different letters within a seedling characteristic indicate significant differences in rates.

Results – loblolly pine

Table 2. Bareroot loblolly pine seedling characteristics treated with pyrimisulfan (Arkon™) at 7 weeks post-sowing on June 17, 2023, at PRT-IFCO Pine Hill Nursery, Camden, AL.

Treatment	Rate (ounces/ 1000 ft^2)	Density (seedlings/ft^2)	Shoot height (cm)	Root collar diameter (mm)	Shoot dry weight (g)	Root dry weight (g)
Control	0.0	21.7 ± 2.60	29.6 ± 0.32	5.27 ± 0.06	3.35 ± 0.17	0.72 ± 0.05
½ label rate	0.85	25.4 ± 0.54	29.5 ± 0.32	5.44 ± 0.18	3.47 ± 0.08	0.72 ± 0.03
1X label rate	1.7	25.7 ± 1.07	30.0 ± 0.30	5.51 ± 0.06	3.73 ± 0.12	0.76 ± 0.04
2X label rate	3.4	24.6 ± 0.77	29.4 ± 0.31	5.62 ± 0.15	3.86 ± 0.15	0.85 ± 0.04
p>f		*0.255*	*0.467*	*0.239*	*0.062*	*0.095*

Results – loblolly pine (not top-clipped during the growing season)

Table 3. Bareroot loblolly pine seedling characteristics treated with pyrimisulfan (Arkon™) at 7 weeks post-sowing on June 8, 2023, at ArborGen Nursery, Shellman, GA.

Treatment	Rate (ounces/ 1000 ft²)	Density (seedlings/ft²)	Shoot height (cm) [1,2]	Root collar diameter (mm) [1,2]	Shoot dry weight (g) [1,2]	Root dry weight (g)
Control	0.0	16.4 ± 0.78	29.4 ± 0.38 a	6.53 ± 0.10 a	5.03 ± 0.12 a	1.19 ± 0.01
½ label rate	0.85	17.4 ± 0.62	**22.0 ± 0.32** b	**6.04 ± 0.19** b	**3.41 ± 0.16** b	1.00 ± 0.04
1X label rate	1.7	17.1 ± 0.73	**21.7 ± 0.41** b	**5.72 ± 0.10** b	**3.29 ± 0.30** b	1.01 ± 0.07
2X label rate	3.4	18.8 ± 1.01	**22.9 ± 0.34** b	**5.98 ± 0.10** b	**3.67 ± 0.17** b	1.05 ± 0.06
p>f		*0.233*	*<0.001*	*<0.001*	*<0.001*	*0.043*

[1]Bold within a seedling characteristic indicates significant difference between that rate and control.
[2]Different letters within a seedling characteristic indicate significant differences in rates.

Results – slash pine

Table 4. Bareroot slash pine seedling characteristics treated with pyrimisulfan (Arkon™) at 7 weeks post-sowing on June 2, 2023, at Weyerhaeuser Quail Ridge Nursery, Aiken, SC.

Treatment	Rate (ounces/ 1000 ft^2)	Density (seedlings/ft^2)	Shoot height (cm)	Root collar diameter (mm)	Shoot dry weight (g)	Root dry weight (g) [1,2]
Control	0.0	18.1 ± 0.44	29.7 ± 0.21	5.84 ± 0.06	4.06 ± 0.16	0.78 ± 0.02 a
½ label rate	0.85	18.5 ± 0.34	29.4 ± 0.18	5.91 ± 0.06	3.98 ± 0.12	0.86 ± 0.01 ab
1X label rate	1.7	18.8 ± 0.76	29.6 ± 0.21	5.85 ± 0.07	3.94 ± 0.11	**0.90 ± 0.02** bc
2X label rate	3.4	17.8 ± 0.51	29.0 ± 0.20	6.32 ± 0.28	4.27 ± 0.10	**0.97 ± 0.03** c
p>f		*0.583*	*0.073*	*0.064*	*0.267*	*<0.001*

[1]Bold within a seedling characteristic indicates significant difference between that rate and control.
[2]Different letters within a seedling characteristic indicate significant differences in rates.

Results – slash pine

Table 5. Bareroot slash pine seedling characteristics treated with pyrimisulfan (Arkon™) at 7 weeks post-sowing on June 17, 2023, at PRT-IFCO Pine Hill Nursery, Camden, AL.

Treatment	Rate (ounces/ 1000 ft^2)	Density (seedlings/ft^2)	Shoot height (cm) [2]	Root collar diameter (mm) [1,2]	Shoot dry weight (g)	Root dry weight (g)
Control	0.0	23.2 ± 0.75	26.0 ± 0.32 ab	5.76 ± 0.08 b	4.36 ± 0.16	0.95 ± 0.05
½ label rate	0.85	21.3 ± 1.10	24.7 ± 0.34 a	5.90 ± 0.15 ab	4.55 ± 0.31	0.98 ± 0.07
1X label rate	1.7	20.0 ± 0.95	25.1 ± 0.37 a	6.06 ± 0.08 ab	4.82 ± 0.13	1.05 ± 0.03
2X label rate	3.4	19.8 ± 1.27	26.6 ± 0.35 b	**6.34 ± 0.19** a	5.13 ± 0.24	1.13 ± 0.05
p>f		*0.117*	*<0.001*	*0.014*	*0.119*	*0.099*

[1]Bold within a seedling characteristic indicates significant difference between that rate and control.
[2]Different letters within a seedling characteristic indicate significant differences in rates.

Results – slash pine

Table 6. Bareroot slash pine seedling characteristics treated with pyrimisulfan (Arkon™) at 7 weeks post-sowing on June 8, 2023, at ArborGen Nursery, Shellman, GA.

Treatment	Rate (ounces/ 1000 ft^2)	Density (seedlings/ft^2)	Shoot height (cm) [1,2]	Root collar diameter (mm)	Shoot dry weight (g)	Root dry weight (g)
Control	0.0	31.3 ± 1.06	25.4 ± 0.16 a	5.54 ± 0.06	3.08 ± 0.13	0.86 ± 0.04
½ label rate	0.85	29.9 ± 0.74	25.1 ± 0.20 a	5.63 ± 0.22	3.15 ± 0.17	0.93 ± 0.04
1X label rate	1.7	28.7 ± 0.48	**24.3 ± 0.22** b	5.46 ± 0.06	3.20 ± 0.12	0.95 ± 0.02
2X label rate	3.4	30.1 ± 0.98	**23.9 ± 0.20** b	5.42 ± 0.07	3.06 ± 0.07	0.93 ± 0.03
p>f		*0.237*	*<0.001*	*0.601*	*0.857*	*0.264*

[1]Bold within a seedling characteristic indicates significant difference between that rate and control.
[2]Different letters within a seedling characteristic indicate significant differences in rates.

Conclusions

- Second year of testing of Arkon™ in bareroot loblolly and slash pine showed good seedling tolerance
- Additional attention should be paid to the effect of Arkon™ on seedling height in future trials
- Additional Arkon™ testing in bareroot loblolly and slash pine (at least 1 more year) will need to be completed before initiation of 24(c) application process

Results of 2023 Arkon™ Bareroot Pine Trials

PYRIMISULFAN | GROUP 2 | HERBICIDE

ARKON
HERBICIDE LIQUID

Not for sale, distribution or use in Nassau or Suffolk Counties in New York State.

ACTIVE INGREDIENT:
Pyrimisulfan 1.24%
OTHER INGREDIENTS: 98.76%
TOTAL 100.00%

THIS PRODUCT CONTAINS:
0.103 lb. Pyrimisulfan per gallon or 1.24%

KEEP OUT OF REACH OF CHILDREN
CAUTION

STOP! **READ THE ENTIRE LABEL FIRST. OBSERVE ALL PRECAUTIONS AND FOLLOW DIRECTIONS CAREFULLY.**

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals
CAUTION: Harmful if swallowed. Causes moderate eye irritation. Avoid contact with eyes or clothing. Remove and wash contaminated clothing before reuse. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.

First Aid	
If swallowed:	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to an unconscious person.
If in eyes:	• Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact 1-877-800-5556 for emergency medical treatment information.	

Personal Protective Equipment (PPE)
All mixers, loaders, and applicators and other handlers must wear:
- Chemical resistant gloves made of barrier laminate, butyl rubber (≥ 14 mils), nitrile rubber (≥ 14 mils), neoprene rubber (≥ 14 mils), polyvinyl chloride (PVC) (≥ 14 mils), or viton (≥ 14 mils),
- Long-sleeved shirt and long pants, and
- Shoes plus socks.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Controls
When handlers use closed systems or enclosed cabs in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations
Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Removing clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Environmental Hazards
Do not apply to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater or rinsate.

Groundwater Advisory: This chemical has properties and characteristics associated with chemicals detected in groundwater. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination.

Surface Water Advisory: This product has a potential for reaching surface water via runoff after application. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of pyrimisulfan from runoff water. Runoff of this product will be reduced by avoiding applications when heavy rainfall or irrigation is expected to occur within 48 hours.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

Agricultural Use Requirements
Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170.

This standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 12 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water is:
- coveralls,
- chemical-resistant gloves made of any water-proof material,
- shoes plus socks

Non-Agricultural Use Requirements
The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

Do not enter or allow people (or pets) to enter the treated area until spray has dried.

1. Product Description
Arkon Herbicide Liquid is a selective herbicide for post-emergent control of listed broadleaf weeds, sedges, kyllinga, and rush species commonly found in turfgrasses. It can be used on established warm-season turfgrasses (including improved varieties of St. Augustinegrass such as Bitterblue and Floratam) and cool-season turfgrasses. Fall applications provide improved control of winter weeds such as henbit, false dandelion, ground ivy (creeping charlie), and chickweed.

2. Resistance Management
For resistance management, this product contains Group 2 herbicide. Any weed population may contain or develop plants naturally resistant to this product and other Group 2 herbicides. The resistant biotypes may dominate the weed population if these herbicides are used repeatedly in the same area. Appropriate resistance management strategies should be followed.

2024 Arkon™ Bareroot Pine Trial Updates

Purpose

Methods

Purpose and Methods continued from 2023 trials

- SFNMC Arkon™ history: Second SFNMC trial in bareroot pine
- Trials in ArborGen Shellman, GA, Rayonier Elberta, AL Nursery and Weyerhaeuser Pearl River, MS Nursery
- Trials in loblolly and slash pine
- 3 rates: 0, 1X, and 2X label rate (dropped 1/2X rate)
- 2 application timings: 1. at 7 weeks post-sowing
  2. at 7 and 12 weeks post-sowing
- 10-foot plots used for each rate; 5 replications per species
- At first spray, quantified nutsedge, annual sedge, and other weeds bed coverage by estimating 0-20%, 20-50%, 50-80%, or 80-100% coverage
- Seedling samples will be collected from within a 9-inch by 4-foot counting frame in each plot and measured for seedling quality in late 2024/early 2025
- Research report follows data analysis (2025)

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College of Forestry,
Wildlife and Environment

Southern Forest Nursery Management Cooperative

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