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FLASHES FROM "SLASH DISPOSAL AND FOREST MANAGEMENT AFTER CLEAR CUTTING IN THE DOUGLAS FIR REGION"

A manuscript recently prepared by
Thornton T. Munger and Donald N. Matthews

Security from fire is the all-important prerequisite for timber growing after clear-cut logging in this region. Maximum security from fire is attained only when the land is again covered with a continuous cover of trees 20 to 30 or more years old.

Broadcast burning has only one real advantage--the removal of some of the fire hazard, thus facilitating subsequent fire control and reducing the chance of disaster from an uncontrollable fire. This advantage is very important, though temporary in effect, and under present conditions generally outweighs all the disadvantages.

The advantages and disadvantages of burning a cut-over tract should be considered from the long-term viewpoint. Too often the condition of the land immediately after burning is used as a criterion of success; rather its probable aggregate condition over a term of 10 or 20 years should be used as a measure of the desirability of burning or not burning the slash.

Burn slashings where these conditions prevail--

a. Burn where the chances of accidental fires are high or the opportunities for fire control are poor.

b. The cutting is clean and there is not an understory that would be killed by the fire and make another hazard comparable to the initial slash.

c. The conflagration hazard is high, due to very extensive areas of recent cuttings.

Do not burn slashings where these conditions prevail--

a. There is a considerable reserve stand or understory that would be killed by the fire, thus making little or no net gain in reducing the fire hazard.

b. The logged-off area is well isolated from risk of fire and is not a particularly high hazard in itself.

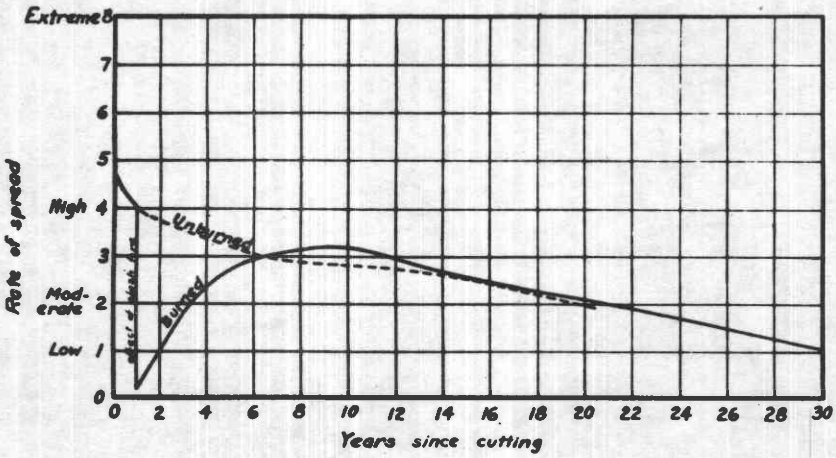
c. There is a good stand of advance or subsequent reproduction that promises to give shade and reduce fuel inflammability in a very few years.

Each area is a problem in itself; blanket rules will not apply.

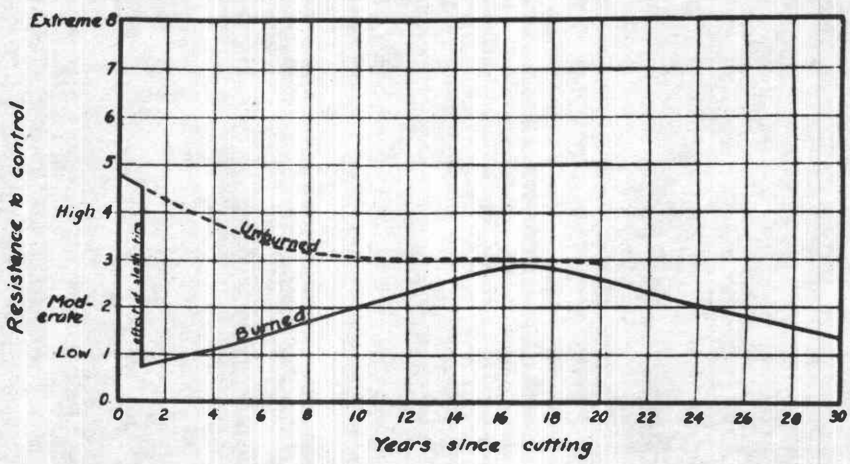
Slash burning does not end the fire hazard; it merely lessens it for a few years, and often creates falsely a feeling of security. In a few years slash-burned areas are as inflammable as unburned areas--though fires thereon are easier to control.

FIRE HAZARD ON SLASH-BURNED VERSUS UNBURNED CUT-OVER LANDS

The following graphs summarize studies recently completed in the Douglas fir region of Washington and Oregon; the first two taken alone mean little but combined to make the third they are very significant.



Rate of Spread. These curves show the trend of rate-of-spread ratings of slash-burned (once-burned) and unburned cut-over lands in the years after cutting. They are based on estimates of the behavior of small fires (less than $\frac{1}{4}$ acre) under the same weather in each area. The kind, quantity, arrangement, and moisture content of the fine fuels were important factors. Individual areas show wide variation from the curves, but the average rate of spread was approximately the same on burned and unburned land about six years after cutting. The drop in rate of spread after 10 or 12 years is caused by the shade of reproduction or brush which decreases herbage and increases the fuel moisture content.



Resistance to Control. The trend of resistance-to-control ratings of slash-burned (once-burned) and unburned cut-over lands for 20 years after cutting is shown by these curves. They are based on estimates of the number of man hours required to control small fires (less than $\frac{1}{4}$ acre) by handwork. Time required to clear a fire line and dig a trench to mineral soil were the principal considerations. Even after 20 years resistance to control averaged somewhat higher on unburned than on burned cut-overs.

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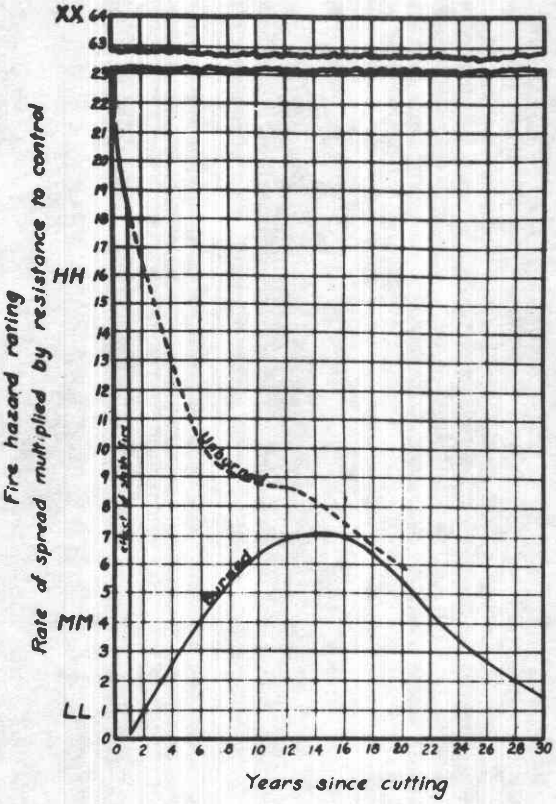

Fire Hazard Rating. An expression of the total fire control job was obtained by multiplying rate of spread by resistance to control. The resultant fire hazard rating of the once-burned and unburned areas is shown in above curves. Reason for multiplying the two factors: The rate of spread expresses the number of chains of perimeter added to the job each hour; the resistance to control expresses the number of men required to control one chain of perimeter; therefore, the total number of men required to control the spread of each hour can be obtained by multiplying the rate of perimeter increase by the number of men required to control each chain of perimeter.

The curves indicate that there is a big difference between the fire control job on burned and on unburned lands in the first years after cutting. Thus two years after cutting one man might be able to control a small fire on burned land in one hour, but about 16 men might be required to control the same size fire in the same time in unburned slash. Individual areas in different parts of the region showed wide variations, but after 10 years the average difference between burned and unburned cut-over land diminishes rapidly and in 20 years they have practically the same hazard rating. The aggregate hazard on unburned land through the first two decades after logging is only 1.8 times that on burned land.

Growth of a forest cover that is dense enough to shade out brush and ground cover but not too dense for men to work in is a major factor in reducing the fire hazard rating after 15 or 20 years. Hence reburning or poor restocking of cut-over land tends to keep the fire hazard at a high level over a long period of years. Successful fire protection and full restocking by reproduction tend to reduce the fire hazard. Donald N. Matthews.

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PRUNING OF SELECTED CROP TREES IN DOUGLAS FIR

The large, old-growth, clear-boled Douglas fir stands are gradually being replaced by knot-studded second-growth stands and the problem of producing high grade timber becomes increasingly important. This species is such a slow natural pruner that more than 50 years elapses from the death of a branch until it drops from the tree. During that 50-year period a tree grows about 10 inches in diameter on an average site, 18 inches on a good site, and will then contain black knots 5 to 9 inches long. Artificial pruning is one means of reducing the length of these knots and of producing a higher grade of lumber.

Two pruning projects, aggregating several hundred acres and conducted by CCC's, are under study now, one in a 30-year plantation, and one in a 60-year natural stand. The dominant and codominant trees, those that are likely to become the final crop trees, were pruned of all branches on the first log length.

The pruning equipment consisted of pruning saws, with five teeth to the inch, mounted either on short handles or on 14-foot poles. One successful crew organization consisted of three men. One man, equipped with a hand saw, selected the crop trees on the basis of 100 trees per acre, pruning them to the 8-foot level. The other two members of the crew, using 14-foot pole saws, completed the pruning of these selected crop trees to the 18-foot level.

It was found that the following principles controlled the pruning cost for trees of the same age: (1) The number of branches in the first 18 feet increases with tree diameters and is greater in dominant than in codominant trees; (2) the dominant trees tend to have a greater percentage of live branches than the codominants and the branch diameters tend to be greater in the dominants; (3) the diameter of all branches increases with increasing tree diameters.

The study of the 30-year plantation showed these averages:

Crown class	Dia. class	Total No. of branches	% of live branches	Aver. size of branches	Aver. size live branches	Total pruning time
Codom.	8	56	15	.66 inches	.78 inches	4.08 min.
Dom.	8	63	47	.78 "	.95 "	5.20 "
Codom.	12	69	6	.68 "	.68 "	5.05 "
Dom.	12	71	38	.87 "	1.17 "	7.59 "

The actual labor cost varied from 3 to 10 cents per tree on the CCC cost basis of 25 cents per man hour; costs per acre varied from 3 to 6 dollars where an average of 85 or 90 trees per acre were pruned.

As a result of this pruning, the fastest growing, best formed "crop trees" are now producing clear lumber on the first log. The average log is approximately 7 inches in diameter and contains 30 board feet, Scribner rule. In 50 years this log should be 17 inches in diameter and will contain 180 board feet. One inch of growth is needed to cover the stubs and scars resulting from the pruning operation; hence there should be a gain of approximately 140 board feet per butt log of clear lumber.
Douglas C. Welch.

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CROP TREE THINNING AND PRUNING IN PONDEROSA PINE CUTOVERS

Important objectives in the management of the extensive cut-over areas in the ponderosa pine region, some overstocked to the point of stagnation, are to increase the rate of growth and the net value of the final product. To help solve these problems this Experiment Station has undertaken a survey of stand improvement work in eastern Oregon and Washington and is now actively participating in devising a better basis for current and future work.

Since 1933 some 11,000 acres have been thinned by the spot release method in which about 40 trees per acre were selected as crop trees and given release. The pruning of crop trees of all dead branches was practiced on about 6,000 acres. On the Malheur and Whitman National Forests, where the residual stands contained pole size or even larger but still economically immature trees, pruning to a height of 18 feet was practiced on some 2,000 acres.

The cost of releasing and low pruning a tree is about 5 cents, based on CCC labor at 25 cents an hour. Pruning to a height of 18 feet costs about 15 cents per tree.

The survey of all work prior to 1938 suggested some improvements in both pruning and thinning methods. It was found that the rigid 33-foot crop tree spacing requirement is detrimental to uniformly good tree selection as well as to the proper consideration of need for thinning. Adequate release was not always given because of the disregard of the crown space requirements of the crop tree.

On the basis of past experiences, recommendations for a flexible 16- to 50-foot spacing, full crown release, plus an additional three feet of crown space for all but the spindliest small trees were made and are now incorporated in the work instructions. The pruning of all crop trees of dead and dying branches was also recommended and is now practiced.

The study of cores taken from well-released trees on the Fremont and Whitman National Forests' spot thinned areas shows that the rate of growth had doubled for released trees in three years after treatment. An increase of at least two inches in diameter over unreleased trees is expected at maturity.

An enhancement in value of at least $1.00 per log is likely to result from pruning, according to the studies of log values made in pine mills by Dr. Lodewick of this Station. A limby 12-inch tree without pruning would produce in 110 years (when it reaches a diameter of 22 inches) only an 18-inch #5 butt log, while if pruned it would yield a #1 butt log with shallow clears.

To what extent this enhancement in volume and quality will more than cover the cost of pruning and thinning only future developments will prove, but the indications are very favorable. Theodore Kachin.

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FORMATION OF KNOTS IN DOUGLAS FIR

An epitome of a study made by Junior Forester Loyd Bransford

Quality growth is quite as important an objective of forest management as quantity growth. A tree's pruning habits control knot formation and thus the quality of the sawlogs that are produced. Controlling stand density is one way to regulate knot formation. Pruning is another. To get a better understanding of knot formation and the natural pruning habits of Douglas fir, four trees were dissected last summer by Loyd Bransford of the Wind River Experimental Forest, following in general the technique used by Paul, of the Forest Products Laboratory, and Rapraeger, of the Northern Rocky Mountain Forest Experiment Station.

The trees were from a 100-year-old stand of even-aged Douglas fir and were from 15 to 23 inches in diameter; a few feet of their lower boles were clear, but for a considerable length they were bristling with dead limbs in various stages of decay. The trees were felled, peeled, and cut into sections by CCC boys and then the sections were put in a combined miter and vise, ingeniously constructed by Bransford, and the largest four knots in each section bisected so as to disclose the life history of each limb.

Bransford's report shows that in the lower 16 feet of the bole the limbs died before the trees were 30 years old, but at 90 feet above the ground the limbs were living and growing vigorously. The knot size increases as the height above ground increases. While the average knot diameter is 0.5 inches at the height of 10 feet, it is 1.0 inches at 80 feet. At the same time the length of black knot decreases with increasing height.

In the lower 20 feet of bole it was 54 years from the time a limb died until complete occlusion of the knot took place and clear wood began to be formed. After 80 years of age the formation of clear wood was extended more rapidly, but these trees will have at best only about 2 inches of clear wood on part of the first log at 100 years of age.

The fact that in a typical natural stand 54 years elapses from the time a limb dies until it is shed and the knot occluded is eloquent proof that the production of clear lumber can be greatly accelerated by artificial pruning on the lower boles of Douglas firs of at least the dead limbs as soon as they die, and thus prevent the occurrence of black (or loose) knots. Thornton T. Munger.

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BEWARE OF ROTTEN WOOD!

In what fuels and under what fuel moisture conditions are cigarettes and matches discarded by smokers most likely to start fires?

Burning cigarettes and matches were dropped on small plots (pans) of rotten wood, pine needles, cheatgrass, or fern of known moisture content in order to answer this question. The tests, over 500 in number, were made by William J. Allyn in the greenhouse at Wind River Experimental Forest during the summer of 1938.

Cigarettes and rotten wood make the most dangerous combination, because it was found that a burning cigarette will ignite rotten wood at much higher moisture contents than will a match. Burning matches dropped on this fuel failed to ignite it when its moisture content reached 10 or 12 percent, although cigarettes would ignite it readily in a high percent of the trials. (The exposed surface of rotten wood is usually much drier than this in fire weather; 5 percent or less is not uncommon.) There was found to be better than a 50-50 chance that a cigarette would ignite rotten wood with a moisture content as high as 20 or 25 percent. These results were obtained in still air. Additional tests made in a 4-mile wind indicated that the wind increased the probability that the cigarette would ignite the rotten wood.

The rotten wood used in the tests was the red or brown colored, crumbly, completely decomposed wood which is produced by the last stages of the decay of coniferous trees. This fuel is not conspicuous, but it is very common throughout the region and occurs in largest quantity in the dense, damp forests of hemlock, spruce, cedar, or Douglas fir. Material for the tests was sifted through a fine screen so that it closely resembled the punky, powdery, rotten wood found in trails, in campgrounds, and on the surface of the flattened masses of decomposed wood.

Matches were found to be more effective than cigarettes in starting fires when dropped on fresh, clean ponderosa pine needles such as make up the top layer of fuel under a pine forest. Even on oven-dry needles cigarettes gave poor results. Had the partly decomposed needle and duff layer next to the ground been used cigarettes might have proved to be better firebrands because this fuel probably resembles the rotten wood tested. Cigarettes failed to ignite oven-dry cheatgrass and fern. These fuels were also fresh and clean and therefore free of any powdery or punky fuel for the cigarette to ignite.

One very obvious observation that might be made after seeing these tests is that it is desirable to eliminate all powdery, punky, rotten wood from trails, roadsides, campgrounds, and other parts of the forest where smokers might possibly discard a burning cigarette. Donald N. Matthews.

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SEVEN METHODS OF CUTTING TESTED AT PRINGLE FALLS

Some 7,000 ponderosa pine trees on 520 acres in the northeast portion of the Pringle Falls Experimental Forest have been tallied as to diameter, age, thrift, log quality, and value, and will be observed as to growth, value increment, and mortality through a term of years. This was the initial task in establishing seven new experimental plots to determine the best methods of harvesting virgin ponderosa pine stands for most profitable permanent production.

Six of the seven new plots were marked and cut over under various modifications of the maturity selection system. On three of them the thrift of the individual trees was the criterion for deciding what was to be cut, while on the other three the decision for cutting was determined by economic maturity, considering both present and future estimated values.

Under each plan three intensities of cutting were employed, namely, 20, 40, and 60 percent of the total volume in trees over 16 inches in diameter. The seventh plot was marked according to the 80 percent volume removal method of the least thrifty trees.

In order to determine the difference in the residual stands resulting from the two approaches or modifications of the maturity selection method, each plot was marked in the field by both plans. This double marking of all plot stands before cutting was made possible by numbering and tagging each tree. Thus, the trees selected to be cut by each system were listed by number. The table below gives the percent of volume removed by tree class for three plots to make easy a comparison of the two methods for each intensity of cutting.

Percent of volume by tree classes marked for removal by the thrift and value methods for three intensities of cutting

Tree Classes (Keen's)	20% Cut			40% Cut			60% Cut		
	Virgin	Thrift	Value	Virgin	Thrift	Value	Virgin	Thrift	Value
1 (All)	0.2	--	--	0.1	--	--	0.4	--	--
2 (All)	5.3	--	--	3.1	--	--	7.0	--	--
3A	22.8	0.1	0.7	7.6	--	0.3	16.9	0.8	7.3
3B	21.3	0.4	1.4	9.2	0.3	0.5	9.2	2.7	3.2
3C	5.3	0.9	0.1	3.6	0.3	0.1	2.2	0.6	0.4
3D	0.5	0.2	0.1	0.2	--	--	0.4	0.1	--
4A	12.4	1.1	5.5	17.9	4.1	8.8	20.4	15.9	15.5
4B	22.6	9.8	7.9	36.7	18.3	17.3	27.2	23.9	21.0
4C	9.5	8.6	4.7	20.7	16.9	13.6	15.8	15.2	12.1
4D	0.1	0.1	--	0.9	0.3	0.1	0.5	0.4	0.2
Total	100.0	21.2	20.4	100.0	40.2	40.7	100.0	59.6	59.7

E. L. Kolbe and D. F. McKay

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REFORESTATION BY BROADCAST SEEDING WITH SMALL-SEEDED SPECIES

Because broadcast seeding appeared to offer distinct possibilities of a more flexible reforestation program at reduced cost, a series of tests were started during the period of 1929 to 1933 with small-seeded species in the coastal region.

Rodent consumption of seed and unsuitable surface conditions appeared to be the causes of past failures; these pitfalls were in a measure avoided by selecting a freshly logged area in the fog belt type and by using small-seeded species native to that region that had from 200,000 to a half million seeds to the pound. A total of 49 areas from a quarter acre to three acres in size were sown on cut-over land in the Olympic National Forest near Quinault, Washington. Except for three tests of Douglas fir, the species used were Sitka spruce, western hemlock, western red cedar, and red alder; some areas were sown with one species, others with a mixture.

Adjacent areas on the same burn were seeded year after year. Fresh burns, old burns, and unburned areas were seeded simultaneously for the purpose of comparison.

Areas seeded within one or two years after the slash fire showed from 200 to 5,600 established seedlings per acre per pound of seed sown; older burns or unburned areas gave less favorable results.

The gradual reduction in number of seedlings from successive years sowing on a 1928 burn are shown in figure 1. Both the initial germination and number of established seedlings declined from year to year. Over 500 established seedlings per acre were found on 100 percent of the 1929 plots, 83 percent of the 1930 plots, and none of the 1931 or 1932 plots. This was not the result of climatic variation or variation in seed viability, as seeding done in 1931 and 1932 on fresher burns gave satisfactory results. (See figure 2.) In 1931 the germination was slightly better on the 1928 burn than on the 1930 burn, but the survival on the 1928 burn was very low, while in 1932 both germination and survival were low on the 1928 burn when compared with the 1931 burn.

Five tests were made with red alder in 1932 and 1933. One of these, seeded on heavy marsh grass, was a complete failure; another was heavily grazed by elk and had 700 seedlings per acre in 1936 per pound of seed sown; the remaining three had in 1936, 3,270, 3,800, and 5,560 respectively, or an average of 4,210 per acre per pound of seed sown.

The study indicates that a satisfactory stand of Sitka spruce, western red cedar, western hemlock, or red alder regeneration can be obtained by broadcast seeding at the rate of one to two pounds to the acre in the spruce-hemlock region, provided the seeding is done within two years after the slash burn. However, the wide variation in results obtained shows that additional study is necessary to determine definitely the minimum amount of seed necessary to produce adequate restocking under different ground conditions. Leo A. Isaac.

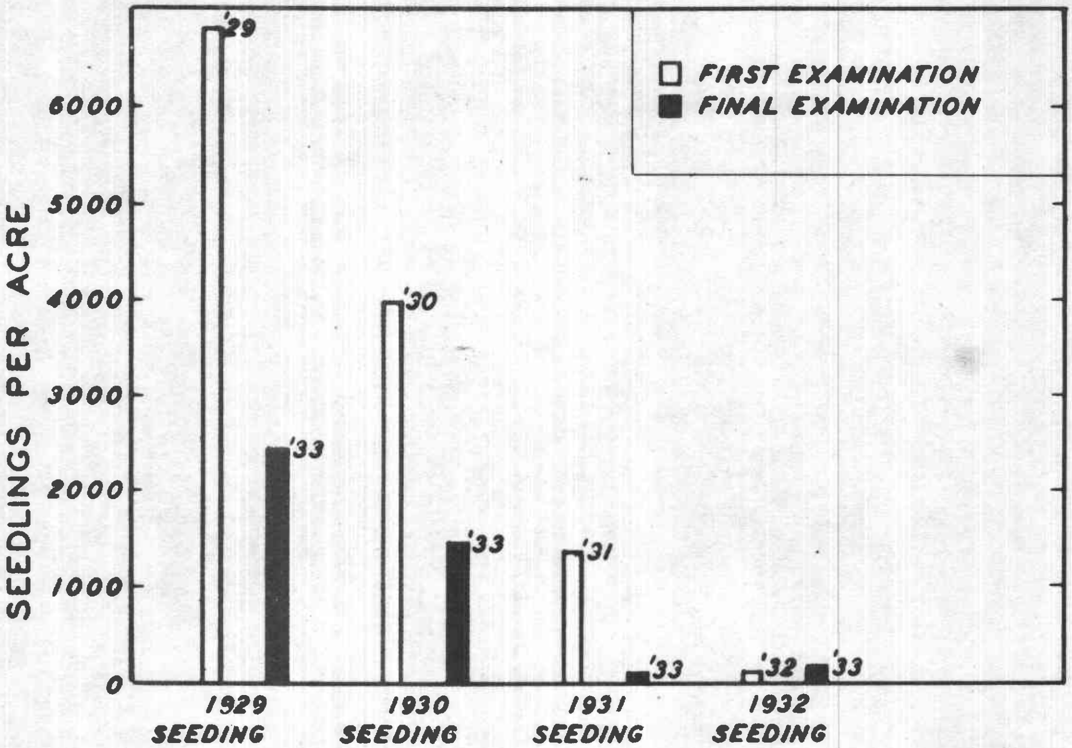

FIG. 1 GERMINATION AND SURVIVAL OF 1929 TO 1932 SEEDLINGS PER POUND OF SEED SOWN ON A 1928 BURN.

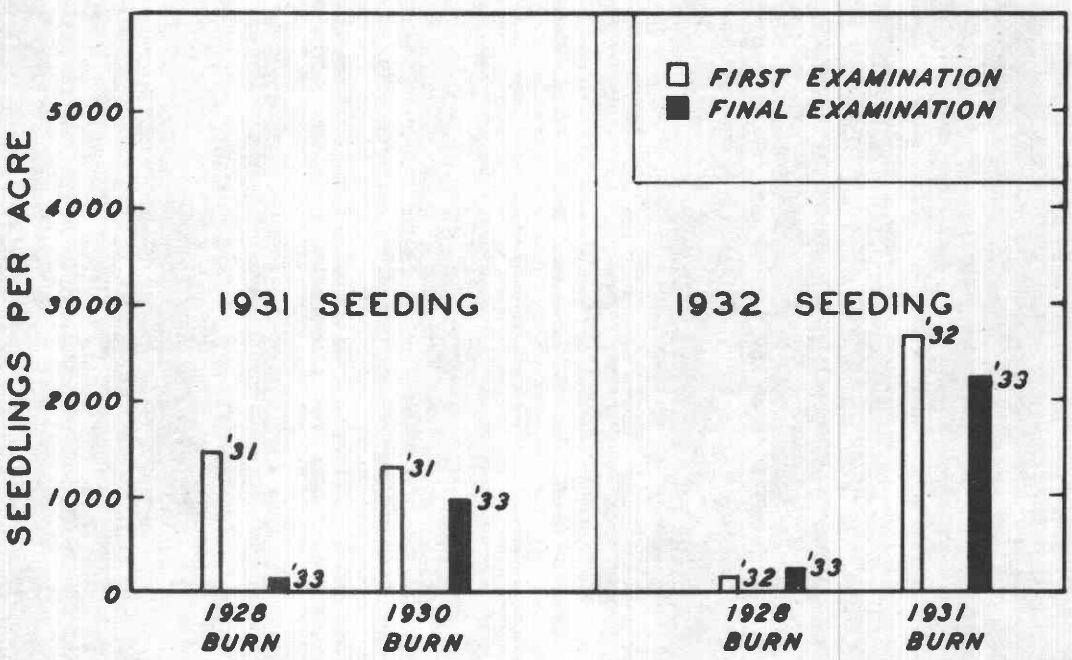

FIG. 2 GERMINATION AND SURVIVAL FROM 1931 SEEDING ON 1928 AND 1930 BURNS, AND 1932 SEEDING ON 1928 AND 1931 BURNS, PER POUND OF SEED SOWN.