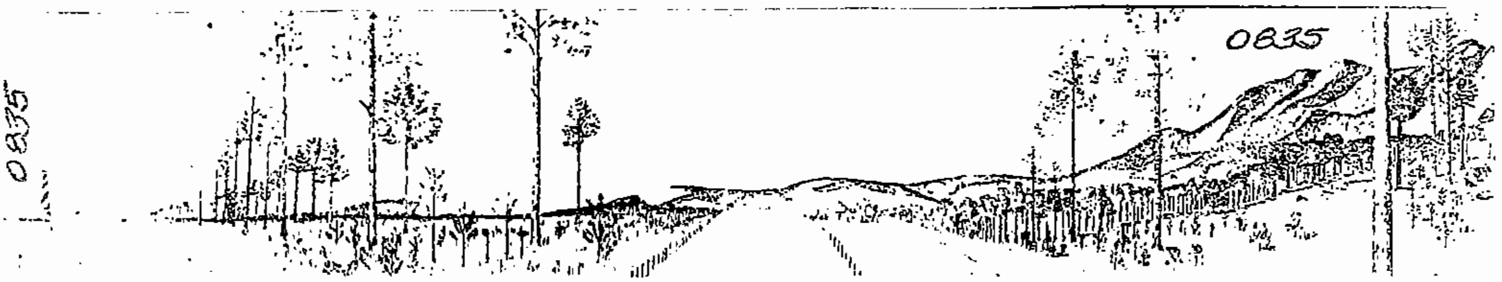

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THICKENING RETARDANTS IMPROVES ADHESION TO TREE CROWNS

Abstract.--Several water solutions of different viscosities were released from an aerial tanker so that the effect of solution viscosity on interception of retardants by tree canopies could be studied. There was no apparent difference in interception between "wet" water and plain water. Viscous water, however, had greater adhesion to the tree canopies.

If firefighting chemicals are to achieve their maximum efficiency in aerial attack, they must be applied in adequate quantities to the fire-carrying fuels. When surface fuels are burning, a solution capable of penetrating tree crowns and getting through to the understory fuel may be required. When crown fires are encountered, however, the retardants should be applied to obtain maximum adhesion of chemicals to the crowns. Control of the solution viscosity level appears to be one practical way to achieve desired results. The effect of different tree-canopy types on interception of a single retardant formulation has been studied,[1] but the effect of viscosity changes on canopy interception has not.

To learn the effect of solution viscosity on penetration of retardants through tree crowns, a study was established in a uniform loblolly pine (Pinus taeda L.) plantation situated on level terrain. The stand averaged 8 inches d. b. h., 50 feet tall, and had a basal area of 120 square feet per acre. Crown closure was approximately 80 percent. A grid of plastic cups covering an area 500 by 150 feet was laid out on the ground in the stand to catch material dropped into the tree canopy from a TBM aerial tanker. Cup spacing was 20 by 25 feet.

Three types of liquid were dropped onto the grids: plain water, wet water (surface tension reduced to approximately 30 dynes per cm.), and CMC (sodium carboxymethylcellulose) thickened water. The thickened water used in the first two drops had a viscosity of 3,200 centipoises (Brookfield, spindle speed 6 r. p. m.), while the thickened water used in the third drop had a viscosity of 600 centipoises.

Total and effective pattern length, and fraction of material reaching the ground were determined by analyzing the weight of liquid caught in each cup.

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[1]Johansen, R. W. Effect of overstory on ground distribution of airdropped slurries. U. S. Forest Serv. Fire Contr. Notes 25(2): 3-4, 15. 1964.

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While a comparison of pattern lengths did not show any significant statistical differences between materials dropped, the measurable amount of material reaching the ground was significantly less for the viscous materials (table 1).

Table 1. --Ground pattern characteristics of three types of water solutions dropped from a TBM aerial tanker through a pine canopy[1]

Drop type	Drop number	Pattern length at minimum application rate of:		Solution reaching ground
		1 gal. /100 ft.^{2}	$\frac{1}{2}$ gal. /100 ft.^{2}	
		- - - - - Feet - - - - -		Percent
Water	1	160	160	28.7
	2	140	160	29.2
	3	140	160	29.2
Wet Water	1	140	200	29.8
	2	160	200	29.2
Viscous water	1	140	240	25.1
	2	100	120	21.7
	3	160	180	22.7

[1]440-gallon loads; air speed - 110 knots; drop heights - 75 feet above treetops; wind speeds - less than 8 m.p.h. during drops.

Drop pattern size and amount of water reaching the ground did not vary significantly when wet water or plain water was used. However, some foaming did occur with the wet water, and dripping from the trees lasted several minutes longer following the impact of the load.

Although the pattern length for the viscous water drops was roughly the same as that for plain and wet water at the level of 1- and $\frac{1}{2}$-gallon per 100 square feet, the amount of liquid reaching the ground was consistently less.

There is some additional evidence to support these test results. In 1960, an unpublished study was made to determine if different pigments could be used in thickened and unthickened solutions to identify more easily drop areas in pine stands from the air. In all instances, the areas where thickened solutions were dropped were more easily identified from the air than those where unthickened solutions were dropped. Since pigment concentration in thickened solutions was always equal to or less than that in the unthickened solutions, we concluded that the thickened solutions were more visible because more pigment adhered to the tree crowns. This adhesion was, in turn, brought about by greater interception of the thickened solutions by the tree crowns.

When serious crown-fire situations are encountered, there may be an advantage in increasing the viscosity levels of retardant mixtures to keep more retardant in the crowns. When it is necessary to retard fire movement in surface fuels under crowns, the use of unthickened solutions is advisable. If a thick ground-fuel layer is present, the wet water formulations may be most effective to reduce surface tension and thus increase penetration into the litter.

If wind speeds exceed 15 m. p. h., there would be good reason to abandon the use of small tanker loads (under 400 gallons) of unthickened solutions because of excessive loss due to wind drift. Because thickened solutions are more cohesive and form less spray, less drift occurs.

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U. S. Department of Transportation, Publications Section M443.1, Washington, D.C. 20590.