Auburn University Southern Forest Nursery Management Cooperative

RESEARCH REPORT 03-01

TRIALS WITH THIAZOPYR ON LOBLOLLY, SLASH, AND LONGLEAF PINE

by
Curtis VanderSchaaf, David B. South, and Tommy Hill

INTRODUCTION

Thiazopyr (Visor®2E) is within the pyridine chemical family and provides preemergence control of certain annual grass and broadleaf weeds. The chemical disrupts cell division by inhibiting mitosis (Ahrens 1994, Chandran and Singh 2000). Preliminary studies were conducted in 2001 using one rate (1 lb. ai/acre) at three nurseries (VanderSchaaf et. al. 2002). No decrease in overall production was observed. However, yellowing occurred at one nursery and root galls were observed on some seedlings. The Coop installed further studies in 2002 to determine if Visor®2E affects seedling growth and appearance at other nurseries.

METHODOLOGY

Nine experiments were installed at eight nurseries during the 2002 growing season (Table 1). Six studies were established in loblolly pine seedbeds, two were applied to slash pine seedlings, and one was conducted in longleaf pine seedbeds. No seedling measurements were conducted for the Shubuta trial.

All studies were installed as randomized complete block designs with five replications except for the longleaf pine study which had only four replications. Plot size was 10-feet long and one bed wide. Treatments included rates of 2, 4, and 8 pints of product per acre. Treatments were applied at two different time periods; generally, 4 weeks after sowing and 8 weeks after sowing. Solutions of the 2EC formulation were applied using a CO_2-backpack sprayer calibrated to apply 28.4 gallons per acre. Seedling densities (i.e. number of seedlings per square foot) were recorded from mid-October to mid-November using a 1' x 4' counting frame. Seedling samples were hand-lifted from drills 2 to 7 of each plot (except for Verbena where samples were obtained from drills 1 to 8) and transported to Auburn for analysis. Heights and root-collar diameters were measured on 25 seedlings per plot. For

the longleaf pine study, all seedlings within the counting frame were measured. Oven-dry weights of shoots and roots were recorded for each sample (longleaf pine only had root analyses). At four nurseries, the number of spurge plants (*Euphorbia* spp.) were counted in each initial application period treatment plot (applied 4 weeks after sowing) and at the time of the second application (8 weeks after sowing). Other nurseries did not contain sufficient amounts of spurge to warrant measurements.

RESULTS

Soil texture information is provided in Table 1. All sites showed significant treatment effects regardless of the timing of treatment except at the Baucum Nursery and for longleaf pine at the Atmore Nursery when thiazopyr was applied 8 weeks after sowing (Tables 2 -17). Generally, as rate increased, height growth decreased, regardless of the time of application. Density showed more inconsistency which also produced more variability in RCD. Dry weights also showed a lot of variability in response to treatment. Thiazopyr appeared to affect seedling production when applied on loamy sands.

Although not quantified, most nurseries had seedlings with galls, especially at the higher rates of thiazopyr. This may have lead to some "false" increases in RCD. Lateral root production was also affected. At many nurseries, the first two inches of the rooting zone below RCD had no lateral roots. At the Verbena Nursery, seedlings treated with the highest rate basically had no lateral roots. Although lateral root production was decreased at most nurseries, it did not greatly affect root dry weight. These same trends were also noted at a test (non-replicated study) in Oklahoma with shortleaf pine. Thiazopyr apparently causes southern yellow pine seedlings to allocate resources to the main taproot and this reduces the production of lateral roots.

Thiazopyr provides fair to excellent control of prostrate spurge depending on the rate of chemical used (Table 18). Although all soil types were sand, we are relatively sure that the same control would occur on heavier soils.

MANAGEMENT IMPLICATIONS

It does not appear that thiazopyr can be used safely in southern pine nurseries. The use of thiazopyr causes gall production, decreases lateral root production, and causes chlorosis.

REFERENCES

Ahrens, W.H. 1994. Herbicide Handbook. 7th ed. Champaign, IL: Weed Science Society of America.

Chandran, R.S., and M. Singh. 2000. Antagonistic effect of thiazopyr on azafenidin to control yellow nutsedge (*Cyperus esculentus*). Weed Technology 14:556-561.

VanderSchaaf, C., D.B. South, and T. Hill. 2002. Preliminary trials with thiazopyr. AUSFNMC Research Report 02-4. Auburn University. Auburn, AL.

Table 1. Soil textures, organic matter and soil acidity levels at three nurseries.

Nursery	Species	Texture	Sand %	Silt %	Organic matter %	pH	Sowing Date	Treatment date (4 weeks)	Treatment date (8 weeks)
Archer	loblolly	sand	94	6	1.0	5.6	April 29	June 11	July 16
Baucum	loblolly	silt loam	41	54	1.0	4.7	May 5	June 3	July 2
Verbena	loblolly	loamy sand	87	12	1.1	4.4	April 22	May 15	June 20
Elberta	loblolly	loamy sand	85	10	0.7	5.1	April 20	June 12	July 17
Shubuta	loblolly	sand	97	2	0.7	5.4	April 10	May 14	June 19
Trenton	loblolly	sand	91	7	0.4	6.2	April 8	May 21	June 24
Atmore	slash	sandy loam	60	27	2.3	5.5	April 18	June 5	July 17
Flint River	slash	sand	88	7	0.4	6.3	April 21	May 23	June 25
Atmore	longleaf	-	-	-	-	-	April 18	June 5	July 17

Table 2. Morphological characteristics for loblolly pine seedlings lifted on November 13 at the Archer Nursery (seedlings treated in June).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	21.2	5.7	31.0	0.84	4.41	131.16
0.5	21.4	5.5	31.5	0.89	4.16	126.19
1	20.3	6.1	31.0	0.97	4.36	133.15
2	19.2	5.9	27.5	0.99	4.11	127.31
(LSD)	1.764	0.415	2.832	0.145	0.605	15.520
P > F-value	0.072	0.066	0.036	0.151	0.640	0.743
Linear	0.191	0.771	0.020	0.966	0.572	0.588
Quadratic	0.021	0.014	0.059	0.036	0.808	0.762
Lack-of-fit	0.894	0.316	0.633	0.398	0.270	0.375

Table 3. Morphological characteristics for loblolly pine seedlings lifted on November 13 at the Archer Nursery (seedlings treated in July).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	22.0	4.5	31.3	0.69	3.78	111.86
0.5	22.3	4.6	31.3	0.76	4.16	122.91
1	22.0	4.6	31.3	0.69	3.92	115.24
2	21.9	5.0	31.2	0.73	4.13	121.55
(LSD)	2.744	0.287	1.611	0.096	0.410	11.850
P > F-value	0.992	0.025	1.000	0.326	0.207	0.193
Linear	0.883	0.033	0.947	0.667	0.676	0.655
Quadratic	0.869	0.037	0.940	0.636	0.685	0.798
Lack-of-fit	0.844	0.168	0.973	0.090	0.046	0.041

Table 4. Morphological characteristics for loblolly pine seedlings lifted on October 23 at the Baucum Nursery (seedlings treated in June).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	25.6	4.0	26.0	0.36	2.49	71.22
0.5	24.1	4.2	26.4	0.35	2.58	73.15
1	25.6	4.2	25.5	0.37	2.74	77.85
2	21.6	4.3	25.2	0.38	2.87	81.19
(LSD)	5.283	0.252	1.469	0.099	0.536	15.460
P > F-value	0.343	0.153	0.341	0.922	0.437	0.512
Linear	0.188	0.997	0.550	0.866	0.708	0.725
Quadratic	0.480	0.075	0.098	0.573	0.140	0.169
Lack-of-fit	0.295	0.140	0.764	0.747	0.605	0.691

Table 5. Morphological characteristics for loblolly pine seedlings lifted on October 23 at the Baucum Nursery (seedlings treated in July).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	27.8	3.9	27.2	0.33	2.41	68.52
0.5	26.9	4.0	26.5	0.37	2.40	69.37
1	26.7	4.2	26.4	0.34	2.46	69.93
2	21.6	4.5	24.3	0.36	2.76	78.11
(LSD)	3.143	0.205	1.667	0.090	0.438	11.710
P > F-value	0.004	0.000	0.014	0.739	0.278	0.298
Linear	0.009	0.010	0.044	0.807	0.176	0.189
Quadratic	0.009	0.000	0.015	0.968	0.176	0.207
Lack-of-fit	0.122	0.023	0.117	0.293	0.662	0.540

Table 6. Morphological characteristics for loblolly pine seedlings lifted on October 15 at the Verbena Nursery (seedlings treated in May).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	23.4	3.8	30.6	0.20	2.72	73.03
0.5	16.1	4.0	29.2	0.35	3.12	86.62
1	10.8	4.3	25.4	0.41	3.06	86.63
2	4.1	3.9	18.1	0.33	1.75	30.84
(LSD)	4.012	0.533	3.556	0.098	0.835	27.890
P > F-value	0.000	0.123	0.000	0.005	0.013	0.003
Linear	0.048	0.021	0.000	0.019	0.004	0.001
Quadratic	0.000	0.853	0.000	0.014	0.082	0.038
Lack-of-fit	0.000	0.961	0.018	0.024	0.918	0.717

Table 7. Morphological characteristics for loblolly pine seedlings lifted on October 15 at the Verbena Nursery (seedlings treated in June).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	20.2	3.8	30.8	0.22	2.88	77.32
0.5	18.4	4.1	31.0	0.28	3.11	84.88
1	16.8	4.3	28.8	0.32	2.95	81.78
2	13.7	4.6	24.2	0.30	2.68	74.55
(LSD)	2.718	0.388	3.121	0.060	0.433	12.200
P > F-value	0.002	0.005	0.001	0.014	0.241	0.306
Linear	0.087	0.530	0.009	0.142	0.126	0.124
Quadratic	0.001	0.002	0.001	0.009	0.229	0.473
Lack-of-fit	0.053	0.056	0.398	0.070	0.493	0.400

Table 8. Morphological characteristics for loblolly pine seedlings lifted on October 16 at the Elberta Nursery (seedlings treated in June).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	15.9	5.2	29.8	0.61	4.22	120.75
0.5	15.5	5.0	30.3	0.52	4.18	116.44
1	17.7	4.9	30.1	0.53	3.45	99.56
2	14.4	5.6	27.8	0.63	3.77	109.87
(LSD)	2.133	0.340	1.593	0.161	0.674	19.750
P > F-value	0.034	0.004	0.021	0.385	0.087	0.158
Linear	0.009	0.001	0.009	0.128	0.331	0.242
Quadratic	0.622	0.146	0.064	0.756	0.019	0.051
Lack-of-fit	0.181	0.849	0.730	0.474	0.856	0.929

Table 9. Morphological characteristics for loblolly pine seedlings lifted on October 16 at the Elberta Nursery (seedlings treated in July).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	16.5	4.7	30.1	0.55	3.57	102.91
0.5	16.8	4.9	30.4	0.55	4.01	114.06
1	17.5	4.9	29.9	0.58	3.56	103.51
2	15.9	5.2	28.3	0.66	3.41	101.68
(LSD)	2.313	0.274	0.919	0.157	0.568	16.900
P > F-value	0.548	0.012	0.001	0.398	0.169	0.390
Linear	0.166	0.053	0.003	0.296	0.289	0.510
Quadratic	0.922	0.014	0.002	0.200	0.124	0.304
Lack-of-fit	0.850	0.068	0.632	0.679	0.182	0.222

Table 10. Morphological characteristics for loblolly pine seedlings lifted on November 21 at the Trenton Nursery (seedlings treated in May).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	25.6	4.7	27.7	0.70	3.27	99.31
0.5	24.1	4.8	27.2	0.85	3.44	107.33
1	25.6	5.1	28.3	0.85	3.37	105.54
2	21.6	5.4	23.3	0.76	2.82	89.49
(LSD)	5.283	0.377	2.529	0.142	0.482	14.890
P > F-value	0.343	0.005	0.004	0.121	0.061	0.087
Linear	0.188	0.106	0.002	0.072	0.022	0.023
Quadratic	0.480	0.002	0.068	0.544	0.121	0.253
Lack-of-fit	0.295	0.188	0.100	0.118	0.969	0.717

Table 11. Morphological characteristics for loblolly pine seedlings lifted on November 21 at the Trenton Nursery (seedlings treated in June).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	27.8	4.7	28.6	0.71	3.47	104.53
0.5	26.9	5.5	28.4	0.83	3.53	108.97
1	26.7	5.6	27.4	0.85	3.66	112.76
2	21.6	6.7	24.4	0.79	3.53	108.08
(LSD)	3.143	0.375	2.772	0.104	0.561	15.760
P > F-value	0.004	0.000	0.022	0.055	0.901	0.731
Linear	0.009	0.001	0.047	0.068	0.602	0.435
Quadratic	0.009	0.000	0.014	0.163	0.606	0.487
Lack-of-fit	0.122	0.000	0.373	0.073	0.954	0.713

Table 12. Morphological characteristics for slash pine seedlings lifted on October 17 at the Atmore Nursery (seedlings treated in June).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	22.5	4.0	27.4	0.43	3.14	89.23
0.5	21.4	4.2	26.3	0.51	3.27	94.54
1	20.3	4.3	24.8	0.51	3.22	93.42
2	20.3	4.6	24.5	0.50	3.26	94.01
(LSD)	1.725	0.152	1.537	0.050	0.340	9.370
P > F-value	0.043	0.000	0.004	0.012	0.828	0.606
Linear	0.654	0.032	0.944	0.155	0.953	0.800
Quadratic	0.011	0.000	0.001	0.052	0.737	0.558
Lack-of-fit	0.193	0.001	0.133	0.008	0.400	0.247

Table 13. Morphological characteristics for slash pine seedlings lifted on October 17 at the Atmore Nursery (seedlings treated in July).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	22.2	4.5	27.8	0.51	3.56	101.71
0.5	22.1	4.6	26.5	0.61	3.66	106.82
1	22.2	4.5	26.4	0.46	3.08	88.60
2	22.1	4.8	25.7	0.51	3.46	99.12
(LSD)	3.299	0.258	2.777	0.083	0.654	17.490
P > F-value	1.000	0.063	0.483	0.014	0.284	0.196
Linear	0.992	0.059	0.857	0.770	0.303	0.318
Quadratic	0.982	0.142	0.262	0.019	0.132	0.092
Lack-of-fit	0.943	0.124	0.296	0.011	0.491	0.329

Table 14. Morphological characteristics for slash pine seedlings lifted on October 29 at the Flint River Nursery (seedlings treated in May).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	22.3	3.2	24.5	0.27	2.01	57.10
0.5	20.4	3.6	22.1	0.37	1.99	58.97
1	20.3	3.6	21.0	0.40	1.91	57.56
2	14.8	4.3	17.6	0.53	1.96	62.32
(LSD)	1.722	0.421	2.435	0.079	0.387	10.460
P > F-value	0.000	0.001	0.000	0.000	0.933	0.701
Linear	0.000	0.014	0.045	0.022	0.735	0.431
Quadratic	0.000	0.001	0.000	0.000	0.591	0.585
Lack-of-fit	0.001	0.015	0.011	0.003	0.995	0.507

Table 15. Morphological characteristics for slash pine seedlings lifted on October 29 at the Flint River Nursery (seedlings treated in June).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Height (cm)	Root (g)	Shoot (g)	Total dry weight (g/sq ft)
0	23.7	3.5	29.4	0.34	2.11	61.45
0.5	22.3	3.8	28.8	0.41	2.43	71.13
1	22.6	4.1	27.4	0.54	2.46	75.16
2	21.7	4.7	23.5	0.46	2.24	67.43
(LSD)	1.470	0.230	1.519	0.096	0.382	11.620
P > F-value	0.060	0.000	0.000	0.005	0.203	0.120
Linear	0.569	0.001	0.000	0.042	0.097	0.075
Quadratic	0.092	0.000	0.000	0.002	0.550	0.209
Lack-of-fit	0.030	0.000	0.022	0.398	0.212	0.231

Table 16. Morphological characteristics for longleaf pine seedlings lifted on October 17 at the Atmore Nursery (seedlings treated in June).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Root (g)
0	6.0	9.0	1.84
0.5	7.3	8.1	1.29
1	6.2	8.4	1.65
2	6.5	8.0	1.49
(LSD)	1.948	0.701	1.181
P > F-value	0.516	0.052	0.762
Linear	0.911	0.848	0.963
Quadratic	0.655	0.209	0.991
Lack-of-fit	0.170	0.013	0.307

Table 17. Morphological characteristics for longleaf pine seedlings lifted on October 17 at the Atmore Nursery (seedlings treated in July).

Thiazopyr Rate lbs. ai/acre	Density (#/sq ft)	RCD (mm)	Root (g)
0	6.2	9.3	1.47
0.5	7.1	9.4	1.63
1	6.8	9.7	1.58
2	7.1	9.8	1.61
(LSD)	1.732	0.906	0.444
P > F-value	0.641	0.723	0.856
Linear	0.960	0.987	0.929
Quadratic	0.578	0.312	0.746
Lack-of-fit	0.265	0.663	0.442

Table 18. Number of spurge plants generally at four weeks after the initial treatment within the 10' treatment plot for four sites.

Thiazopyr Rate lbs. ai/acre	Flint River	Trenton	Shubuta	Archer
0	12.4	11.2	10.2	2.4
0.5	7.8	3.8	1.2	2.0
1	2.4	1.6	0	0.2
2	0	0.2	0	0
(LSD)	3.466	3.793	4.986	1.697
P > F-value	0.000	0.000	0.002	0.018
Linear	0.000	0.000	0.001	0.003
Quadratic	0.347	0.031	0.015	0.859
Lack-of-fit	0.465	0.440	0.394	0.247