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THE EFFECT OF CERTAIN VEGETATION ERADICATORS ON THE INFLAMMABILITY OF VARIOUS MATERIALS

by

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INTRODUCTION

The problem of vegetation eradication is one that confronts many organizations, among whom are railway companies. Their problem is that of reducing fire hazard by clearing potential fuels, such as shrub and herbaceous growth, from rights-of-way. These fuels could be ignited by live coals falling from a passing locomotive. Some chemical vegetation eradicators, however, have been suspected of providing a fire hazard themselves because of their inflammable nature. It was also thought that they increase, temporarily, the inflammability of vegetation and render railway ties more subject to burning and charring when contacted by hot coals.

In addition to studying the effectiveness of several herbicides, members of the Federal Forestry Branch conducted further tests at the Petawawa Forest Experiment Station in an effort to determine the effect on the inflammability of materials with which these herbicides come in contact. For this latter project, railway ties, grass, and heavy cloth were used as inflammability test media.

No attempt is made here to assess the effectiveness of the chemicals as vegetation inhibitors. This is the topic of a separate publication.

STUDY TECHNIQUE

Stock solutions of various herbicides were made up in concentrations listed in Table 2. Some of these concentrations were made stronger than those normally used so that poorly mixed solutions could be duplicated. (In order to reduce the effect of sodium chlorate solution in increasing the inflammability of materials contacted, calcium chloride is sometimes added.) One quart of stock solution was used to spray each plot. To each quart of solution, except in the case of diesel oil, was added an extra quart of water. The extra liquid volume did not alter the amount of chemical used per square foot but did ensure more uniform plot coverage. The solutions were applied with an ordinary garden sprinkler can.

Tests involving railway tie and grass inflammability were made on an open field on which all dead vegetation was burned off early in the spring in order to ensure a uniform coverage of green grass.

Twelve creosoted and 12 uncreosoted 6- by 8-inch softwood ties were used in the inflammability tests. Four pairs of one-foot sections of each type were set on the ground in plots measuring 25 square feet each. One plot was sprayed with each type of herbicide. Similar grass-covered plots in the same location were sprayed with the same chemical vegetation inhibitors in order to determine their effect on the inflammability of grass.

Further tests were made to check the effect of the vegetation inhibitors in increasing inflammability of other material on which the chemical might fall. Strips of heavy denim cloth, 1 inch by 6 inches in size, were soaked in the various chemicals and were checked for inflammability both when wet and after being allowed to dry.

Matches were used as the ignition agents. First, one match was placed on the tie and ignited with another. If fire did not spread from the first, two matches were placed on the tie with their heads abutting. If only the matches burned, four were tried, and then eight. Inflammability tests were made simultaneously on creosoted and plain ties at intervals of 20 minutes, one day, 12 days, and one year after application of the chemical. Inflammability of untreated ties was tested at the same time.

On the grass plots, attempts were made to burn plots representing each treatment at intervals of five minutes, one week, one month, and one year after spraying. Up to three matches were used for ignition. Again, as a control measure, untreated plots were tested at the same times.

The denim strips were ignited with matches. Distance from a match when the material started burning, time and size of burn, and time of smouldering, were all noted.

DISCUSSION OF RESULTS

Tests on Railway Ties

In only a few cases were the results of tests made on creosoted and plain railway ties appreciably different (see Table 1). During tests made 20 minutes after treatment, only the plain ties treated with diesel oil and creosoted ties treated with diesel oil, C.M.U., or 2, 4, 5-T, appeared more inflammable than the untreated ones. When ignited with one or more matches, fire spread across the surface of each of these more inflammable ties. They were not damaged as seriously, however, as the untreated, plain tie which was deeply charred beneath the eight matches used in the test. During subsequent tests one day after treatment, ties sprayed with 20 per cent sodium chlorate and 5 per cent calcium chloride, and creosoted ties treated with diesel oil or 2, 4-D butyl ester, appeared more inflammable than untreated ties. Twelve days later, tests indicated that creosoted ties treated with 20 per cent sodium chlorate and 5 per cent calcium chloride or C.M.U., and plain ties treated with diesel oil, 2, 4-D amine salt, 2, 4-D butyl ester and 2, 4, 5-T, were more inflammable.

After one year, only those ties treated with diesel oil, C.M.U., five per cent solution of sodium chlorate, ammate, and 2, 4, 5-T, still indicated a slight tendency to burn, while the others showed no reaction. The degree of charring and fire spread was insignificant and occurred only near the matches. Of the ties treated with the first two solutions, the plain tie burned briefly, and on some of the creosoted ties treated with the latter three solutions, the creosote coating seemed to burn momentarily. No burning or charring resulted from tests made on the remaining ties, including the untreated ones.

The only treatments which obviously increased inflammability during the tests were diesel oil, strong solutions of sodium chlorate, 2, 4-D butyl ester, and 2, 4, 5-T. The latter two caused only a slight increase.

In no case was the charring of treated ties more serious than was evident on those untreated. In some instances, fire flashed over the surface of the tie causing ignition of surrounding herbaceous growth. This tendency was noted on ties treated with diesel oil and strong solutions of sodium chlorate, especially one day after treatment.

None of the solutions appeared to harm the ties through chemical action.

Tests on Grass Plots

During inflammability tests made on grass, none of the plots could be ignited five minutes after spraying except those treated with diesel oil and C.M.U. Grass treated with the former burned quite vigorously, but grass treated with the latter burned only an inch away from the igniting match. The untreated plot did not burn at all since, like other plots, it contained a very large percentage of green grass.

In tests made one week and one month after treatment, the relative inflammability of the grass plots reflected to a great extent the percentage of grass killed by the chemical and the amount of accumulated dead material (see Table 2). One week after treatment, the plots treated with either Atlacide or a mixture of sodium chlorate and 2, 4-D burned somewhat more vigorously than the percentage of green would indicate. Despite the fact that the ammate-treated plot was only two per cent green, it burned less vigorously than would be normally expected. This may indicate that this chemical had a fire-retarding effect. Two other plots could be ignited briefly, but the fires were insignificant.

One month after treatment, plots treated with 2, 4-D amine salt and 2, 4, 5-T were predominantly green, but small fires were obtained on them. Test plots indicating very high or extreme inflammability were those treated with 20 per cent sodium chlorate and five per cent calcium chloride, C.M.U. and Atlacide. On all of these plots, however, very little green grass remained. With very little dead vegetation existing on those treated with 2, 4-D butyl ester and C.M.U., no fires were obtained. A very small fire burned briefly on the untreated plot.

One year after spraying, the inflammability of plots coincided quite closely with the degree of kill and the amount of dead material on them. Test plots which had been treated with diesel oil showed a slightly increased inflammability, but on the others any increase of fire activity could not be traced positively to the influence of the vegetation inhibitors applied to them.

Tests on Cloth

Tests of denim soaked in solutions of the same herbicides used in the previous tests indicated results somewhat similar to those noted above. The only wet samples to burn completely were those treated with diesel oil and C.M.U. The ammate-treated material was least inflammable and did not even smoulder. This result was similar to that obtained with a water-soaked piece of the cloth. Both samples treated with 2, 4-D compounds smouldered only momentarily. The longest smouldering was noted on samples treated with a 10 per cent sodium chlorate solution, and a 20 per cent sodium chlorate and five per cent calcium chloride solution.

All dried samples, except those treated with ammate and water, burned completely. The ammate-treated sample smouldered for a short time and the water-treated sample burned momentarily and then smouldered for a short time. Most rapid burning occurred on samples treated with sodium chlorate, especially the one treated with 20 per cent sodium chlorate and five per cent calcium chloride. It was consumed instantly. Samples treated with diesel oil and the 2, 4-D compounds were notably slower in burning than the others which could be ignited.

Further tests were made to determine whether heat of friction would be enough to ignite denim strips which had been treated and oven-dried. No ignition resulted when two strips were vigorously rubbed together following removal from the oven.

SUMMARY AND CONCLUSIONS

A decrease in the inflammability of the test media could be positively traced to the chemical treatment in only one instance. This was observed during tests of the ammate-treated cloth. In no other case could it be definitely assumed that the chemical used actually reduced inflammability.

The chemicals which most strongly exhibited the tendency to increase inflammability were diesel oil and strong solutions of sodium chlorate. C.M.U. seemed to increase inflammability slightly when the sprayed material was still wet. These observations held true for each set of materials tested. Solutions of 2, 4-D compounds and 2, 4, 5-T raised inflammability to a negligible extent in some cases.

Any advantages which may result from the use of diesel oil as a herbicide are offset by the increased inflammability of materials so treated. Therefore, its use as a vegetation inhibitor could not be justified where fire is not wanted. The same conclusion applies to strong solutions of sodium chlorate unless they are mixed with calcium chloride in a ratio of at least two to one respectively. (It was observed in previous tests that the normal inflammability of materials was actually reduced when treated with a mixture of equal parts of the two chemicals.) It was clearly evident that one year after application none of the herbicides seriously affected the inflammability of either railway ties or grass.

In order to keep fire hazard to a minimum by avoiding an accumulation of dead material, it would seem advisable to do one of two things:

1. Before treatment, cut and burn grass and herbaceous growth in the autumn or early spring. Spray with herbicide during the development of new growth.

2. After treatment, burn the area when considerable browning of the vegetation has become evident. This should be followed by a respray of the area since some new plant growth often appears.

Following satisfactory killing of the vegetation on the treated area, it would be wise to maintain periodic spraying to prevent the vegetation from becoming re-established and providing another accumulation of fuel. Observations made to date on some of the herbicides would indicate that effective control would be maintained only if respraying was done at intervals not exceeding three years. Another publication in this series will deal at greater length with the effectiveness and permanency of the vegetation inhibitors so far tested.

TABLE 1.—SUMMARY OF OBSERVATIONS: RAILWAY TIE INFLAMMABILITY TESTS

Treatment	Time Since Treatment							
	20 minutes		1 day		12 days		1 year	
	Plain Ties	Creosoted Ties	Plain Ties	Creosoted Ties	Plain Ties	Creosoted Ties	Plain Ties	Creosoted Ties
Sodium chlorate 10%.....	slight char no spread	brief burn no spread	slight char no spread	2-inch spread brief burn	very light char	brief burn	no effect	no effect
Sodium chlorate 5%.....	no effect	creosote burned briefly	very light char	burned 55 secs.	very light char	brief burn	no effect	brief burn
Sodium chlorate 10%..... Calcium chloride 5%.....	no effect	burned briefly under matches	light char under matches	light burn under matches	very light char	brief burn	no effect	no effect
Sodium chlorate 20%..... Calcium chloride 5%	flared, around matches, no spread.	no effect	flashed over tie, deep char, prolonged smouldering	burned few seconds, explosive in spots.	light char	slight spread from matches	no effect	no effect
Sodium chlorate..... 2, 4-D Esteron	light char	light burn	no effect	moderate burn on butt end	light char	brief burn	no effect	no effect
Star diesel oil.....	oil burned vigorously	oil burned slowly at first	brief burn in crack	burn 30 secs. rapid spread	light char spread to grass	no spread	brief burn	no effect
2, 4-D Amine salt.....	slight char	creosote burned briefly	slight char	burned briefly	moderately heavy char	brief burn	no effect	no effect
2, 4-D Butyl ester.....	no effect	creosote burned briefly	burned 5 secs. in crack	burned 125 secs.	moderately heavy char	no effect	no effect	no effect
2, 4, 5-T.....	no effect	2-inch spread in creosote	slight char	slight char	mod. deep char burned 3 secs.	slight burn under matches	no effect	brief burn
Ammate.....	slight char	creosote burned briefly			light char	brief burn	no effect	brief burn
C.M.U.....	slight char	1-inch spread cont'd few secs.	no effect	no effect	light char	burned 80 secs. slight spread	brief burn	no effect
Atlacide.....	slight char	light burn	no effect	no effect	light char	brief burn	no effect	no effect
Untreated.....	deep char under matches, no spread	creosote burned briefly	deep char burned 45 secs.	burned 125 secs.	very light char	creosote burned under matches when still alight	no effect	no effect

TABLE 2.—SUMMARY OF OBSERVATIONS: GRASS INFLAMMABILITY TESTS

Treatment	Actual Amount of Chemical Used Per Acre[1]	Time Since Treatment						
		5 Minutes	1 Week		1 Month		1 Year	
		[2]Actual Grass Hazard	[2]Actual Grass Hazard	Per Cent Green	[2]Actual Grass Hazard	Per Cent Green	[2]Actual Grass Hazard	Per Cent Green
Sodium chlorate 10%	462·2 lbs.	0	0	20	8	1	8	10
Sodium chlorate 5%	226·7 lbs.	0	0	20	9	2	6	20
Sodium chlorate 10% Calcium chloride 5%	470·9 lbs. 235·4 lbs.	0	1	10	8	2	13	3
Sodium chlorate 20% Calcium chloride 5%	1059·5 lbs. 218·0 lbs.	0	0	10	12	2	12	0
Sodium chlorate 2, 4-D Esteron	122·1 lbs. 152·6 lbs.	0	7	20	7	10	10	15
Star diesel oil	436 gals.	16	16	1	—	—	7	20
2, 4-D Amine Salt	30·5 lbs.	0	0	80	4	75	11	15
2, 4-D Butyl ester	52·3 lbs.	0	0	80	0	80	9	20
2, 4, 5-T	13·1 lbs.	0	0	80	3	80	7	15
Ammate	872·0 lbs.	0	4	2	—	—	12	0
C.M.U.	74·5 lbs.	1	0	60	14	2	13	0
Atlacide	436·0 lbs.	0	12	10	12	5	12	10
Untreated	—	0	0	95	0	90	12	15

[1] Except in the case of diesel oil, each chemical is dissolved in 436 gallons of water per acre.

[2] Actual Grass Hazard was derived from results of test fires conducted in accordance with standard test fire procedures developed by the Fire Protection Section of the Federal Forestry Branch.

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