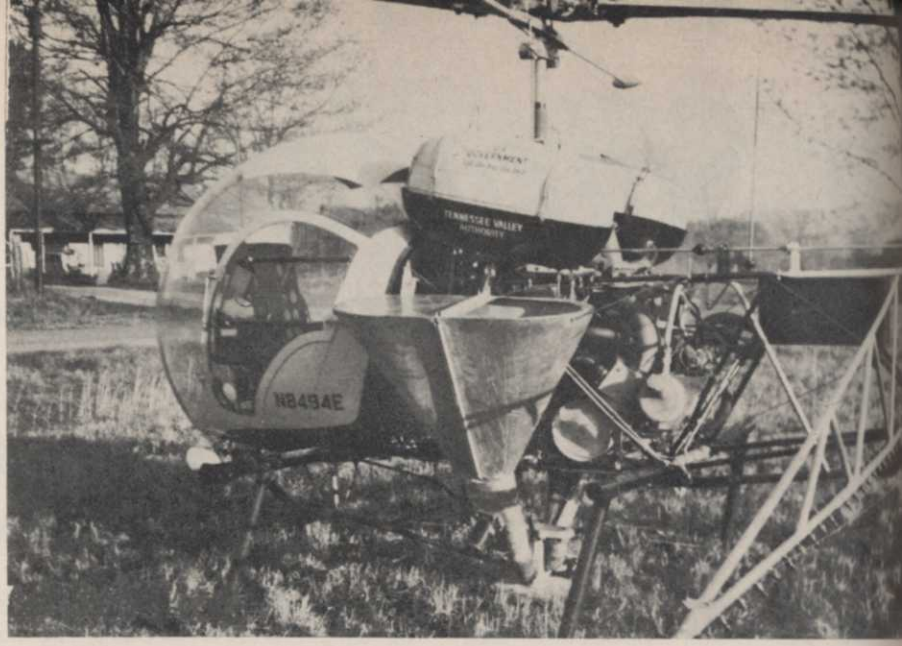
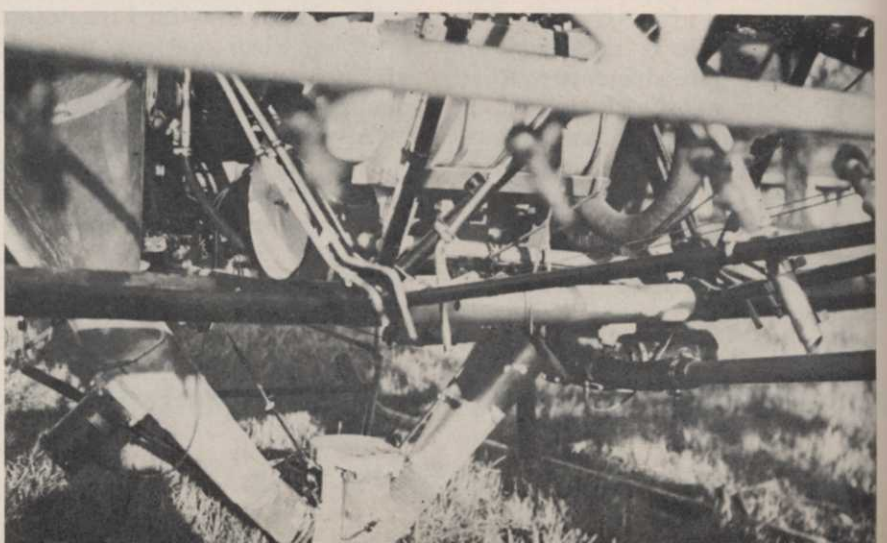


A Bell helicopter (right) is equipped with two 60-gallon bins that tote pelleted material which is fed through chutes to a centrifugal spreader.

Results of TVA Tests with Helicopters to Spread Pellets for Rights-of-way Brush

Pellets scattered (above) from the Bell helicopter fall in a rather uniform pattern. Density is compared with the 3" x 5" filing card.

Three-inch flexible chutes (right) carry granules from side bins to a centrifugal disk that spins at 225 rpm and spreads the pellets.



Helicopter crews maneuver their craft with great agility along the right-of-way of a 500-kilovolt power line near Madison, Ala.

Report by

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CAN a helicopter spread pellets in a uniform and satisfactory pattern on transmission line rights-of-way? Will the pellet material be effective for stump treatment on cleared construction and on lines where brush is established?

To answer these questions, the Tennessee Valley Authority set up 1-acre test plots. Nine plots were arranged along the right-of-way of a 500 kilovolt line under construction, and nine more were laid out along the right-of-way of a 161 kilovolt line. There was considerable brush cover under the 161-kv line even though it had been treated with chemical. The plots were established in an area between Huntsville and Scottsboro, Alabama. Pellets were applied with a Bell model 47G-3B helicopter equipped with a supercharged Lycoming engine. The helicopter was rigged with a variable speed, centrifugal disk that spread the pellets and two 60-gallon saddle-back tanks, each with 3-inch flexible chutes to the disk.

Pellets were checked for caking before loading. Then they were loaded on the helicopter by using buckets, and little time was wasted on the ground. Pellet materials used were Dybar (25% active) applied at 60, 80, and 100 lbs./A, Urab (25% active) at 60, 80, and 100 lbs./A., and Tordon 10K (10% active) applied at 80, 100, and 120 lbs./A. Approximately 14,000 pellets weigh one pound, if the pellets range from ⅛ in. to $\frac{5}{32}$ in. Applied at the rate of 100 lbs./A., about 32 pellets would be spread in each square foot. To spread pellets at a 50-foot swath, the centrifugal disk is spun at its maximum speed, 225 rounds per minute. The pilot was able to start and stop the flow of granules from the helicopter very efficiently, and the pellets were applied even up to the edges of the rights-of-way.

Ground Control Maintained

If pellets caked or clogged the disk, a ground observer told the pilot on a portable ground-to-air "walkie-talkie" system, and the pilot quickly landed and the malfunction was repaired. The radio equipment proved to be very helpful since errors and malfunctions could be discovered and corrected immediately.

The soil type of the test areas varied from red clay to gray silt loam; the terrain had rolling hills and a few limestone outcroppings. Pellets were applied on April 13 and 14, 1965. Size of the cleared plots along the 500-kv line were about 550 feet long and 150 wide. Along the 161-kv line, the plots were about 870 feet long and 100 feet wide. Rainfall for the two rights-of-way are shown in Table 1.

The number of plants, counted from Nov. 29 through Dec. 1, 1965, in the plots varied from a high of 35,432 to a low of 1,234 stems per acre. Weeds controlled are listed in Table 2. Chemicals applied at the high rates completely eradicated most species, and chemicals applied at low rates resulted in high stem counts. These plots will be evaluated again late in 1966 and in 1967, if necessary, to determine the effectiveness of the various rates and whether they will be economical for brush control.

Let's consider the advantages and disadvantages of applying pellets for brush control by helicopter. Since no special ground

Table 1. Rainfall data taken along two rights-of-way from December 1964 to November 1965.

Pellet Plots on Widows Creek—Huntsville 161-Kv Line

	Scottsboro	Hytop	Paint Rock	AVERAGE
December 1964	4.40	5.09	4.27	4.58
January 1965	3.71	4.85	4.03	4.20
February	6.32	9.35	6.97	7.55
March	13.27	11.58	10.84	11.90
April	3.39	3.80	2.60	3.26
May	1.29	4.10	5.08	3.49
June	8.17	6.54	4.45	6.38
July	5.93	8.91	5.19	6.67
August	4.15	4.81	2.83	3.93
September	5.10	2.37	2.62	3.36
October	0.73	2.85	1.82	1.80
November	1.32	0.97	1.34	1.21
TOTAL	57.78	65.22	52.04	58.35

Pellet Plots on Widows Creek—Madison 500-Kv Line

	New Market	Monte Sano	Bingham Mt.	AVERAGE
December 1964	3.43	4.35	4.81	4.20
January 1965	3.11	4.37	4.58	4.02
February	5.06	6.75	7.20	6.34
March	9.06	10.89	11.66	10.54
April	4.37	2.62	3.60	3.53
May	2.96	1.21	2.77	2.31
June	5.40	5.79	5.18	5.46
July	6.43	5.33	6.80	6.19
August	2.63	1.83	3.00	2.49
September	3.30	3.52	2.33	3.05
October	1.91	2.69	1.98	2.19
November	1.46	1.19	0.96	1.20
TOTAL	49.12	50.54	54.87	51.51

equipment is required to service the helicopter, the first advantage is that the overall equipment cost is relatively low. Pellets can be applied during the entire day in winds of up to 12 miles per hour. The pelleted material is nonvolatile and can be applied in rough or in inaccessible areas. Pellets can be applied from a helicopter before it is needed for the work during the foliage spray season.

On the other hand, some of the disadvantages of applying pellets by helicopter begin with cost. At the present time, pellets are more expensive than liquid materials for equivalent brush control. There is minor kill of brush off of the right-of-way, because the chemical released from the granules affects the roots of plants that extend within the right-of-way. Also, in order for the chemical to be washed from the granules onto the plants, adequate rainfall is a necessity. A higher and heavier pellet application rate would be required for heavy soil than that required for porous, sandy, well-drained soil, since the active ingredients must penetrate the soil and be absorbed through the roots. Two or three years are required for kill of some species. However, there is no need for a quick kill of brush, because the growth of most species is retarded, and the plants are ultimately killed.

Pellets were applied evenly, and we believe that helicopter application will do an excellent job at a reasonable cost if pellets can be formulated at a cost comparable to the liquid ester formulation for an equal kill. Pellet application by helicopter will be a valuable tool for brush control work.

Table 2. Weeds controlled (%) by Dybar, Urab, and Tordon 10K, applied at three different rates.

Plot No. 25-B: Dybar 60 pounds per acre. Acid 15 pounds per acre.

SPECIES	1	2	3	4	5	TOTAL STEMS PER PLOT	TOTAL STEMS PER ACRE	PERCENT EACH CODE NUMBER 1	2	3	4	5
Paulownia	2			1		3	109	67			33	
Winged Elm	12	1			1	14	508	86	7			7
Cedar	8	1	4		8	21	762	38	5	19		38
Persimmon	8				16	24	871	33				67
Ash	13					13	472	100				
Quince		1				1	36		100			
Sumac	17				8	25	908	68				32
French Mulberry	21					21	762	100				
American Elm	1				2	3	109	33				67
Red Oak	3					3	109	100				
Hickory	1					1	36	100				
Redbud	4					4	145	100				
Hackberry	1					1	36	100				
TOTAL	91	3	4	1	35	134	4863					

Plot No. 26-B: Dybar 80 pounds per acre. Acid 20 pounds per acre.

SPECIES	1	2	3	4	5	TOTAL STEMS PER PLOT	TOTAL STEMS PER ACRE	PERCENT EACH CODE NUMBER 1	2	3	4	5
French Mulberry	7					7	254	100				
Redbud	8			2	6	16	581	50			13	37
Ailanthus	8	1	1			4	14	508	57	7	7		29
American Elm						5	5	182					100
Cedar	7	2	1			3	13	472	54	15	8		23
Cherry	1		1			4	6	218	17		17		66
Sassafras	7						7	254	100				
Winged Elm	5					12	17	617	29				71
Sugar Maple	2		1			32	35	1271	6		3		91
Ash	17						17	617	100				
Unidentified	1					7	8	290	13				87
Chestnut Oak	1	1		3			5	182	20	20		60	
Sumac	4					14	18	653	22				78
Hackberry	4	2				5	11	399	36	18			46
Red Oak	1					1	2	73	50				50
Beautyberry	2						2	73	100				
Persimmon	1					1	2	73	50				50
Hickory	3					1	4	145	75				25
TOTAL	79	6	4	5	95	189	6862					

Plot No. 27-B: Dybar 100 pounds per acre. Acid 25 pounds per acre.

SPECIES	1	2	3	4	5	TOTAL STEMS PER PLOT	TOTAL STEMS PER ACRE	PERCENT EACH CODE NUMBER 1	2	3	4	5
Chestnut Oak	4				4	8	290	50				50
Sugar Maple	3	2			39	44	1597	7	5			88
Redbud	1				11	12	436	8				92
Cedar	5				2	7	254	71				29
Ash	3					3	109	100				
Buonymus	2					2	73	100				
Sumac	1				22	23	835	4				96
Winged Elm					7	7	254					100
Hackberry	1				1	2	73	50				50
American Elm					6	6	218					100
Ailanthus		1				1	36		100			
Walnut			1			1	36			100		
Mulberry	2					2	73	100				
Persimmon					5	5	182					100
Poison Oak	3					3	109	100				
Red Oak					2	2	73					100
TOTAL	25	3	1	-	99	128	4648					

Plot No. 28-B: Urab 60 pounds per acre. Acid 15 pounds per acre.

SPECIES	1	2	3	4	5	TOTAL STEMS PER PLOT	TOTAL STEMS PER ACRE	PERCENT EACH CODE NUMBER 1	2	3	4	5
Sumac	1				7	8	290	13				87
Mulberry		1	1		1	3	109		33	33		34
Redbud	39		5		5	49	1779	80		10		10
Paulownia	2					2	73	100				
Sugar Maple	1				1	2	73	50				50
Chestnut Oak		4	6			10	363		40	60		
Winged Elm	11	1			2	14	508	79	7			14
French Mulberry	1					1	36	100				
Hackberry	16					16	581	100				
Cedar	4				1	5	182	80				20
Persimmon					2	2	73					100
Red Oak					1	1	36					100
American Elm	7					7	254	100				
Ash	2					2	73	100				
White Oak		1				1	36		100			
Crab	6					6	218	100				
TOTAL	90	7	12	-	20	129	4684					

Plot No. 29-B: Urab 80 pounds per acre. Acid 20 pounds per acre.

SPECIES	1	2	3	4	5	TOTAL STEMS PER PLOT	TOTAL STEMS PER ACRE	PERCENT EACH CODE NUMBER 1	2	3	4	5
Winged Elm	9	3			6	18	653	50	17			33
Ash	6		2			8	290	75		25		
Redbud	77		2		4	83	3,013	93		2		5
Red Oak	1		3		1	5	182	20		60		20
Chestnut Oak	3	1	3			7	254	43	14	43		
Sugar Maple	1					1	36	100				
Cedar	2					2	73	100				
White Oak			1			1	36			100		
American Elm	6					6	218	100				
Persimmon	1				3	4	145	25				75
Hickory	2					2	73	100				
Mulberry	4					4	145	100				
TOTAL	112	4	11	-	14	141	5,118					

Plot No. 30-B: Urab 100 pounds per acre. Acid 25 pounds per acre.

SPECIES	1	2	3	4	5	TOTAL STEMS PER PLOT	TOTAL STEMS PER ACRE	PERCENT EACH CODE NUMBER 1	2	3	4	5
Redbud	63		5	3	48	119	4,320	53		4	3	40
Winged Elm	4		4		13	21	762	19		19		62
Mulberry	2					2	73	100				
Ash	5					5	182	100				
Cedar	3				1	4	145	75				25
Paulownia	4					4	145	100				
TOTAL	81	-	9	3	62	155	5,627					

Plot No. 31-B: Tordon 10K 80 pounds per acre. Acid 8 pounds per acre.

SPECIES	1	2	3	4	5	TOTAL STEMS PER PLOT	TOTAL STEMS PER ACRE	PERCENT EACH CODE NUMBER 1	2	3	4	5
Winged Elm			1		13	14	508			7		93
Redbud					201	201	7296					100
Ash	5	1			2	8	290	63	13			24
Cedar					2	2	73					100
White Oak					3	3	109					100
Red Oak	2					2	73	100				
Sugar Maple					1	1	36					100
Hackberry					9	9	327					100
Chestnut Oak		1	6			7	254		14	86		
American Elm		2				4	145		50			50
TOTAL	7	4	7	-	233	251	9111					

Plot No. 32-B: Tordon 10K 100 pounds per acre. Acid 10 pounds per acre.

SPECIES	1	2	3	4	5	TOTAL STEMS PER PLOT	TOTAL STEMS PER ACRE	PERCENT EACH CODE NUMBER 1	2	3	4	5
Redbud					50	50	1815					100
Winged Elm					41	41	1488					100
Sugar Maple					24	24	871					100
Chestnut Oak			1			1	36			100		
White Oak			4		3	7	254			57		43
Ash	1					1	36	100				
Ailanthus					25	25	908					100
Sassafras					2	2	73					100
Sumac					2	2	73					100
Cedar					3	3	109					100
Prickly Ash					1	1	36					100
American Elm					3	3	109					100
TOTAL	1	-	5	-	154	160	5808					

Plot No. 33-B: Tordon 10K 120 pounds per acre. Acid 12 pounds per acre.

SPECIES	1	2	3	4	5	TOTAL STEMS PER PLOT	TOTAL STEMS PER ACRE	PERCENT EACH CODE NUMBER 1	2	3	4	5
Winged Elm					15	15	1089					100
Sugar Maple					37	37	2686					100
Ailanthus					10	10	726					100
American Elm					16	16	1161					100
Redbud					27	27	1960					100
TOTAL	-	-	-	-	105	105	7622					

Explanation of Code Numbers:

No. 1—Little or no chemical effects.

No. 2—About one-half of the canopy showing chemical effects.

No. 3—Chemical effects on all the canopy, but still some green.

No. 4—All leaves dead and stem dead to ground line; however, resprouting from root collar or ground line.

No. 5—Dead to ground line with no resprouts.