

AGRICULTURAL EXPERIMENT STATION
OREGON STATE AGRICULTURAL COLLEGE

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RECOMMENDATIONS FOR NARCISSUS NEMATODE CONTROL*

by

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I. GENERAL CONSIDERATIONS.

The recommendations here presented are essentially those contained in Circular 30, issued under date of June, 1930. Certain procedures which received only casual mention in the previous circular are herein elaborated upon, since for successful nematode eradication even apparently minor details must receive careful attention. One important change was agreed on by all the specialists at the Portland conference; namely, that we recommend the addition of a disinfectant to the treating water. Adding a disinfectant tends not only to minimize the chances of rot but increases the efficiency of the treatment. Periodic treatment of planting stocks, even those in which nematode infestation has not been observed, is advisable since such treatments free the planting stock from flies, mites, and other pests with which the bulb growers have to contend. As before, we are separating our recommendations into two groups, depending on whether the stock is thought to be free from or infested with nemas.

The essentials of nematode control are (1) very early digging; (2) removal of all rotten or suspicious bulbs; (2) hot-water treatment of the sound bulbs; (4) planting in clean ground; (5) fallowing the infested field and not replanting narcissus for three or four years; and (6) destroying all volunteers which appear in the infested field.

II. RECOMMENDATIONS FOR ELIMINATION OF NEMATODES FROM FIELDS AND PLANTING STOCKS.

a. Roguing: Roguing of nema-infested plants should not be attempted except under the supervision of an experienced inspector. Unless extreme precautions are taken to prevent mechanical spreading

* These recommendations are based on a conference between representatives of the Oregon and Washington State and Government Inspection services and the plant disease workers of both states interested in bulb diseases and pests. This meeting took place in Portland, Oregon, March 5 and 6, 1931.

of nemas, roguing may do more harm than good. Rather than rogue the infested plants it is safer to destroy them in place by drenching the plants and the ground about with kerosene. Moreover, when the bulbs are dug for treatment every precaution should be taken to prevent the spreading of nemas at that time.

b. Sanitary Measures: A field or portion of a field in which nemas are known to occur should be kept isolated as far as possible. Irresponsible parties should be kept out. Every possible precaution should be taken to prevent the soil of a nema-infested field from being carried to other parts of the bulb farm. Ploughs, teeth of cultivators, etc., may be sterilized by brushing with formalin solution made up by using one part of formalin to seven parts of water. As a substitute for formalin one may use kerosene or crank-case waste oil, the latter being especially applicable to parts of farm machinery.

c. Dig Infested Bulbs Early: Dig at least two weeks earlier than the normal digging time. By normal (optimum) digging we refer to the time when the foliage of the variety in question has yellowed and wilted down. At this time, the upper portion of the "neck" should be dry but the leaves should not be brittle. In the case of nema-infested stock, digging approximately two weeks before the normal (optimum) digging time in Oregon implies around the first of July. When possible, leaves of plants in infested areas should be removed, piled and burned in place in the field. Extreme care should be exercised to prevent scattering these leaves about over a bulb farm.

d. Cure Bulbs Before Treating: Allow the early dug bulbs to cure for a period of not less than two weeks and not more than four before proceeding to treat with hot water. During this period the bulbs should be sorted and all obviously diseased bulbs picked out and destroyed. Never treat immediately (12-24 hours) after digging. Keep the bulbs and the trays containing them segregated so that they cannot contaminate healthy stock. They may be piled in trays in the infested fields provided that trays are arranged to insure aeration and covered to prevent sun injury.

e. Treating: Treat the bulbs in hot water to which a disinfectant has been added. The following disinfectants may be used: - Ceresan, formalin, mercury bichloride and Semesan. The proper strength and application of each of these is given in the footnote below*. The addition of a disinfectant does not affect the treating

* 1. Ceresan: This compound is especially desirable for bulb treatments since it is relatively cheap and does not corrode treating apparatus; furthermore the effect on the bulbs is very beneficial. Use at the rate of one pound of the chemical to 25 gallons of water. The solution may be used four times, after which it should be dumped and a new solution prepared.

2. Formalin: Use at the rate of one pint of commercial formalin to fifty gallons of water. This solution can be used during an entire day's run provided the necessary volume is maintained by adding formalin solution of the same strength. This solution accelerates nematode control but the beneficial effect on the narcissus plant is not so marked as number 1 above.

(See bottom of next page for continuation.)

time nor general routine of the treatment process. The temperature must be 110-111.5 degrees Fahrenheit. Treat large bulbs (2 inches or more in diameter) for four hours; treat small bulbs (less than 2 inches in diameter) for three hours. Begin the timing in each case as soon as the temperature of the bath, lowered by immersion of the bulbs, returns to 110° F. If the treating apparatus does not maintain a constant temperature, the manipulation should be such that fluctuations will be above 111.5 degrees rather than below this temperature. Constant circulation of the water is essential not only for proper distribution of heat but also for maintaining the germicidal efficiency of the solution.

f. Trays: The trays used in handling the nema-infested stock should be so handled that there is no danger of infesting healthy bulbs with dirt falling from the trays. These trays should be sterilized with very hot water before treated bulbs or nema-free bulbs are put into them. It is good practice to place the treated bulbs in clean trays, and then after a batch of treating solution has been used up to heat the water to near the boiling point and place the contaminated trays (in which the nema bulbs were kept) into the very hot water. A few minutes in very hot water, especially if a trace of active disinfectant remains, will suffice to destroy all dangerous organisms.

g. Bulbs: These early dug bulbs should be thoroughly dried and held for a period after treating. During this time it is desirable to sort out the partially decayed bulbs which may have escaped notice prior to treatment. This sorting process should continue throughout the regular storage period and the bulbs should be planted at the regular planting time.

h. What to do with the Nema-infested Field: Killing the nemas in the bulbs is only half the task of ridding a bulb farm of this most dangerous pest. The ground itself must also be cleansed by keeping host plants away so that the nemas will be starved out. During the first year the field should be fallowed, not only to keep food away from the nemas but to make possible removal of all narcissus volunteers. To facilitate removal of volunteers it is suggested that during the period of fallowing the field be harrowed, not ploughed. All volunteers from such a field should be dug out and destroyed.

3. Mercury bichloride: Use at the rate of four ounces to thirty gallons of water. This solution cannot be used in metal lined tanks except where all metal parts have been coated with high melting point asphaltum paint. The solution may be used four times provided an ounce of chemical per thirty gallons of tank water content is added each time.

4. Semesan: Use at the rate of one pound to fifty gallons of water. The solution may be used four times provided that the volume is maintained by adding double strength (1 lb. to 25 gals.) solution between each treatment. This treatment is very efficient and does not injure treating apparatus but is expensive.

When large quantities of bulbs are to be treated numbers 1 and 2 should prove most satisfactory both because of their efficiency and their low cost.

i. Rotation: It requires three years to rid land of nemas. If, during the year of fallow, the land proves to be full of volunteers it cannot be considered safe for narcissus until four years after the crop was originally dug. For Oregon conditions the following rotations are suggested:

Fallow - Hyacinths - green manure - Iris - Narcissus
 Fallow - Potatoes - Tulips - green manure - Narcissus
 Fallow - Grain, Clover seed - Clover hay - Narcissus

The first crops should be such that any narcissus rogues which may have survived the season of fallow may be discerned and removed. Under no circumstances should onions, oats, or bulbous Iris be planted as the next crop after nematode infested narcissus.

III. RECOMMENDATIONS FOR PLANTING STOCKS IN WHICH NO NEMATODES HAVE BEEN FOUND DURING THE CURRENT SEASON.

a. Dig the bulbs as near the optimum time as feasible. As defined above, the normal or optimum time for digging is the time when the foliage of the variety in question has yellowed and wilted down. In Oregon the recommended time for digging planting stocks in which no nematodes have been found during the current season would be between the middle of July and the middle of August.

b. Bulbs dug during the normal digging period should be treated after two or three weeks of curing. If, for some reason, it is found impossible to dig the bulbs until later (towards the end of August in Oregon) they should be treated after 7 to 10 days of curing. Treat the bulbs in hot water to which a disinfectant has been added as recommended above. The use of a disinfectant in this case is advised to prevent the development of basal-rot or basal-rot tendencies. Treat at a temperature of 110-111.5 degrees F. for from 3 to 4 hours, according to the size of the bulbs. If the bulbs are relatively small, or are "slabs" (2 inches in diameter or smaller) treat for three hours. Begin timing the treatment in each case as soon as the temperature of the bath, lowered by the immersion of the bulbs, has come back up to 110 to 111.5 degrees F. If the treating apparatus does not maintain a constant temperature it should be so handled that the fluctuations will be above 111.5° F. rather than below.

c. Bulbs from non-infested stock may be replanted shortly after treating. We make this statement since the average grower will not have proper space for spreading out and curing large quantities of treated planting stock and, moreover, there appear to be no injurious effects from planting wet bulbs. Such curing is very necessary, however, in the case of planting stock where nemas have been found.

IV. SPECIAL NOTES AND SUGGESTIONS.

a. Keep down weeds so that the presence of nematodes may be more readily detected. Incidentally, inspection of weedy fields is impossible and certification of such fields cannot be made.

b. Roguing, whether for volunteers, mixtures, weak plants, mosaic plants, or other undesirables, should be done carefully and the rogues should be either burned or heeled in (deeply) and segregated.

c. Leaving bulbs about fields, buildings, etc., creates a fly menace. All unwanted bulbs should be destroyed. To destroy bulbs by burning one must employ an efficient incinerator. Many growers have found burying to be the most satisfactory means of bulb disposal. The bulbs should be piled in a deep trench, saturated (above) with waste oil and then covered with three feet of earth.

General inspection requirements permitting certification of bulbs, sales, and interstate shipments, are:

1. Authorized inspection of the plants after flowering and of the bulbs after digging.

2. Certificates are granted:

- (a) When inspection reveals no fly or eelworm, or
- (b) If nematode is found, after proper hot-water treatment under the supervision of an inspector.
- (c) If fly is found, after hot-water treatment or fumigation under the supervision of an inspector.
- (d) No bulbs can be shipped within or without the state except when accompanied by the Federal narcissus shipping permit, which can be obtained from the local inspection service of the State Board of Horticulture.