Chemical Treatment of Hardwood Stumps To Prevent Sprouting And Suckering

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Introduction.

This is not a new field of research. Early recognition was given to the desirability of a method, both reasonably economical and effective, which would prevent sprouting from stumps of cutover land. Seedlings planted on such land cannot hope to compete in vigor with coppice reproduction during early life, and they are soon overtopped. Coppice stands are inferior to stands grown from seedlings for most purposes, or often spring from an undesirable species when the area is to be converted to a better species by planting.

Early experiments indicated that a cheap chemical might be found which would prove effective in killing undesirable trees or preventing the stumps from sprouting. In 1931 Cope and Spaeth obtained fair results with a sodium arsenite solution[1]. Other experiments have also used this solution with varying results, usually good. In 1932 Mac Kinney and Korstan found poisoning superior to girdling because basal sprouting may also be prevented.[2] Bull and Chapman confirmed these views with their findings on the

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[1] Cope, J. Alban, & Spaeth, J.N. "Killing Trees with Sodium Arsenite." Journal of Forestry, 1931, V. 29, pp 775.

[2] Mac Kinney, A.L. & Korstian, C.F. "Felling, Girdling, and Poisoning Undesirable Trees in Forest Stands. Journal of Forestry, Feb. 1932, pp. 169-177.

Southern Forest Experiment Station.[1] Many other chemicals have been tried since, including sodium hydroxide, phenol, formaldehyde, creosote, kerosine, zinc sulfate, ferric sulfate, copper sulfate zinc arsenate, calcium chloride, zince chloride, mercuric chloride, nitric acid, sulfuric acid, hydrochloric acid, picric acid, and chromic acid. Of all these only creosote and kerosine proved at all satisfactory, but perric acid, zinc sulfate, and picric acid were promising enough to deserve further trial.

Suckering from the roots is a more difficult problem, and with such species as black locust and aspen, cutting often results in thickets that would soon suppress any attempted plantations. Here prevention is complicated by the necessity of reaching and killing the roots. Inserts, deseases, and girdling are more apt to stimulate suckering rather than prevent it, but this field needs more investigation before discarding. Chemicals can be applied only to the stump, hence, to reach the roots they must be passed by tissue they were designed to gill. However a few evidences were found where sodium arsenite had seemingly effected adjacent sprouts when well concentrated, presumably through accumulation. So I tried using two different concentrations of this solution on black locust stumps and repeating the treatment two weeks later to determine if such an effect does occur.

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[1] Bull, Henry and Chapman, R.A. "Killing Undesirable Hardwoods in Southern Forests" S. Forestry Exp. Sta. Occasional Paper No. 50.

From previous attempts at chemical poisoning for sprout prevention, two trends seem evident.

(1) Salts of heavy metals usually give better results than salts of lighter metals.

(2) Acids are more effective than bases. Indeed, phenol seemed to even encourage sprouting.

in following these trends, I determined to try lead nitrate and mixtures of sulfuric acid with nitric acid, and sulfuric acid with hydrochloric acid. All three of these acids had been tried before with poor results, but it is known that mixtures of the acids often possess stronger properties than the separate acids.

Method of Application.

In keeping with the conclusions of recent investigators, "frilling" was adopted as the most effective method of applying the solutions. Bull and Chapman stated that trees should be completely girdled before poisoning. S.D. Anderson and Ronald L. Bird, working separately on stump poisoning experiments at the University of Michigan, proved that "Frilling" is the most effective method of application. In this method the trees are girdled as near the ground as possible by cuts through the bark and cambium into the sapwood leaving a frill of bark and wood all around the stump to retain the poison. This is best done with a small hand axe. Care must be taken that the cambium is exposed all around the stump.

I applied the chemicals in water solutions of varying concentration. Glass gallon jars were used as containers with rubber stoppers at the mouth. Two pieces of glass tubing were passed through the stoppers, one reaching to the bottom of the jar and the other merely going through the stopper, this was attached to a piece of rubber tubing, and used to apply the chemical to the frill. Enough was used to thoroughly wet the exposed cambium and sapwood. A gallon was sufficient to treat from 25 to 40 stumps, according to their size.

Procedure

A total of 301 stumps were treated with various chemicals, and 57 more were numbered for purposes of checking. All of the stumps were located in Saginaw Woods, property of the School of Forestry and Conservation, University of Michigan. The stumps were marked with numbered aluminum tags. Diameters were measured and condition of the stumps were recorded for both treated and untreated stumps.

The chemicals used and their strengths are listed in Table I.

Table I.-Chemicals used in Treatment.

Solution	Chemicals	
A	Sodium Arsenite	1 lb. as_2O_3, 2/3 lb. NaOH, 1 gal. H_2O
B	Sodium Arsenite	½ lb. as_2O_3, 1/3 lb. NaOH, 1 gal. H_2O
C	Lead Nitrate	3 oz. $PbNO_3$, 1 gal. H_2O
D	Lead Nitrate	2 oz. $PbNO_3$, 1 gal. H_2O
E	Lead Nitrate	1 oz. $PbNO_3$, 1 gal. H_2O
F	Mixed nitric & Sulf.Acid	1 oz. HNO_3, 1 oz.H_2SO_4, 1 gal. H_2O
G	Mixed Nitric & Sulf.Acid	½ oz. HNO_3, ½ oz.H_2SO_4, 1 gal. H_2O
H	Mixed Nitric & Sulf.Acid.	1/4 oz. HNO_3, 1/4 oz.H_2SO_4, 1 gal. H_2O
I	Mixed hydrochloric & Sulfuric Acid.	1 ox. Hcl, 1 oz. H_2SO_4, 1 gal. H_2O

The black locust stumps (Robinia pseudoacacia) were left from a final clearcutting of a plot last winter. A portion of the area had been cut previously but had been so badly infested with locust borers that not much suckering resulted. The trees cut last winter were thriftier and only partly infested, hence, more suckering was expected. Eighty stumps were treated here; 43 with solution A and 37 with solution B. Twenty were left as a check plot. Two weeks later the stumps were again treated with the same solutions, in hopes that an accumulation of the chemical might work into the roots.

The rest of the stumps were treated in an effort to prevent sprouting. The lead nitrate solutions were applied, to 92 cottonwood stumps; 34 being treated with solution C, 30 with Solution D, and 28 with solution E. Ten were left as a check plot.

(Populus deltoides): These trees had been planted on a gravel site entirely unsuited for them. As a result, they had declined when about 30 years of age and were cut in the winter of '38-'39.

The mixed nitric and sulfuric acid solutions were applied to 100 red and white oak stumps (Quercus rubra and Quercus alba) which had been cut the previous winter and to 15 white elm stumps (Ulmus Americana) which had been cut a couple of years before and had sprouted profusely. Solution F was applied to 42 red and white oak stumps, - Solution G to 43 red oak stumps, and solution H to 15 red oak stumps and 15 white elm stumps. 15 red oak stumps were left

as a check plot and 11 elm stumps were frilled but not poisoned. Only part of the sprouts were cut back on the elm stumps in an effort to see the effect upon vigorous well established sprouts.

Solution I was applied to the stumps of 10 box elders (Acer nequnda) and 2 osage orange trees (Machura pomifera) which had been cut the previous winter. Because there were so few stumps, none were left as a check plot, but adventitious buds were already present upon the stumps.

A record of the time of treatment and weather condition afterwards is listed in table II

Table II - Record of Date of Treatment and Following Weather Conditions.

Date	Solution	Stump numbers	Weather
April 18	A & B	1101-1200	Cold & Cloudy - Cold rain 1 week later
May 2	A & B	Same Stumps	Warm, sunshine; hard rain 1st week.
April 21	C,D,E,	1221-1312	Cold & cloudy; rain 5 days later
April 22	F,G,H,	1323-1419 1440-1454	Cold & rainy 1st. week. Showers & Warmer 2nd. Week.
April 26	I	1466-1477	Warm; rain 4 days later

Results of Treatment

The data gathered from the black locust experiment is given in Table III. This includes the number, diameter, condition of the stump, treatment, and results. Examination was made on May 27.

Table III - Black Locust Treatment

Stump No.	Diameter (Inches)	Remarks	Solution	No. Sprouts	No. Suckers	
1101	4	Borers	A			
1102	5		"	2		
1103	4.5	Borers	"			
1104	9		"		2	
1105	9.5	Double Stump	"			
1106	7.5	" "	"			
1107	7		"			
1108	7		"	3	2	
1109	6.5	Borers	"		4	
1110	6.5		"			
1111	9		"	1	1	
1112	4.5		"	3	2	
1113	5	Double	"	2	8	
1114	7.5	Stump	"	2		
1115	5		"	2	2	
1116	7.5		"		1	
1117	5		"			
1118	5.5	Borers	"			
1119	5		"		1	
1120	4.5		"			
1121	9	Slight borers	"			
1122	3		"			
1123	6		"	1	4	Dying
1124	5.5	Borers	"		2	
1125	5.5		"			
1126	7		"	2	1	
1127	5		"		9	
1128	4	Borers	"			
1129	3	Borers	"			
1130	9	Slight Borers	"			
1131	3.5		"	4	1	
1132	5.5	Slight Borers	"			
1133	5.5	Borers	"	1		
1134	4.5		"			
1135	5		"			
1136	4	Borers	"			
1137	5.5	Borers	"			
1138	6		"		1	
1139	4		"			
1140	4.5		"		1	Dying
1141	9	Borers	"			
1142	6	"	"		1	
1143	3.5	"	"			
1144	5	"	B	1	6	
1145	4		"		1	

Table III. - Continued

Stump No.	Diameter (Inches)	Remarks	Solution	No. Sprouts	No. Suckers
1146	7	Borers(Badly hit)	B		3
1147	6		"		3
1148	6.5	Double stump	"		
1149	6		"		
1150	7.5	Borers	"		1
1151	4.5	Borers	"		
1152	3	Borers	"		
1153	4.5	Borers	"	2	1
1154	5.5	Borers	"	2	1
1155	4	Borers and rot	"		
1156	4.5	Borers	"		
1157	4		"		
1158	4.5		"		2
1159	4.5		"		2
1160	6	Borers	"		1
1161	6		"		1
1162	4		"		
1163	4		"		2
1164	4.5	Borers	"		2
1165	4	Borers(Badly hit)	"		1
1166	4.5	Borers(Badly hit)	"	2	1
1167	4.5	Borers	"		
1168	7		"		
1169	12.5	Borers	"	5	1
1170	3	Rot	"		
1171	3.5		"		
1172	4.5	Rot	"	1	4
1173	3	Borers	"		
1174	3		"		
1175	4	Borers	"		1
1176	3		"		
1177	3.5		"		3
1178	3.5		"	1	1
1179	5	Borers	"	1	1
1200	4	Borers	"		
1201	4.5	Borers	Check Plot	13	9
1202	3.5		" "	5	2
1203	4		" "	11	1
1204	4		" "	14	4
1205	8	Borers, badly hit	"	7	2
1206	5	Borers	"	5	
1207	8	Borers	"	2	4
1208	4		"	8	1
1209	4.5	Borers	"	4	
1210	4	Borers	"	6	3
1211	4		"	4	1
1212	3	Borers	"	3	1
1213	5		"	4	2
1214	6		"	5	2

Table III - Con't.

Stump No.	Diameter (Inches)	Remarks	Solution	No. Sprouts	No. Suckers
1215	3.5	Rot	"	3	2
1216	3		"	3	
1217	4		"	6	2
1218	3.5		"	3	
1219	5		"	5	
1220	3	Borers	"	2	1

The results again indicate the effectiveness of the sodium arsenite treatment in preventing sprouting, but are not as conclusive in regards to suckering. Table IV gives the percentages of sprouting and suckering in each plot.

Table IV - % of sprouting and suckering in black Locust stumps.

	Solution A	Solution B	Check plot
	%	%	%
Sprouting	26	22	100
Suckering	39	57	70

At best the experiment can only be an indication of the effect on suckering, rather than a basis for definite conclusions. The amount of suckering was counted as the number of suckers within 4 feet, of the stump, and where the stumps were closer than 8 feet, apart, the sprouts were counted as belonging to the nearest stump. Sprouts from old suckers were not counted. While nothing is proven, the results do suggest that repeated treatments may be used to prevent suckering, especially as the amount of suckering decreased in proportion to the strength of the solution.

The effect upon sprouting ability is fairly conclusive. All the check stumps, as others scattered over the area and not treated, sprouted profusely, while those treated showed

a great decrease in the number of sprouts where sprouting occurred at all. Borer injury seemingly made little difference in the ability of the stumps to sprout or sucker. Diameter had little effect upon sprouting ability here, but only the larger stumps did much suckering, possibly because the larger roots are more apt to become exposed.

The results with the lead nitrate and different acid treatments were all negative. The cottonwood stumps were examined while bud masses were still forming in the frill, so possibly the number of sprouts counted were even lower than they should be. At least, it is certain that the chemical had little or no effect. Indeed the frilling apparently acted as a stimulant for the formation of adventitious buds.

The combined acid treatments were similarly ineffectual. On the oak stumps treated with mixed nitric and sulferic acids, sprouting was confined entirely to the root collars, while on the check stemps sprouting occurred from the sides of the stumps as well. However, sprouting occurred at the base of practically every stump, so this treatment must be discarded. The sprouted elm stumps appeared entirely unaffected in preventing sprouting from the box elder stump. Here sprouting occurred profusely from the tops and sides of the stumps as well as the root collars. This treatment must also be rejected as an effective stump poison.

CONCLUSION

The sodium arsenite showed itself to very successful as a stump poison to prevent sprouting with solution B proving as effective as solution A. It also gave good promise of being able to prevent suckering, with the more concentrated solution working better. These solutions were applied in two treatments the same stumps, two weeks apart, which may have been the cause of any effect upon suckering. Single treatments had previously proven effective to prevent sprouting. Further experiments should be conducted along this line.

Lead Nitrate, mixed nitric and sulphuric acids, and mixed hydrochloric and sulfuric acids all failed to show any effect at all in preventing sprouting. Weather conditions were similar to those following the sodium arsenite treatments, and frilling was done with equal care in all cases. Consequently, we must conclude that these chemicals are unsatisfactory to use in the prevention of sprouting.