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Department of Economic Entomology and Plant Pathology

The Rex Spray and Other Lime and
Sulphur Compounds

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THE REX SPRAY AND OTHER LIME AND SULPHUR COMPOUNDS.

For several years there has been much discussion as to the efficacy of the different lime-sulphur sprays, and if this brief bulletin, based for the most part on only one year's thorough testing, though reinforced by a few tests during former years, and the experience of many fruit growers, can avail in shedding any additional light on the subject, I shall be amply repaid.

It has been a question for several years whether the addition of salt to these sprays does any good, and even whether the proportion of the ingredients could not be varied without destroying their efficiency. I therefore determined to give the subject as thorough a trial this year as I could in the limited time at my disposal, and as we have no scale about Moscow, to transfer my work to Lewiston.

The Rex people of Omaha, Nebraska, had asked me to give their mixture of lime and sulphur a trial, and when I asked them for a barrel for experimentation, they kindly complied, sending us one through their Portland house.

I regret to say that all my notes on this experiment were burned in the fire which destroyed our Main building this spring, but as I had taken the precaution to check the trees sprayed, I am convinced I have made no mistake, and that all essential points have been given as if from my notes. A few of the minutiae have been lost or forgotten, but nothing I am convinced that would impair my deductions. The only danger is, not that there may be anything inaccurate in this paper, but that we should form our conclusions entirely from one year's experiments.

SAN JOSE SCALE.

I wished to make a thorough test of these compounds first with Scale, for I did not consider any experience I had previously gained in treating this insect authorized me to

speaking with any degree of certainty. So, having engaged the assistance of fruit inspector Mohl and an Italian, I went down to Lewiston late in February. We immediately started out to look for a bunch of very scaly trees, which owing to the very efficient work done by former State Inspector McPherson and District Inspector Mohl, was no easy matter. As a matter of fact no trees sufficiently scaly to serve as an experiment could be found in the greater part of Lewiston. Finally, after a prolonged search, we found a small lot of trees in a yard east of Lewiston, which were simply crusted with scale, alive and dead. We also heard of a small orchard of old apples, pears and prunes above the Central Ferry on the north bank of the Clearwater, and on seeing this I was perfectly satisfied with the field of labor. Many of the trees were so covered with the scale that it did not seem possible any more could adhere, while some of the trees had abundant scales but not overlapping, and several had few scales or none.

As I wished especially to test the efficiency of the Rex spray with scale, I determined to use nothing but this preparation on the Lewiston trees, leaving the comparative value of the three sprays, the ordinary formula, the Rex, and what we in this part of the country call the 1-1-4, or Piper formula, to be determined by the orchard up the Clearwater.

The weather throughout our operations was delightful, clear and not too warm, so as far as atmospheric conditions went we could ask for nothing better.

In the Lewiston yard there were about twenty-five trees, consisting of peaches, apples, pears, cherries, and plums. While the trees in front of the house were but slightly scaly, those at the rear were almost as scaly as they could be. Here scales overlapped scales like the shingles on a house, and on examining them with a powerful pocket microscope, many were dead, but probably the greater part living. So many were alive that the ordinary method of rubbing the thumbnail down the trunk or limb brought out that moist, greasy mark that always indicates live scale.

I measured out carefully proportionate parts of Rex and water, hot and cold, so as to give me the ratios 1-15,

1-10, and 1-5, or 15, 10, and 5 gallons of water respectively to each gallon of Rex. I took care to coat every twig, branch, and body of every tree till the spray ran down the trunk in streams. This I did to see whether such an unusual drenching would not kill every single scale. The next day we transferred our labors as well as our spray wagon and material, to the up river orchard. In another way these orchards were a strong contrast. While the one in Lewiston consisted of trees none of which could have been over six or seven years old, the majority of these were hoary old monsters, the bark on most of them shaggy, and the large limbs intermingling. Owing to the time it took in cooking the several sprays, and in going back and forth to our boarding place, two whole days were consumed in spraying this small orchard of fifty or sixty trees, counting the time taken also in coming and returning to Lewiston, six or seven miles away.

SPRAYS USED HERE.

This was to be my main experiment and we did not hurry, determined to give the whole orchard a thorough spraying and the several sprays a thorough testing.

The sprays to be used were three, and were made of the following ingredients in the ensuing manner:

REX SPRAY.

Rex lime-sulphur liquid, mixed up with both hot and cold water, and of the former strengths, 1-10 and 1-6. I did not dare to risk the 1-15 spray on such large and scaly trees. With the 1-6, an intensely strong spray and when placed in water giving it almost as strong a red brown color as the undiluted material showed, we sprayed the eastern five or six trees. About twice as many were then sprayed with the weaker 1-10 spray, which was still so strong as to eat the skin off my hands through the holes in my rubber gloves, and when an occasional drop struck me in the eye, it burned like fire. It seems, as the makers claim for it, a perfect, clear solution of lime and sulphur brought about by intense heat.

1-1-4, OR PIPER FORMULA.

This formula receives its name from the amount of ingredients used, or from the name of the man who first recommended its use, Prof. C. V. Piper, formerly of Washington School of Science. I had advised him to experiment with several mixtures of lime and sulphur, with and without salt, and I think it was the following year that he carried on systematic work along this line in the large orchard of Mr. Lafollette on Snake River. From the writings of Prof. Pierce and from my own rather inadequate experiment the year previous at Lewiston for scale and peach leaf curl, I had become very skeptical not only whether the salt is of any use, but even whether the mixture could not be weakened and still be efficient. To his own satisfaction, and with the unqualified support of Mr. Lafollette ever since, he demonstrated there at least that almost perfect results could be obtained by the weaker formula, as well as by leaving out the salt altogether. As there are still many who not only doubt this, but state the very opposite as their experience, I wished to make a thorough trial for myself. Hence much time was spent in careful preparation as well as the next, Mr. Mohl and I both working at the two mixtures with our own hands and watches. In making this spray one pound of lime and one pound of sulphur are used to four gallons of water, the lime being first slaked in enough water, the sulphur added to the water when warm, and the whole allowed to boil together an hour at least, or until the mixture assumes an amber color, and has lost all its yellow due to the undigested sulphur. Add water requisite to bring to 1-1-4.

About the same number of trees were sprayed with this mixture as with the last, or about one third of the whole orchard.

CALIFORNIA LIME-SULPHUR-SALT SPRAY.

Unslaked lime.....	40 pounds
Sulphur	20 pounds
Stock salt	15 pounds
Water to make.....	60 gallons

In the preparation of this spray we followed the ordinary method of making as given in Oregon, Washington, and Idaho. Slake the lime in about twenty five gallons of water, make a paste of the sulphur with water, and add it to the hot slaked lime. Allow it to boil for half or three quarters of an hour, then add the salt dissolved, and allow the whole to boil for a quarter of an hour longer. If the mixture has boiled properly, and the reaction taken place, the liquid will be a deep red brown color with no residue of sulphur.

Both this and the 1-1-4 formula must be strained through a sieve whose mesh is not greater than twenty to the inch, in order to eliminate all particles which would tend to clog the nozzle. The remaining third of the orchard was covered with this spray. I had put on the other sprays, while Mr. Mohl put on this one. So thoroughly were the trees sprayed that on our departure this part of the orchard looked at a distance as though it had recently passed through a snow storm, while the trees were still white when I examined them in May. I emphasize this spraying that no one may say, after having read my conclusions, that the trees might not have been well sprayed.

OBSERVATIONS MADE MAY 8TH, AND CONCLUSIONS.

I went down to Lewiston at this date, and first took up the little lot orchard in the city which had received the spraying with the Rex Compound. Two things occurred which render to a certain extent some of my deductions uncertain while they do not in the least impair my general conclusions. The first of these was the loss of my notes by the fire above referred to, the second to a most unexpected cold snap in March. I had used the Rex spray upon this orchard in three varying strengths and with both hot and cold water, as above stated, but as my notes were lost I could not tell just which trees had received which treatment. So I was forced to lump conclusions. In the second place where scale had been on a tree for several years and had become

encrusted, I found in February that many were old and dead. Then I could not be sure that some of the scale had not been killed by the cold weather in March, which came so late as to kill or injure many peach trees in the vicinity of Lewiston and Clarkston. I did have this left as a guide. While before spraying, a greasy wet streak followed the thumb nail when rubbed up or down the scaly trees in *every case* proving that the greater part of them were alive, the same marks with the thumb showed no moisture, or "grease" when made in May. This showed that the majority of the scales had been killed by the spray. That it was not due to the cold wave primarily, I ascertained by examining trees which had not been sprayed, where most of the scales were alive. I think right here is a mistake many make in judging what per cent of the scales the spray has killed. It is only too common to see one rub his nail over the tree, and, if it leaves a dry streak, say that *all* the scales are killed. As states above, my thumb nail rubbed over the tree was followed by no moisture, and yet the scales were not all killed, as I found out by using a powerful magnifier. On examining the very scaly trees, or those with crusts of scales, all over them, about one scale in every sixty was alive. On the trees less scaly, that is where the individual scales could be seen and counted, still about one in sixty was alive! As nearly every one of these scales was alive in February, while fully half upon the crusted trees were dead, this equality of live scales in May can only be accounted for by the fact that the inside live ones were better protected from the spray and cold weather than the separate scales.

OBSERVATIONS AT THE UPPER ORCHARD.

The next day I went up to the orchard on the Clearwater and spent the day scraping the scales from the limbs and counting the dead and alive under the glass, or counted them individually on the limbs where I could make out the individuals.

As I had expected from my former experience, as well as from the bulletins of many of the Stations, not a tree

could be found which did not have *some* live scales upon it. I therefore have come to the firm conclusion that when anyone says he has killed *all* the scales on a tree, where it has multiplied for years, by one spraying, he is talking about what he does not know and has not proved. Not a single bulletin from a single institution with which I am acquainted makes any such boast. Here again I could not say what proportion of scales were dead before spraying, as they differ on every tree, and at several places on the same tree. Neither could I be certain what proportion of the scales was killed by the March cold, but the same marks with the thumb before the spraying and after in March gave results similar to the others, as before stated. On counting, and I kept at it the greater part of the day till eyes and brain were almost exhausted, the proportions were from one to fifty, one to sixty, one to seventy all over the trees. I can not for a moment claim that our spraying killed a greater proportion of the scales than I remember to have seen stated in any other bulletin, for this would be less than two per cent live scales. It was simply impossible to tell how many were dead before spraying in February, and how many more were killed by the unexpected cold in March. But I am sure of these facts:

1. As most of the scales were alive in February before spraying, and as the cold did not kill any great portion as seen in unsprayed trees, and as all but about one in sixty were dead in May, the sprays must have killed a greater part of them.

2. As the three sprays, the Rex, the 1-1-4 formula, and the "California Wash" had each killed the same number of scales, one can be pronounced just as good as either of the others.

3. Mr. Isaman of Lewiston and Mr. Lafollette of Penewawa, on the Snake River, both think the 1-1-4 formula kills *more* scales than old wash with salt. A bulletin* published this year by Mr. S. A. Forbes, State Entomologist of Ill., and of the Agricultural Experiment Station, says that he

*Bulletin 107, page 259.

also got the *best* results with his 15-15-50 spray which is almost the 1-1-4 formula of our use.

RELATIVE COST OF SPRAYS.

These vary so much in various places, that it is hardly fair to give a comparison. I will say this, however. Several of us went over the items involved in making these sprays, and we concluded that, if we should count anything for boiling apparatus, wood for fire, and labor of men attending cooking sprays, which seems fair, the California Wash would cost more than the Rex, while the 1-1-4 formula would cost nearly as much. Anyone desirous of using this spray for scale had better correspond directly with the Rex Food Company at Omaha, or their agents in Portland, Oregon. I can only say in concluding this part of my bulletin, that if the company *continues* to put out the fine mixture they are now making, so high in the valuable calcium sulphides, and can put it into our country at a reasonable figure, or one that can vie with our home made compounds when we consider the trouble and expense in making up the sulphur sprays, it will prove a boon to sprayers for scale.

THE REX SPRAY FOR PEACH CURL, PEAR-LEAF BLISTER-MITE, AND APHIS EGGS.

Besides the experiment with scale, I also determined to give this spray a test for the above mentioned troubles on my own fruit farm, a few miles out of Moscow.

(1) Peach Curl. I had several years ago used the California Wash for Peach-leaf Curl on a farm near Lewiston, following the recommendations of Prof. Pierce of California, and had found it very efficient in preventing the curl. As my own trees had been subject to this disease during the previous year or two, I determined to try the Rex spray for this purpose. It must be understood that curl is due to a fungus which works within the tissues of the leaf and shoot, and can not be reached by spray at that time. The only

time the spraying does much good is when we catch the young growing fungus just as it is passing from its overwintering condition in the bud scales into the young leaves as the buds expand.

So just at this time I applied the 1-10 spray most thoroughly. I may say shortly that I never had so much curl as this year, after the spray was applied, and that the checks or controls suffered no worse than the sprayed trees. I wrote of this to the Rex people, and received a reply stating that that had been exactly the experience of a southern investigator who used their spray for this disease just as it is made without *salt*, but on adding the salt good results were obtained with the spray. I shall try this next year.

(2) I used the Rex spray on my pear trees for the blister-mite. My trees though young, had had their leaves very much blackened and injured by this little mite in previous years. The little round holes by which the mites enter being in evidence all over the lower surfaces of many leaves, if looked at with a strong pocket glass. I applied the spray on the 13th of April, when all the trees were in strong bud, and many had pushed out the first unopened flower clusters. The strength was as in the last experiment, 1-10, or one gallon of Rex to ten gallons of water.

I am pleased to say that not a single leaf affected by the mite could I find on my pear trees this summer and fall. How much of this immunity is due to the severe frosts we had this year after the buds were well out, I cannot say, but think it mainly due to this lime-sulphur spray, first, from the *entire* suppression of the mite; second, that the Montana Station reports good success with the ordinary home made lime-sulphur sprays in combatting this insect.

(3) Finally I used the Rex spray to kill the eggs of the apple-aphis. Prof. Aldrich had shown in Bulletin No. 40 of our Station that the lime sulphur sprays would kill a majority of the eggs if applied shortly before hatching, and that of these combinations the 1-1-4 formula was as effective as any. I have used this ever since to kill the eggs, or even

young aphids, applying it just as the buds are bursting. This season I used the Rex at the same strength as before, or one gallon liquid Rex to ten gallons of water. I found it very effective, hardly an egg hatching where this spray was applied.