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P. T. Smith  
*Iowa State College*

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# Reforestation on the Black Hills National Forest

P. T. SMITH  
Forest Examiner, Black Hills National Forest

The Black Hills National Forest is located in the north half of the Black Hills of South Dakota. The forest is approximately square, being about 36 miles wide and 33 miles long and comprising a gross area of 600,480 acres. The country is rough, being a series of low rolling hills with only occasional high peaks.

The forest is primarily a western yellow pine forest, about 95% of the forested area being occupied by this species. Yellow pine thrives in practically all situations and the country seems peculiarly adapted to the growth of this species.

Fire has always been the principal factor in limiting the growth and development of yellow pine in this country. The Indians, who were the first settlers in this region, tell of the forest fires in the Black Hills which occurred a great many years ago and evidences of these early fires are still seen throughout the country. Since the white men came to the country a number of large fires have occurred which completely denuded large areas. There is at present a total area of approximately 40,000 acres which have been denuded by fire and on which the chances of establishing another stand by natural regeneration are very slight for an indefinite period.

The object of the reforestation work which has been done on the Black Hills Forest for the past ten seasons has been to hasten the establishing of a stand of some valuable species on these denuded areas. If left to the whims of nature, these areas would not be restocked with a valuable stand for centuries.

The first work in reforestation on the Black Hills Forest was done during the spring of 1905 on what was called the Custer Peak Experimental Area. In this operation a total of 39.6 acres were sown by the broadcast and cornplanter methods. This work proved very successful, the resulting stand of seedlings being very thick and healthy. In 1906, 1907 and 1908 the work was continued on this area, the amount of ground covered each

year varying from 15 to 60 acres. The broadcast method of sowing was used almost exclusively. This work was almost entirely experimental in character, an attempt being made to determine the best method by which direct seeding work could be done. The results of these four years' work were as a whole very satisfactory, hence the broadcast method of seeding was considered to be a very satisfactory method by which to do the work.

As a result of the success attained by the use of this method of direct seeding in the first four years of the work on the Black Hills Forest, large areas were thus sown in 1909 and 1910. The results show the fallacy of this deduction, as the seeding of these two years is almost an entire failure. The weather conditions had been favorable for the work in the previous years and had made success possible, but the conditions during the latter period were unfavorable, and the results were failures.

In 1911 the direct seeding work was conducted with a view to developing the method which was most applicable to the conditions on the Black Hills Forest. In this operation a number of species were sown by various methods under different conditions of soil and aspect. The operations were given thorough study from the standpoint of both cost and adaptability to conditions. It was found in this work that the simple spot method was not only one of the cheapest methods which had been used, but also gave the greatest assurance of success at the time of the operations than any other. The results proved that these deductions were correct, as the only areas which showed any stands of seedlings were those sown by the simple spot method. The corn planter and broadcast methods were eliminated entirely, as the results attained would not warrant the continued use of these methods.

The simple spot method as applied to the reforestation work in the Black Hills Region consists of the following: the men are each equipped with a mattock and a small bag of seed. They are lined up at the edge of the area to be seeded, spaced according to the distance apart which it is desired the spots shall be. The leader then starts off, making the spots the desired distance apart in the row. The other men follow in order, keeping the prescribed distance away from the man to his right or left as

the case may be and spacing the spots according to the required distance apart.

The spots are made from 6 inches to 8 inches wide and from 8 inches to 10 inches long. All vegetation is removed from the spot by two or three strokes of the mattock and the soil loosened up by a few light strokes. From 10 to 20 seeds are then scattered over the spot and covered with from one-half to three-quarters of an inch of loose dirt and packed in by the pressure of the foot as the man passes on to the next spot.

This method of direct seeding is cheap and effective. One man can sow about two acres per day, which at \$2.50 per day brings the cost of the operation to \$1.25 per acre. By this method the seed are placed in direct contact with the mineral soil and are covered to the proper depth. This gives the greatest assurance of success which it is possible to obtain at the time the work is done.

In direct seeding work which has been done since the spring of 1911, the simple spot method has been used almost exclusively. The results obtained thus far prove the efficiency of the method as used for the Black Hills Region. In 1912, approximately 1400 acres were seeded by this method and the resulting stand of seedlings varied from 1000 to 6000 per acre. In 1913, the seeded area covered 795 acres, with results equally as good as those of 1912. The work done during the past spring (1914) showed an average of 50% of successful spots on an area of 867 acres.

The success or failure of direct seedling work in the Black Hills, however, is very largely at the mercy of the climatic conditions. In normal seasons, when the rainfall is well distributed throughout the growing season, the work if well done will produce very satisfactory results. In excessively dry seasons, such as 1910 and 1911, it would be almost impossible to secure a satisfactory stand by any method of direct seeding.

A factor in direct seeding which, previous to 1910 had never been considered, is the rodent factor. During the 1910 work Dr. Ned Dearborn of the Biological Survey, made an exhaustive study of the rodent question. He determined that while rodents were possibly not entirely to blame for past failures in direct seeding work they had a very great influence. A few busy chipmunks can do a great amount of damage to seeded

areas in a very short time. In fact, one chipmunk was shot in whose pouches 76 yellow pine seed were found. These seed had been collected by the rodent in a short time. Thus the amount of damage done by a number of these animals is enormous, as they are very quick and work with astonishing rapidity.

The question of eradication at once presented itself. It was certain that satisfactory results could never be attained by direct seeding until some means of protecting the seed sown from the depredations of the rodents had been devised. Poison at once presented itself as an easy and possibly an effective way of accomplishing this end. Several different kinds of poison were used with several kinds of bait. It was, however, finally determined that wheat, treated with a mixture of strychnine, saccharine and tallow gave the best results of any mixture tried. This method has been followed in the eradication work which has been done since that time and the results show that it is effective.

The wheat is treated by the following formula:

Wheat, 16 qts.

Strychnine, 1 oz.

Saccharine, 1 teaspoonful.

Tallow, 1 pt.

The wheat, after being treated, is scattered over the area at the rate of one bushel to 40 acres, or from 20 to 30 kernels at every 20 foot interval. This amount is sufficient to eradicate the rodents which may be on the area, as one kernel is enough to kill.

Planting has never been undertaken in more than an experimental way on the Black Hills Forest. It has never been considered necessary to plant on this forest as direct seeding, under normal conditions, has produced as good results at a very much lower cost than could be attained by planting.

In 1905, 40,000 yellow pine seedlings were planted in connection with the seeding work which was done that spring on the Custer Peak Experimental Area. This plantation, however, did not prove successful and no other planting was attempted until 1909, when a number of one-tenth acre plots were planted with exotic seedlings. This planting was also a failure.

In 1913, 5,000 yellow pine seedlings were planted by the deep hole method. This plantation proved successful and there is at

present an average of 570 living seedlings per acre. The following spring (1914), 5,000 douglas fir and 15,000 yellow pine seedlings were planted by the deep hole method. The results of this operation as indicated by an examination made on September 1, were very satisfactory, 95% of the douglas fir and 98% of the yellow pine plants being alive and thrifty. Most of the plants in both plantations had put on a very healthy growth during the summer.

Planting is a much more certain way of securing a satisfactory stand on a denuded area than direct seeding. The cost of the operation, however, is usually from three to four times that of seeding. In regions where direct seeding gives a fair assurance of success, therefore, it is obviously a good plan to give the direct seeding a good trial before resorting to planting. Such has been the experience in reforestation work on the Black Hills Forest.

There is still a large area of denuded lands within the Black Hills Forest on which there is no chance of restocking, except by artificial means, within a very long period, while the area reforested up to the present time is comparatively large, over 5000 acres, it is only a beginning. As the work progresses year by year, other methods of seeding and planting may be developed which will entirely supplant the ones now in use.

The reforestation of all the denuded areas within the Black Hills Forest will require a number of years to accomplish. At the rate of 1,000 acres a year it will require from 30 to 35 years to complete the work. By reducing the damage by fire, however, when this work is completed and by a proper system of silvicultural management, it will never have to be repeated.