POISON OAK STUDY

CAMP ADAIR, OREGON

by

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INTRODUCTION

The proper use of much of the land area of the Willamette Valley is impossible because of the presence of poison oak (Rhus diversiloba T. & G.). Any method of eradication, mechanical or chemical, or a combination of both methods which would make it possible to get poison oak areas into productive use should be thoroughly investigated.

The poison oak eradication program undertaken at Camp Adair, Oregon offers an excellent opportunity to study the results obtained by a combination of mechanical and chemical eradication of poison oak. The size of the Camp Adair undertaking, its location and importance make it desirable to study the effectiveness of the treatment on poison oak, the effect on trees, and the possibility of preventing the reestablishment of poison oak by the introduction of grasses or other vegetative cover on the eradicated areas.

If the eradication of poison oak can be successfully carried out in the Willamette Valley, it may be feasible to adopt an eradication program of this kind when labor and materials are again plentiful. It will be necessary, however, to observe the effects on vegetation of the chemical, borax, used at Camp Adair before treatment is given to other areas within the Willamette Valley.

Objective of the study: The primary objectives of this paper are:

(1) To measure the effectiveness of the treatment on poison oak

(2) To measure the effectiveness of the treatment on timber

History of the Eradication Project at Camp Adair

Soon after Camp Adair was established, the United States Army was faced with a serious problem. This problem, poison oak, was seriously interfering with the training of army personnel. As a result, the army instituted an intensive program for the eradication of poison oak from a large area.

The area upon which poison oak was eradicated consists of approximately 17,000 acres. The treated areas are made up of a stand of Douglas fir, (Psuedotsuga taxifolia Poir. Britt.), Oregon white oak, (Quercus garryana Dougl.), several fence rows, and old pastures. On much of this area 20,000 to 40,000 poison oak plants per acre were not uncommon. On these areas with such a heavy concentration of Rhus diversiloba if 99% of the shrubs were killed or removed, there would still remain about 200 to 400 plants per acre. On such areas, however, a small maintenance program must be carried out for several years if the ultimate goal is the complete extermination of poison oak from the area.

The work of eradication was started in December, 1942, under the supervision of the Post Engineer and a poison oak technician, H. J. Hartman of the U. S. Bureau of Entomology. The men employed on the project worked in fifteen-man crews; each crew had its own foreman, truck, and was assigned definite areas to work. The average number of men employed on the project was one hundred twenty. Eradication work was completed in June, 1943.

Method of Eradication at Camp Adair

Heavy Concentrations

Two caterpillar tractors equipped with a specially designed brush rake bulldozer assembly* were used to uproot the poison oak plants and push them

*Similar to that used in the eradication of Ribes

into windrows or piles so they could be burned. The bulldozer operated in the following manner: Teeth at the base of the blade were set so that they would penetrate three or four inches into the ground, or deep enough to catch the poison oak roots. The machine was driven ahead and uprooted the poison oak and brush along the path of travel. The brush collected in front of the rake was then pushed into a pile so that it could be burned. On the areas where the brush was piled, the ground was first cleared of vegetation by the bulldozer. After the brush had been piled by the bulldozer, it was then forked by hand into piles, so that it would be sufficiently free of dirt to speed drying and to insure complete burning.

A small hand-grubbing crew was used to follow the bulldozer operation. These crews cut off, three inches below ground level, all poison oak roots remaining in the soil, and hand grubbed all bushes which were missed by the brush-rake bulldozer.

The bulldozed areas were then treated with agricultural mesh borax, $Na_2 B_4.07\ 10H_20$., at the rate of ten pounds per milacre (equivalent to 10,000 pounds per acre). When crowns of poison oak were easily located, they were spot-treated with borax, and a complete treatment was given to the surrounding ground area in order to kill all buried roots and stems. Dense patches of large, mature poison oak plants were given a uniform treatment. Borax was applied to these areas at the rate of fifteen pounds per milacre.

Light Concentrations

The areas which supported light, scattered concentrations of poison oak, or where it occurred in a very close association with trees, the poison oak plants were hand-grubbed and the area treated with borax as explained above. The hand-grubbed bushes were cut off at a minimum of three inches below the ground surface. The resulting brush was piled and

burned. A systematical procedure was used to locate and destroy all poison oak bushes.

The application of the poison, borax, should be made to the treated areas as soon as possible after the bushes have been grubbed or bulldozed. Quick application of the borax will insure its killing action to act before new shoots can be produced by the roots remaining in the ground.

Method of Applying Borax

Borax, in the dry form, was applied to the hand-grubbed and bulldozed areas by hand broadcasting. A three gallon bucket was used as a chemical (Borax) carrying container. Between twenty and thirty tons of borax were applied per day by a twelve-man crew. As soon as the brush had dried sufficiently to burn, it was burned. All burned areas were then treated with borax in the same manner as on the other areas. A total of 3,520 tons of borax was used on the project.

In the Willamette Valley indications are that the best kill is obtained when the borax is applied during late February through July. At this time plants are most active, rain fall is sufficient to put borax into solution, but at the same time the rain is not sufficiently heavy to wash the borax away.

The Chemical Used

In order to kill the plants, the borax* must go into solution and boron picked up by active roots and accumulated in lethal amounts by plant tissues. This is a slow process, and it may take some time for the plants to show indications of boron poisoning.

Although boron compounds such as borax and boric acid must be used in large quantities in poison oak control work, they present no hazards to man or to livestock. Borax is clean, nonirritating to the skin, and offers

*Agriculture mesh Borax. Cost $32.00 a ton.

no objectionable odors or dust while it is being handled. In addition borax may act as a mild fire retardent. At the present time, because of its safety and ease of handling, borax is outstanding among the herbicides that are now in general use.

Costs of Eradication

Cost of eradication range from a few dollars per acre on areas supporting light concentrations to $400.00 per acre on the areas supporting large numbers of poison oak plants that must be worked by hand labor. The Camp Adair eradication costs were $18.00 per acre.

Boron and Plant Growth

Boron has long been known to have an effect on the growth of plants. The toxicity of boron upon plants was first studied by the Frenchman, Peligot, in 1876.

During the first World War boron toxicity became a problem of economic concern in certain Eastern and Southern states as a result of using fertilizers containing borax as an impurity. The fertilizer, potash, was obtained from the Southwestern part of the United States.

The element, boron, is widely distributed and usually occurs in the form of boric acid, $H_3 BO_3$, or more commonly as borax, $Na_2 B_4.0710H_2O.$, especially in volcanic regions. The present known borax deposits in the United States are located principally in the semiarid regions of the West.

Boron is of importance to plant growth for two reasons, namely: (1) Some of it is essential to the growth of many if not all plants; (2) it is extremely toxic to a large number of plants if it is present in the soil solutions in concentrations above a few parts per million. As may be expected, however, plants differ widely in their capacity to resist the toxic action of boron.

There appears to be a direct connection between the presence of soluble boron in soil and injury to plant growth. The rapidity with which

boron becomes insoluble varies with each individual soil or soil type and climate.

Concentrations of boron in soil solutions can be classified into three categories. (1) Concentrations that are insufficient to support normal plant growth, usually 0.10 to 0.50 p.p.m. (parts per million); (2) those that cause injury, usually in excess of 0.50 to 5.00 p.p.m.; and (3) intermediate concentrations that produce normal plant growth. Plants exhibit wide differences both in their boron requirements and in their boron tolerances.

Borax or other boron compounds are not easily translocated by plants. An aqueous solution applied to the aerial portions of a plant will not be transmitted to the roots in lethal dosages. When borax is applied to the soil, boron is picked up (from solution) by active roots, especially the surface roots, and is accumulated in lethal amounts by the plant tissues.

Because of its low solubility*, borax is not a quick acting poison when it is applied directly to the soil. It is best to make several applications of borox to the soil at intervals rather than a single heavy application. Soils which are rich in calcium may convert large amounts of the borax into highly insoluble calcium compounds.

Characteristics of Boron Poisoning.

The injury produced by boron is distinctive in its effects upon plant foliage. Boron symptoms are at once striking, and in many cases they are clearly distinguishable from those normal to maturation processes or injury which results from excesses of other elements in soil solutions.

Plants have a tendency to concentrate boron in their leaves, and these organs are typically the first to exhibit its injurious affects. Usually the apical margins of the leaves first turn yellow, and the yellowing then extends between the lateral veins towards the mid veins. Areas

*The solubility of borax at $0^{o}C$ or 32^{o} F = 1.3 grams which can be dissolved in 100 grams of water.

of dead tissue develop as yellowing progresses.

In some plants the dead tissue is confined to the margins of the leaves, while in others, such as walnut, sycamore, cotton, and bean, dead spots develop between the lateral veins either with or without noteable yellowing in advance. These dead areas become large and may coalesce near the margins of the leaves.

In citrus and some other plants the effects of boron are not noticeable until they have approached or attained full size; the configurations of such leaves are unchanged. Grapes, beets, tomatoes and other similar plants show the effects of boron poisoning while the leaves are still young. The affected leaves do not grow to normal size, and, either with or without yellowing or drying, they sometimes become cupped because of the cessation of marginal growth in advance of that of the more central leaf portions. Injured leaves abscise a fall sooner than leaves that are not affected by boron poisoning.

Observations by H. J. Hartman (September 1943) The following is from a memorandum by Mr. Hartman:

"It seems best to postpone the actual measurements of the Camp Adair poison oak eradication areas until next spring. It is too early to determine the full effect of the borax on the poison oak and on the trees. Present indications are that the treatment is around 99% effective, and that the maple and chittum are killed; the white oak and Douglas fir are not seriously damaged.

"The white oak has been seriously damaged by the Jumping Oak Wasp, Neuroterus saltatorius (Edwards). The damage of this insect is limited to the leaf surface, and it is doubtful if it will kill the trees, hence trees dead next spring should be labelled as poisoned by the borax.

"Damage to the white oak trees is greatest in the area east of 'Tent City'. The trees along the swale north of the road appear most badly dam-

aged, however, in merely examining the leaf damage it is difficult to tell which is due to borax and which to the wasp.

"Velvet or mesquite grass is coming in on some of the areas, particularly on some fence rows and on the hills west of the small arms range. Most of the treated areas, however, are bare of vegetation except for an occasional poison oak sprout."

At this time Mr. Hartman recommended that transects be run and permanent plots established as follows:

1. West of 99 W and above the small arms range - area treated in May, 1943.

2. East of "Tent City" just southeast of camp - area treated in April, 1943.

3. On hill in mortar range area - treated in June, 1943.

4. Douglas-fir area north of camp - treated in June, 1943.

The measurements taken on poison oak should consist of:

1. Number of plants
   a. From sprouts
   b. From seed
2. Average height of each plant
3. Number of feet of live steam in each plant.

The original recommendations for control work consisted of spraying the poison oak with atlacide at the rate of 800 pounds per acre or sodium chorate at the rate of 3 pounds per square rod. The spray method was discarded for the following reasons:

1. It is extremely difficult to get spray equipment around in the woods.
2. It creates a big fire hazard.
3. It does not remove the hazard to men since the poison element in the poison oak plants remains. (Tests show that the poison remains at least six months)

4. The effective time of spraying is limited with a large chance of rains washing away the spray.

5. The effectiveness of the method is doubtful, particularly if no repeat spraying is done.

6. The total cost is as great as the borax treatment.

The Inspection of the Eradicated Areas

It was the writer's intention to make a fairly intensive survey of the area which received treatment. This was to be done by:

1. Running transects through different areas on which a count is taken of the living poison oak plants on a sufficient number of four milacre plots to secure a good sample. This would have made it possible to have a record of the size of poison oak bushes and the number per acre.

2. Establishment of several permanent milacre plots on each are examined. Each plot to give the number of poison oak bushes and their origin, i.e., whether from seed or roots.

3. Establishment of several fifth-acre plots in the Douglas fir and Oregon white oak stands. The trees to be tallied by D.B.H. in three classes, namely, undamaged, damaged, and killed (damage to be determined upon leaf characteristics of boron poisoning).

Because I had difficulty in getting on the area, I was not able to do what is outlined above. It must be remembered that the area is within Camp Adair, and it is not always possible to go on the eradicated areas as often and as freely as desirable. I would recommend that future work, if possible, be done in conjunction with someone from the camp.

Plot 1

I was able to get one fifth-acre plot established in a stand of Oregon white oak a short distance south of the small arms range. A table showing the D.B.H. of the trees and observations upon them is on page 14.

Poison oak on the plot: Numerous small poison oak plants are within this plot. The plants are apparently growing from roots, and most of them are only a few inches in height.

Grass on the plot: Scattered plants of orchard grass (Dactylis glomerata L.) are within the plot.

I have been unable to find any definite indications of boron poisoning on either the trees, poison oak, or the grass within this plot. I did find two poison oak plants with leaves that might possibly be affected by boron poisoning. These two bushes are outside the plot. Upon examination of poison oak on an untreated area, I decided that larger numbers of observations on poison oak on the treated areas would have to be made before any decision could be made relative to boron poisoning.

The Douglas fir stands north of camp were hand grubbed. I was through one stand of timber here, but I was unable to find any poison oak bushes. This area should be examined more closely.

The east end of "Prune Ridge", just west of highway 99W, is an area that was worked by hand. I was unable to get on this area to make an examination or to establish plots.

An attempt was made to get some pictures, particularly of the bulldozed area south of the small arms range. It was necessary to get an officer from the camp to accompany me while the pictures were being taken. The combination of a rainy day and defective film caused the pictures to be no good.

Conclusions

Since I have not covered enough of the eradicated area to make any definite conclusions, I hesitate to make any statement relative to the success of the eradication program. From what I have seen I believe that a maintenance program will have to be carried out on part of the area, particularly the bulldozed area where there were heavy concentrations of

bushes. It may be that the full effect of the poison has not yet shown up on the plants. Several years may elapse before definite results may be expected in regard to the poisoning action of the borax. It will take further observations of the area to determine the success or failure of the eradication project. Even if the eradication project does prove to be successful, it may not be possible to apply the treatment to other areas of the Willamette Valley. Costs of such a program may be too high for a private individual to attempt the eradication of poison oak from his property, or it may be that the borax used will make the soil unfit for agricultural purposes for several years after treatment.

Recommendations for future study

1. The study should be continued for several years.

2. Two men should work together on the study. This would make it easier to do the necessary field work.

3. It would be highly desirable to have someone from Camp Adair to work with anyone who is engaged in the study. It may be possible that the Post Engineer or the Medical Corps would be willing to furnish a man for this purpose.

4. Plots should be located as recommended by Mr. Hartman. In addition, plots should be established in the Douglas fir and Quercus garryana stands in order to observe the effects of the treatment upon the trees. Observations should also be made on cascara and maple trees.

5. It would be well if two Juniors from the Forestry School would work together on the study. This would give an opportunity for the same persons to inspect the area at two different times. The second time they inspected the area these men could show two new men the location of the plots and the necessary work to be done.

Plot No. 1

(1/5 acre)

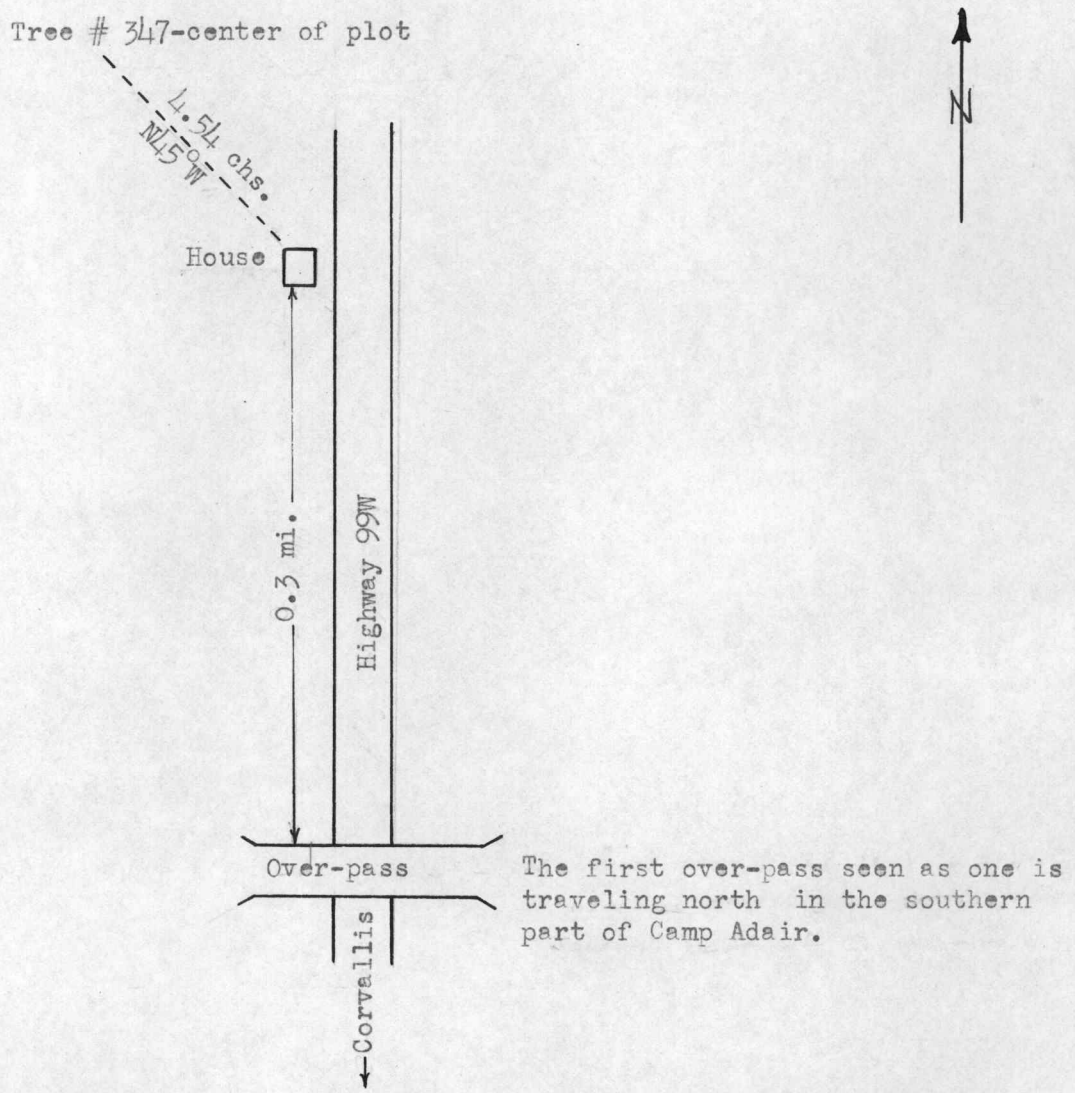
Tree No.	D.B.H.	Undamaged	Partially Damaged	Killed
347	5.3	x		
348	6.0	x		
350	4.0	x		
351	5.9	x		
352	4.9	x		
353	5.5	x		
354	4.3	x		
355	4.4	x		
356	5.1	x		
357	5.2	x		
358	5.3	x		
359	4.0	x		
360	3.6	x		
361	4.4	x		
362	3.8	x		
363	3.2	x		
364	6.4	x		
365	3.2	x		
366	5.5	x		
367	3.7	x		
368	5.1	x		
369	4.3	x		
370	3.5	x		
371	4.5	x		
372	4.3	x		
373	5.5	x		
374	5.6	x		
375	4.5	x		
376	5.2	x		
377	3.2	x		
378	4.2	x		

Note: tag number 349 is missing.

Tree number 347 is the center of the plot.

Plot is circular and 1/5 acre in size.

LOCATION OF PLOT #1 (In a stand of Quercus garryana)



The first over-pass seen as one is traveling north in the southern part of Camp Adair.

Bibliography

Eaton, Frank M., and Wilcox, L. V., The Behavior of Boron in Soils, USDA Tech. Bul. No. 696.

Eaton, Frank M., Boron in Soils and Irrigation Water and Its Effects on Plants, USDA Tech. Bul. 448.

Cook, Frank Cummings, Effects of Three Annual Applications of Boron on Wheat, Jour. Agric. Research, Vol. X, No. 12.

Cook, Frank Cummings, Boron: Its Absorption and Distribution in Plants and Its Affect on Growth, Jour. Agric. Research, Vol. V, No. 19.

Chemical and Mechanical Methods of Ribes Eradication in the White Pine Areas of the Western Stands, USDA Tech. Bul. No. 692

Hartman, H. J., Poison Oak Eradication at Camp Adair.

Poison Oak eradication, Season 1943.

Wooded area on Poison Oak Hill lying west of the main camp area which was cleared partly by bulldozer and partly by hand work.

Poison Oak eradication, Season 1943.

View of an area similar to that of #2, 3, and 4, before eradication program was started.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Poison Oak eradication, Season 1943.

Wooded area on Poison Oak Hill lying west of the main camp area which was cleared partly by bulldozer and partly by hand work.

Poison Oak eradication, Season 1943.

View of a wooded area north of Suver Road, showing work at start of eradication program. Note the poison oak vines crawling up the tree trunks. There is evidence that some of these ran up as high as forty feet.


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Poison Oak eradication, Season 1943.

A view on the northeast slope of Poison Oak Hill, showing the portion of original stand.


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Poison Oak eradication, Season 1943.

Showing hand work in operation.


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Poison Oak eradication, Season 1943.

Wooded area cleared principally by hand.


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Poison Oak eradication, Season 1943.

Wooded area on Poison Oak Hill lying west of the main camp area which was cleared partly by bulldozer and partly by hand work.