

CONNECTICUT
Agricultural Experiment Station
NEW HAVEN, CONN.

BULLETIN OF IMMEDIATE INFORMATION

No. 3

NOVEMBER, 1906

The Fumigation and Treatment of Nursery Stock

By W. E. BRITTON, State Entomologist

There is a sentiment more or less prevalent among orchardists and nurserymen that stock is injured by fumigation with hydrocyanic acid gas, and some refuse to purchase stock which has been so treated, preferring to run the risk of obtaining scale-infested stock thereby. We cannot state that this sentiment is without foundation, because in many cases it is doubtless true that nursery stock has been injured by the treatment, but we have yet to learn of such injury where the work was properly and carefully done and where the stock was well ripened. At the meeting of the Official Horticultural Inspectors at Washington, D. C., November, 1905, the consensus of opinion was that no injury would result if the treatment was properly done. *Trees should not be fumigated when wet, and they should not be fumigated longer than the prescribed period,—half to three-quarters of an hour.*

If the gas is started generating at night and the house not opened until morning, or if the trees are wet when put into the house, we may expect injury. It is well known that a weaker dose for a longer time than is prescribed is both less

fatal to the scale and more injurious to the trees. Some injury, especially bruising, results from the extra handling of the trees when fumigated, but it seems probable that injuries of other kinds, such as drying of the roots, or freezing, are often attributed to fumigation.

Since the San José scale became such a pest in the Eastern States it has been the custom of many official inspectors to advise or compel nurserymen to fumigate certain kinds of nursery stock before sending it out, especially if any infested trees have been found in or near it.

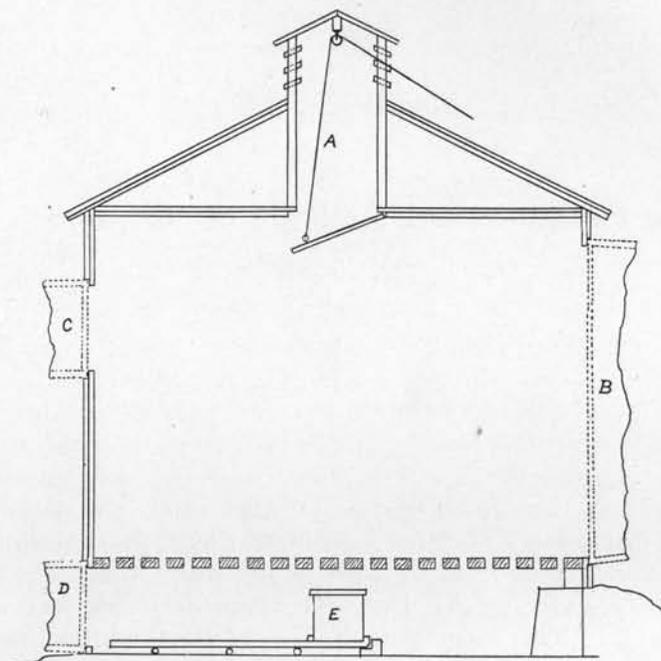


FIG. 1.—Diagram showing cross-section of a fumigating house 10 x 10 x 8 feet in size, with slat floor. A, ventilator that can be opened and closed from the outside; B, door where trees are carried in and out; C, small door opposite large one, for ventilation; D, small door for communicating with generator; E, jar for generating the gas.

THE FUMIGATING HOUSE.

The house, if small, should be as nearly square as possible, with the generating basin at the bottom near the center, in order to insure the greatest possible uniformity in the distribu-

tion of the gas. The house should be gas-tight, with a door for transporting the stock, and adequate ventilators manipulated from the outside. A house ten feet square will be found adequate in most nurseries of not more than one hundred acres, and if not large enough, it will often be more convenient to have two of this size than one, larger. At any rate, a small house or box is absolutely necessary in any nursery to save the expense of chemicals in charging the large house when only a few trees or plants are to be treated.

A satisfactory house may be constructed of wood and double-boarded, with building paper between the boards. A slat floor raised a foot or more above the ground, with space for the generator beneath, ensures a more even distribution of the gas and also keeps the trees from contact with the moist earth. The accompanying diagram will give an idea of a good pattern of fumigating house.

Simple contrivances may be used for manipulating the ventilators from the outside and for removing the generating jar and replacing it, as well as for dropping the cyanide into it. All doors and ventilators should be arranged so that the house will be perfectly tight when closed.

DIRECTIONS FOR FUMIGATING.

The space to be fumigated should first be measured carefully, the quantities of chemicals computed, and the figures posted in some place convenient for ready reference. The cyanide for charging the generator a number of times can be weighed out in advance, each lot being placed in a paper or cheese cloth bag ready to be dropped, bag and all, into the acid, but these should be kept dry, in a tight tin box or glass jar, until wanted.

Formula.

The following simple formula for preparing the gas was adopted by the Association of Official Horticultural Inspectors at a meeting in Washington in 1903:—

Quantity for Each 100 Cubic Feet of Space—

- 1 oz. (av.) Potassium cyanide 98-100% purity.
- 2 fluid ozs. High-grade sulphuric acid, 66° B. test.
- 4 " " Water.

A house 10 x 10 x 8 feet, such as is shown in the diagram, contains 800 cubic feet, and for each charge requires:—

- ½ lb. Potassium cyanide.
- 16 fluid ozs. (1 pint) Sulphuric acid.
- 32 “ “ (1 quart) Water.

Caution! Potassium cyanide is one of the deadliest poisons. Do not let it come in contact with cuts or bruises, nor inhale the dust or fumes which rise from it when it is handled.

Filling the House.

The trees should be placed horizontally upon the slat floor with the roots outside and the tops meeting in the center over



FIG. 2.—An excellent type of fumigating house, Keney Park, Hartford.

the generating jar. Trees or plants may be tied together loosely in bunches, but should not be packed in bales for shipping, as the packing may prevent the gas from reaching the insects, and thus render the operation valueless.

Generating the Gas.

For a small house like that described, a single jar in the center will suffice. If much larger and square, four jars will insure a more even distribution of the gas. If the house is much

longer than broad, it is well to have two jars, one under the center of each half of the house. Stone, glass, or earthenware should be used for generating jars. Metal is corroded by the acid, and wood is charred by it.

After the nursery stock has been placed in the house and the ventilators and doors closed, all is in readiness to generate the gas. The water should first be placed in the jar and the acid poured into it in a thin stream with constant stirring in order to prevent too rapid generation of heat. The jar should then be put in place and the cyanide dropped into it. The house should remain closed for at least thirty and not more than forty-five minutes. The overhead ventilator should

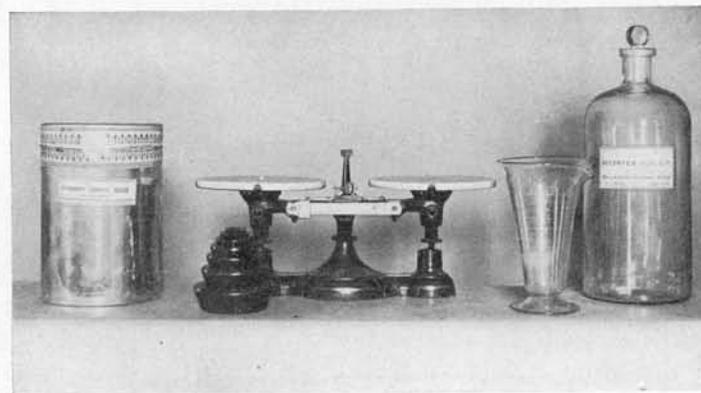


FIG. 3.—Fumigating utensils.

first be opened, and then the side ventilator and the door. Care must be taken not to breathe the gas, which is one of the most deadly of poisons. The house should be aired for at least ten minutes before allowing any one to enter or remove the trees.

The liquid and residue from the generating jars is poisonous, and should be buried, and not left where children or domestic animals can get at it.

Chemicals.

Much of the cyanide on the market contains, with other impurities, more or less sodium chloride, which decomposes

a certain amount of the hydrocyanic acid gas, and is unsatisfactory for fumigating purposes. The Georgia State Board of Entomology collected a number of different brands of cyanide from various dealers and had them analyzed. Only two brands were sufficiently pure to be reliable for fumigating nursery stock, and nurserymen were recommended to buy these brands, which are—

Merck & Co.'s "98-100%" potassium cyanide.

Baker & Adamson Chem. Co.'s "99%" potassium cyanide.

Both kinds are prepared for chemical use, and may be ordered in advance from any wholesale druggist or dealer in chemicals. The nurseryman should insist on getting one of these brands in the *original sealed packages*, and not be supplied with something else "just as good." The Station has just purchased a five pound package of Merck's cyanide at 35 cents per pound.

A high grade commercial sulphuric acid (66° B.) should be employed. In the large nurseries it will pay to buy acid in carboys, but small quantities can be had in bottles.

FUMIGATE BUDS AND CIONS.

The most serious source of infestation of growing nursery stock is through the buds or cions. If slightly infested when set, the scales multiply sufficiently to mark the stock by the time it is inspected, or is large enough for sale, consequently much of it must be destroyed on account of scale. Where the scale is introduced on buds or cions, the lower portion of the trunk is the first to show the infestation, but if brought by animals, the scale is usually found in the tops of the trees. If allowed to remain untreated in either case, the tree soon becomes coated. All buds and cions should therefore be fumigated thoroughly before setting. A small box can be used, and the cost of materials will be much less than if the large fumigating house is charged.

TREATMENT OF GROWING STOCK.

The foregoing directions are applicable only to such nursery stock as may be dug for sale or shipment. Of course, much of the stock cannot be so treated, because it is too small for

sale, and if dug and replanted its growth will be greatly checked. Though possible to fumigate growing stock by covering it with gas-tight canvas, the expense is too great, and spraying must be relied upon to destroy any scale that may be on the trees. Official inspection as commonly practiced is sufficient to detect the infestation unless it be extremely slight, but it is practically impossible on account of the time and expense involved to examine the stock with such care that an absolute statement can be made that it is not infested. Too many nurserymen rely solely upon the official inspector for detecting the scale, and give no inspection themselves or treatment to hold the scale in check, if it be present. It often happens that a few specimens of scale may be overlooked during the annual September inspection, or perhaps may be



FIG. 4.—San José Scale on apple bark. Natural size.

brought to the trees after the inspection. These will multiply until December, and go on spreading the next season, becoming badly covered by fall; and from this source birds, insects or other agencies carry the pest to surrounding stock, necessitating the destruction of a large quantity of it. The scale breeds from June 25th to December 1st in Connecticut, and during this time anything coming in contact with the bark of an infested tree is liable to carry away some of the new-born scales. From a badly infested tree the scales are certain to be distributed along the row by the men and horses in cultivating the field. The owner should inspect his own stock each year not later than July 1st. One tree destroyed then may save a dozen later in the season. The workmen should be familiar with the pest, and whenever an infested tree is discovered it should be taken out.

SPRAY GROWING NURSERY TREES.

Even though we guard against the introduction of the scale by means of buds of cions, it may be brought to the trees by birds and insects during the growing season, especially if in a region where scale is common and the environs are not under direct control of the nurseryman. By spraying the young trees, during the winter or while dormant, with the lime and sulphur wash, "Scalecide," or some other "soluble oil," it is possible to keep the pest in check. "Scalecide" has given satisfactory results, and on account of ease of preparation it is



FIG. 5.—Inspecting nursery stock. The infested trees are marked by breaking them, and they are afterwards removed.

preferable to lime and sulphur. It is especially adapted to nursery purposes, as it leaves no white coating on the trees. It forms no spots on painted buildings or fences, and is not unpleasant to handle. On the other hand, lime and sulphur possesses fungicidal properties not found in the "soluble oils."

The cost of this spraying should not be more than fifteen or twenty dollars per acre, and the work probably can best be done by men working separately, each fitted with a knapsack sprayer. The spraying should be done when there is no snow on the ground and on a still day.