

Georgia Forestry Commission

Research
REPORT

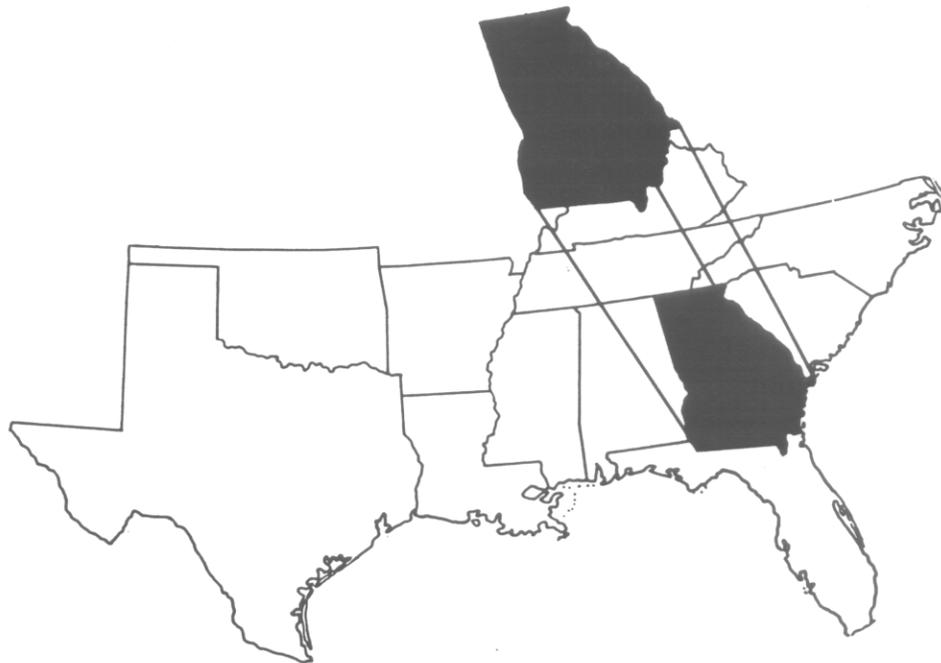
No. 3

AUGUST, 1988

**LEGUMES FOR MULCH IN
TREE NURSERIES**

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ABSTRACT

Experiments were conducted at the Morgan Nursery near Byron, Georgia for four years to study the potential for utilizing winter annual legume mulches as a cheaper replacement for Hydromulch in establishment of pine tree seedlings. Winter annual legumes and grasses were generally effective in protecting planting beds from soil erosion but production of too much herbage prevented the presently used tree seed planter from placing pine seed in direct contact with the soil. Pine stands with plant mulches were poor and unsatisfactory as compared to Hydromulch, pine bark, wheat straw, or sand. If plant mulches are to be successful, planter modifications will be needed to improve seed-soil contact.

INTRODUCTION

Pine tree seedlings are raised by the Georgia Forestry Commission at a number of nurseries in the State. It is a common practice to apply Hydromulch or pine straw on planting beds to reduce soil erosion, reduce soil crusting, and protect tree seeds during germination and early seedling growth. Approximately 1 ton per acre of Hydromulch or chopped pine straw are currently used. Both of these mulches are expensive and a cheaper mulch is needed to reduce cost of pine seedling production.

Winter annual legumes, planted in autumn, and killed with a herbicide before planting pine tree seed in April, might provide suitable low-cost mulch. Winter annual legume mulches would allow land preparation and building of seedbeds in September rather than risking land preparation in March or April when excessive rainfall may limit tillage operations. Another advantage of legume mulches would be to supply nitrogen for enhanced tree seedling growth.

The results reported here were obtained in a cooperative research project funded by the Georgia Forestry Commission to investigate the use of legume mulches for pine tree establishment. The research was conducted at the Morgan Nursery near Byron over a 4-year period.

PROCEDURES

Experiments were conducted during the winters of 1982-83, 1983-84, 1984-85, and 1985-86 at the Morgan Nursery on a Faceville sandy loam soil. A Randomized complete block design with 4 x 30 foot plots and four replications was used. Various winter annual legumes or grasses and planting methods were compared with chopped pine straw mulch, Hydromulch, and no mulch fumigated beds. Entries varied from year to year depending on results of the previous year but consisted of the following:

Mulch treatments:

	Seeding rate		
	6-inch rows	12-inch rows	Broadcast
Auburn crimson clover	15	--	25
Tibbee crimson clover	20	--	30
Mt Barker subterranean clover	15	--	25
Bigbee berseem clover	15	--	--
Yuchi arrowleaf clover	10	--	--
Regal ladino clover	5	--	--
Redland II red clover	15	--	--
Hairy vetch	30	20	--
Cahaba White vetch	35	20	--
Marshall annual ryegrass	20	--	--
Wintergrazer rye	90	--	--
Hydromulch at 1 ton/acre			
Wheat straw at 5 tons/acre			
Pine bark at 5 tons/acre			
Pine straw at 1 ton/acre			
Sand mulch to cover the pine seed			
Herbicides used to kill mulch plants in spring:			
Paraquat at 2 quarts/acre + surfactant at 1/2% of solution			
Roundup at 3 quarts/acre + surfactant at 1/2% of solution			

Planting was done in October each year on beds fertilized with 550 lb/acre 5-5-15 fertilizer. Broadcast-seeded legumes were raked into the soil and cultipacked. Row-planted legumes and grasses were planted at a depth of 1/4 to 1/2 inch deep with a Planet Jr. planter. Plant stands and ground cover were rated several times during the winter. Prior to application of herbicides, two 1-square foot quadrats were harvested from each plot and dried to determine herbage production. Herbicides were applied in mid-March to kill the plant mulch. Ratings of herbicide kill were made. Pine seed were planted 1/4 inch deep in 6-inch rows during April. Irrigation water was applied as needed to insure stand establishment in autumn.

RESULTS

Winter 1982-83

Excellent stands were obtained on all legumes. Nearly complete ground cover was obtained by December 8 with Tibbee crimson clover, Cahaba White vetch in 6-inch rows, and hairy vetch (Table 1). By February 15, ground cover was adequate on all legumes except berseem clover, probably because of its erect growth habit. All legumes except subterranean clover were quite tall by April. Beds were well protected by all legumes except berseem clover. The amount of herbage produced was very large and much greater than desired for just protecting the beds and furnishing mulch. Removal of the heavy growth with a mower would be necessary for planting.

Excellent kill of both vetch species was obtained with both Paraquat and Roundup herbicides (Table 2). Crimson and berseem clovers had somewhat less kill than the vetches. Paraquat appeared to be slightly more effective than Roundup. Unexpected was the tolerance of subterranean clover to both herbicides. A second application of herbicides was made 2 weeks later but there was no effect on subterranean clover by April 29.

Planting of pine seed was done with a planter on April 29. Excellent stands were obtained with Hydromulch and pine straw, about double that on unmulched beds (Table 2). None of the legume mulched beds had stands equal to the unmulched beds. Subterranean clover was poorest of all, a result of dense low growth and lack of kill by the herbicide.

The reasons for the poor tree seedling stands on legume mulched beds can probably be attributed to the planting method and the large amount of mulch. Pine seed were dropped on the legume mulch surface and remained out of contact with the soil. Removal of the large amount of mulch would be necessary to alleviate this problem. The vetches had the best surface for planting as the plant material was killed quickly by the herbicide and started disintegrating. Penetration of the legume mulch by the planter is needed if the pine seed are to have soil contact. Possibly the use of a rolling coulter mounted ahead of each planter row would cut a slit in the mulch and achieve soil contact with the pine seed.

Winter 1983-84 and 1984-85

Excellent stands were obtained on all clovers and grasses but unusually severe freezes in both winters killed most of the legumes except crimson clover and arrowleaf clover in 1983-84. In 1984-85, all legumes were killed by the freeze and stands of the ryegrass and rye were injured too badly for pine seeding.

Winter 1985-86

Good stands were obtained on most species except Yuchi arrowleaf clovers (Table 3). Rye, ryegrass, and the two vetches grew off fastest. By late March, complete plant cover was present with rye, ryegrass, and crimson clover. Good cover was also provided by hairy vetch and red clover. Ladino clover was poorest.

The mulches differed greatly in protection of the beds over the winter. Rye, ryegrass, and crimson clover provided excellent protection. Arrowleaf, subterranean, and ladino clovers gave poor protection and were little better than unprotected beds.

All mulches had been mowed once in early spring to reduce available mulch. Thus, herbage yields measured in April are lower than in the first year. Even so, ryegrass, rye, and crimson clover had far too much mulch for planting. Herbicide kill by the Roundup was similar to the first year. Subterranean clover again was virtually unaffected by the herbicide.

Planting of the pine seed pointed out again the problems of getting the seed in contact with soil on plant mulched plots. The planter used did not cut through existing plant mulch. To be effective, a rolling coulter would be needed to cut stems and stolons of legumes. Pine stands were best with pine bark mulch. All legume mulches resulted in unsatisfactory pine stands.

CONCLUSIONS

1. Winter annual legume and grass mulches generally protected tree nursery planting beds with rye, ryegrass, and crimson clover providing the best protection.
2. A major problem with plant mulches is production of too much herbage that prevents the presently used tree planter from placing pine tree seed in good contact with the soil. Pine stands with grass and legume mulches were poor and unsatisfactory as compared to Hydromulch, pine bark, wheat straw, or sand.
3. If winter annual plant mulches are to be successful, modifications will need to be made in the tree seed planter to cut the mulch and place the seed in direct contact with the soil.

Table 1. Ground cover, plant height, and herbage yield of plant mulch species on planting beds, winter 1982-83.

<u>Mulch</u>	<u>Planting method</u>	<u>% ground cover</u>		<u>Planting height inches, April 5</u>	<u>Dry herbage yield, ton/acre April 5</u>
		<u>Dec 8</u>	<u>Feb 15</u>		
Tibbee crimson clover	Broadcast	88	99	22	4.1
Tibbee crimson clover	6" Rows	82	95	23	3.4
Auburn crimson clover	Broadcast	59	87	23	3.1
Mt Barker subterranean clover	Broadcast	51	83	12	2.8
Mt Barker subterranean clover	6" Rows	34	77	12	2.6
Bigbee berseem clover	6" Rows	8	36	19	1.8
Hairy vetch	12" Rows	79	98	18	2.4
Cahaba White vetch	6" Rows	85	98	18	3.0
Cahaba White vetch	12" Rows	54	90	19	2.8

Table 2. Percent herbicide kill of plant mulch species and pine seedling stands, winter 1982-83.

<u>Mulch</u>	<u>Planting method</u>	<u>% kill, April 29</u>		<u>Pine seedlings/sq ft</u>	
		<u>Paraquat</u>	<u>Roundup</u>	<u>Roundup</u>	<u>Paraquat</u>
Tibbee crimson clover	Broadcast	87	79	3	4
Tibbee crimson clover	6" Rows	86	81	4	3
Auburn crimson clover	Broadcast	84	74	3	4
Mt Barker subterranean clover	Broadcast	1	14	2	1
Mt Barker subterranean clover	6" Rows	2	2	3	1
Bigbee berseem clover	6" Rows	90	81	4	2
Hairy vetch	12" Rows	100	100	5	3
Cahaba White vetch	6" Rows	100	100	4	4
Cahaba White vetch	12" Rows	100	100	4	6
Hydromulch					14
Pine straw					13
No mulch					7

Table 3. Plant stand, height, plant cover, bed condition, herbage yield, herbicide kill, and pine seedling stand in grass and legume mulches, winter 1985-86.

Mulch	Nov 19		March 27		Dry herbage yield, tons/acre April 15	Roundup herbicide kill, % May 1	Pine seedlings per sq ft June 18
	% stand	Height, inches	% cover	Bed condition*			
Wintergrazer rye	100	8.0	100	4.8	1.9	100	2
Marshall ryegrass	85	5.1	100	4.3	3.0	95	2
Tibbee crimson clover	94	1.5	100	4.3	1.9	90	3
Redland II red clover	99	1.9	85	3.0	0.5	87	4
Yuchi arrowleaf clover	50	1.0	71	2.5	0.6	90	4
Mt Barker subtterranean clover	82	1.5	58	2.3	0.5	6	1
Regal ladino clover	80	1.5	45	1.8	1.4	80	2
Hairy vetch	75	3.8	89	3.3	1.3	100	4
Cahaba White vetch	73	4.9	63	2.8	1.4	100	4
Pine bark				1.8			12
Wheat straw				1.8			9
Sand				1.8			8

*Bed condition is a visual estimate of how usable a bed is for planting without further modification. Almost perfect condition = 5, little or no distinct bed remaining = 1.

Pine bark, wheat straw, and sand were applied when pine seed were planted May 1.

All grasses and legumes were planted in 6-inch rows.



John W. Mixon, Director