OLEORESIN CAPSICUM HAS POTENTIAL AS A RODENT REPELLENT IN DIRECT SEEDING LONGLEAF PINE

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Abstract—Direct seeding of southern pines has been a versatile and inexpensive alternative to planting on many reforestation sites across the South. Successful direct seeding has required that seeds be coated with thiram to repel birds, and with endrin to repel rodents. Endrin, which is extremely toxic, is no longer produced in the United States. Therefore, a substitute is needed. Oleoresin capsicum, a natural substance derived from pepper plants, has potential as a repellent. It occurs in an extremely concentrated form, and its repellency is caused by the heat of the capsicum. Preliminary tests have shown that at low rates oleoresin capsicum had little effect on the germination of longleaf pine (*Pinus palustris* Mill.) seeds, and significantly reduced losses from predation.

INTRODUCTION

Direct seeding is an affordable alternative to planting on many sites needing reforestation of the southern pines. It is also an appropriate supplement to natural regeneration where seedfall is inadequate. Techniques were thoroughly researched during the 1950's and 1960's by Derr and Mann (1971) and the 1970's by Campbell (1981a, 1981b). Studies show that success depends on protection of seeds from birds and rodents (Derr and Mann 1971; Campbell 1981a, 1981b). The recommended formulation of thiram and endrin protects against all important species of seed-eating birds, and deters small mammals common to most southern pine sites. Many field studies, tests with caged animals, and operational seedings have confirmed the repellent properties of these chemicals (Campbell 1981c).

Thiram, a fungicide currently marketed as Gustafson 42-S[R2], is safe, effective, and easy to use. Anthraquinone is almost as effective, but is more difficult to apply because it is a powder. It is, however, a good alternative as a bird repellent.

Endrin, an insecticide, is very toxic. Although still registered as a rodent repellent in forestry due to the small quantities used (Barnett and others 1980), endrin is no longer manufactured in the United States because of the lack of demand. Thus, the continued use of direct seeding in southern forestry may depend on finding a satisfactory substitute.

In a series of tests evaluating potential repellents, Barnett (1995) and Campbell (1981c) could not find an effective replacement. Recently, the substance oleoresin capsicum (OC) has shown promise. For example, it is added to the paint used for hulls of ships to deter barnacles. Oleoresin capsicum, a rust- to red-colored liquid obtained from dried cayenne peppers (*Capsicum frutescens* L.), is standardized with olive oil. The chemical in capsicums that can produce a burning sensation in the mouth is capsaicin. Its strength is measured in parts per million (ppm). These ppm are converted into Scoville Units (SV), the industry standard for measuring the heat of peppers (American Spice Trade Association 1960, Hoffman and Lego 1983). One ppm is equivalent to 15 SV. The material used in this study has an SV of 500,000. Although oleoresin capsicum is a natural and nontoxic chemical derived from pepper plants and is used in many foodstuffs to increase their pungency, it is an irritant to the skin or eyes. Protective gloves and eyewear are recommended when handling this product. The repellancy of capsicum is attributed to its heat. This paper describes initial evaluations of oleoresin capsicum as a rodent repellent for direct seeding.

METHODS

Candidate chemicals for direct seeding must meet these criteria: (1) they must be relatively benign to the seeds, and (2) they must repel the target animals. The first tests described, therefore, measure effects of various formulations of capsicum on germination of longleaf pine (*Pinus palustris* Mill.) seeds.

Lab Tests for Germination

Longleaf pine seeds were chosen for the evaluations because they are the most sensitive of the southern pines to such treatments. Germination was tested under standard laboratory conditions for 28 days (Association of Official Seed Analysts 1980). Results were recorded three times weekly during the periods of peak germination. Three replications of 100-seed samples from each treatment replication were tested. The seed treatments used were: an untreated control; thiram- and clay-slurry treatments with and without latex; and 1x, 2x, 4x, 8x, and 16x dilutions with capsicum and with thiram- or clay-latex slurry. The 1x capsicum treatment (500,000 SV, American Mercantile, P.O. Box 240654, Memphis, TN 38124) was applied at a rate of 1 tablespoon per 25 pounds of seed. The rates of application per pound (454 grams) of seed were: 76 mililiter of thiram, 3 mililiter of latex, 0.6 mililiter of capsium (1x), and 45 grams of kaolin clay in 100 mililiter of water. The latex was added to the mixture to improve binding of the materials to the seeds. The same proportion of materials was used for each treatment. The laboratory tests were conducted in the Alexandria Forestry Center Seed Testing Laboratory.

Field Tests

Longleaf pine seeds, selected from a single lot of Louisiana seed orchard origin, were selected for field evaluations.

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Empty seeds were removed from the lot by pentane flotation (Barnett 1971). Random samples were drawn for treatments. Repellent treatments were applied and the seeds were air-dried overnight.

It is logical to evaluate candidate rodent repellents in caged animal trials before testing in the field. However, the Alexandria Forestry Center no longer has the facilities to conduct such tests. We, therefore, skipped the intermediate step and moved directly to field tests conducted on the Palustris Experimental Forest in central Louisiana.

Five of the seed treatments were evaluated in the field: (1) an untreated control, (2) 1x capsicum plus thiram (0.6 mililiter capsicum, 76 mililiter thiram, and 3 mililiter latex per pound of seed), (3) 2x capsicum plus thiram (1.2 mililiter capsicum, 76 mililiter thiram, and 3 mililiter latex), (4) 1x capsicum plus kaolin clay (0.6 mililiter capsicum, 45 grams clay in 100 mililiter water, and 3 mililiter latex), and (5) 2x capsicum plus kaolin clay (1.2 mililiter capsicum, 45 grams clay in 100 mililiter water, and 3 mililiter latex). Treatment plots consisted of five 12-inch circular spots arranged around a central stake. Each spot was sown with 100 seeds. Plots were randomly selected for a particular treatment and marked with a flagging pin. Twenty replications, separated by at least 50 feet, were established April 1, 1996, on a previously cleared site. Plots were randomly arranged. Seed losses were determined by counting seeds remaining on the spots at 2- to 3-day intervals. Heavy rains washed the seeds from the spots 12 days after initiation of the test.

Because the plots in this study were small and subject to overwhelming predation, we evaluated them frequently to determine predation patterns for each of the five treatments.

RESULTS AND DISCUSSION

The laboratory germination test results show that capsicum with thiram or clay reduced germination when applied at rates greater than 2x (table 1). However, the 1x and 2x rates did not reduce laboratory germination more than the thiram- or clay-latex controls. Thiram alone reduces germination in the laboratory (Campbell 1981c), but the reduction in these tests was more than expected. Previous studies have shown that thiram has less impact on germination in the field (Barnett and others 1980, Campbell 1981c). The key to success for a repellent is field performance, so field evaluations of capsicum were initiated.

Results from the field evaluations indicate that the seeds were subjected to heavy predation. After 11 days, 78 percent of the seeds in the control treatment were lost due to predation (table 2). Because rapid losses were anticipated from the small seed spots, seed counts were started 4 days after sowing and continued at 2- to 3-day intervals until heavy rains washed seeds from the spots. Though there were heavy losses in the control and in the clay-capsicum treatments, the thiram-capsicum treatments protected the seeds well through 11 days of the test, with average losses of less than 1 percent. Because this study did not evaluate endrin and capsicum alone, their effectiveness could not be compared. Caged animal and additional field tests will be required to make these comparisons. Losses in the capsicum-clay slurry treatment were less than in the control, but were significant. If these losses were caused by partial predation from birds, treatment with the combination of thiram and capsicum is needed to assure protection.

Table 1—Effects of oleoresin capsicum with thiram or clay slurry on the germination of longleaf pine seeds

		Treatment combination	
Variables	None	Thiram	Clay slurry
		Percent	
Control	89	—	—
Without latex	—	45	85
With latex	—	46	69
1x capsicum	—	41	76
2x capsicum	—	47	68
4x capsicum	—	35	59
8x capsicum	—	34	46
16x capsicum	—	23	37

Table 2—Percentages of seeds removed or damaged on each plot 4, 7, 9, and 11 days after seeding on April 1, 1996, by treatment

	Seed losses at (days)			
Treatment	4	7	9	11
	Percent			
Control	2.2	26.4	58.9	78.5
Thiram + 1xOC	.6	.6	.6	.7
Thiram + 2xOC	.1	.2	.3	.4
Clay + 1xOC	1.1	3.7	22.0	53.6
Clay + 2xOC	.3	3.0	19.3	44.1

The results from this study indicate that oleoresin capsicum has potential as a rodent repellent for southern pine seeds. The 1x rate is as effective as the higher 2x rate in these tests.

It is difficult to state with any certainty whether birds or rodents were the primary predators. An examination of remaining seedcoat fragments suggested that both birds and rodents were feeding on the longleaf seeds.

Despite the heavy predation on these small plots, the seed loss figures show that the repellents are effective. However,

a larger-scale field evaluation should be conducted to gain additional information on the use of oleoresin capsicum as a rodent repellent for direct seeding. Seeding large acreages with thiram and capsicum treated seeds will be necessary to evaluate the effectiveness of the repellents when exposed to the environment and predators for a longer time period.

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