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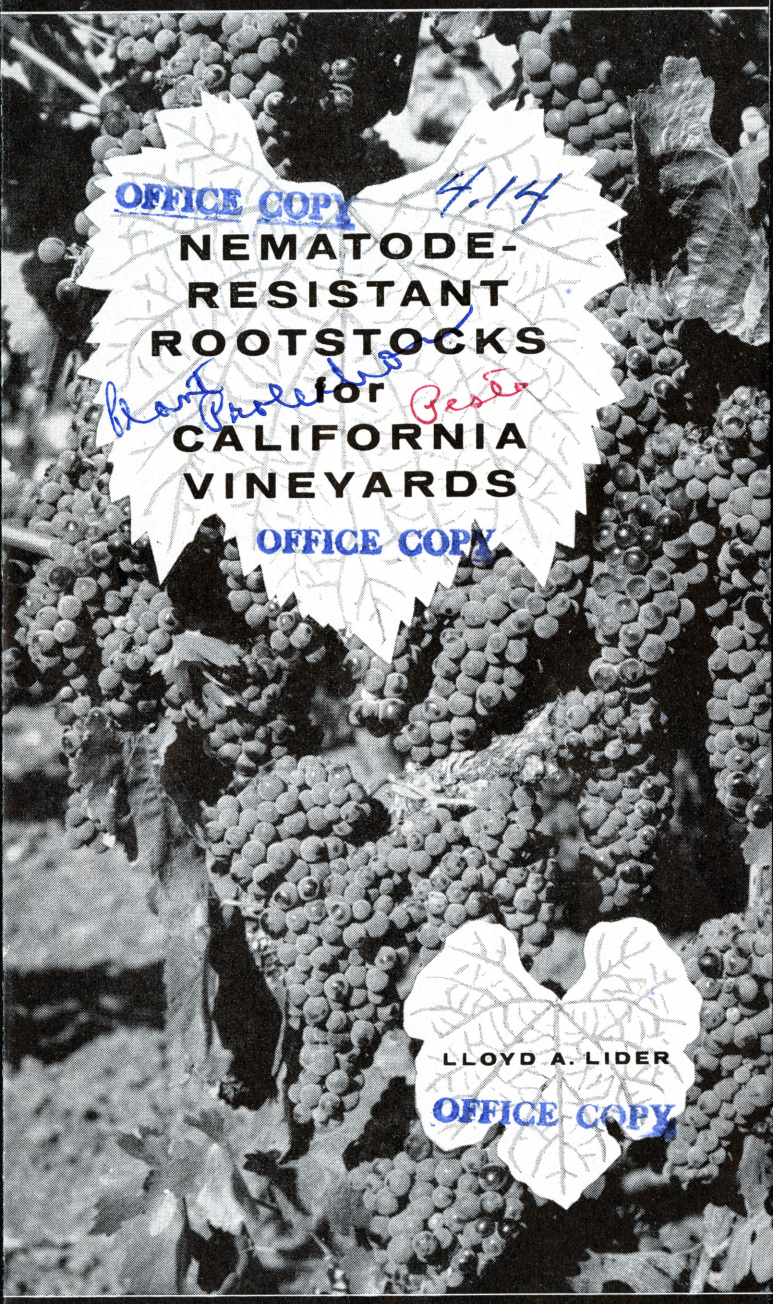

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NEMATODE-RESISTANT ROOTSTOCKS for CALIFORNIA VINEYARDS

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CALIFORNIA AGRICULTURAL
Experiment Station
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A three-year-old Thompson Seedless vine severely infested with root-knot nematodes.

IF YOU PLAN TO REPLACE DAMAGED VINES—

DO use rootstocks if you need nematode resistance; these stocks will pay off, even though they cost more to establish and maintain.

DON'T use rootstocks if your vineyard is relatively free of nematodes. Where nematodes are not a problem, get own-rooted vines of the desired variety from a nematode-free nursery.

If, over several years, your vines grow progressively more stunted and unproductive through nematode injury, they should be removed. If you use own-rooted vines, remember, before replanting, that new vines will have a better chance against nematodes if you:

- Rotate other crops several years before replanting to grapes.
- Fumigate, especially where soils are loose, deep and fertile. (Heavy, rocky or shallow soils are hard to fumigate successfully.)

THE ROOT-KNOT NEMATODE—ITS SYMPTOMS AND EFFECTS

Nematode infestations commonly result in declining vine vigor, reduced yield, and various types and degrees of root destruction.

Symptoms:

Above-ground: stunted vines, pale green leaves that often yellow and drop early; reduced yields with unusually small clusters and berries.

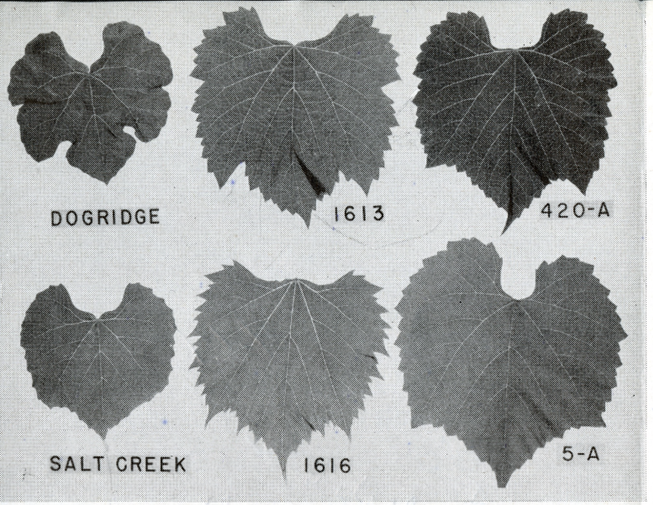
Below-ground: gradual rotting and ultimate destruction of the roots. The nematodes feed on root tissue; this irritation stimulates the roots to abnormal growth. Finally, the infections become decayed areas on the roots, disrupting root functions and eventually killing the roots.

Young, shallow-rooted vines are often hit harder by nematodes than are old, deep-rooted vines. Nematode damage is most severe when young vines are replanted in old vineyards.

Many of the vineyard areas of the San Joaquin Valley and Southern California are infested with nematodes. All of the fruiting varieties of grapes grown commercially are quite susceptible to nematode injury. In general, however, grapevines are attacked and seriously injured by nematodes only when the vines are grown in light, sandy, or sandy-loam soils. Vines in fertile loams and heavier soils are seldom seriously damaged.

Some nematodes feed externally on the roots, and it is not easy to detect injury by these pests. Decayed areas on the roots and masses of dead feeder roots are indications of such injury. These nematodes can be detected with certainty only after careful examination of the attacked roots and surrounding soil by a trained nematologist.

The more common group of parasitic nematodes on grapevines is the root-knot nematode. The larvae of these pests invade the soft tissue of young roots and feed and reproduce within them. Root-knot nematodes are easily recognized in the field. Characteristic symptoms include galls or knots resulting from



Leaves of six rootstocks. Color, size, and shape are used to identify them.

THE REASON FOR ROOTSTOCKS

Once the decision is made to use a rootstock, the proper choice of stock for a given vineyard situation is very important. These nematode stocks differ markedly in vigor. The most vigorous and thrifty stocks are recommended for very infertile soils that don't hold water well (often the extremely sandy locations). The less vigorous stocks should be used in the better grape soils in which nematodes are a problem.

The performance of grafted table grapes has varied; although many profitable table grape vineyards on rootstocks do exist, if a choice of scion varieties is available, the use of wine or raisin varieties is recommended.

In very sandy soils where nematode infestations are heavy it may be impossible to grow grapevines without the use of nematode-resistant rootstocks.

Most rootstock varieties are hybrids, produced by crosses involving two or more grape species. A few are direct seedling selections from wild grapes. Many hundreds of rootstocks exist. Only a few, however, have shown enough resistance to nematodes to justify their use in California commercial vineyards.

A few species of grapes native to the central southern part of the U.S. seem to possess inherent resistance to root-knot nematodes. Little is known about their ability to withstand the attacks of other plant parasitic nematodes. However, field trials have shown that some of these varieties have enough tolerance to nematodes to permit their use as rootstocks for fruiting varieties in many vineyards.

RECOMMENDED ROOTSTOCKS FOR NEMATODE RESISTANCE

Over the past 25 years, the performance of nematode-resistant rootstocks under commercial conditions has been evaluated by the U.S. Department of Agriculture and the Department of Viticulture and Enology of the University of California. The most promising varieties thus tested are discussed here.

Dogridge

This stock, a seedling from the wild grape species *Vitis champini*, is recommended for use with heavy-producing wine and raisin varieties on light, sandy soils, where nematode infestations may be heavy. It produced the most vigorous grafted vines of all rootstocks tested.

Although this great vigor can be a problem, vines grafted on Dogridge have made moderate growth and produced fruit of good quality in sandy, nematode-infested soils. Fruit set can be improved by training vines grafted to Dogridge to a high, open form. The vigor that vines on this stock show will be favored by wider vine spacing and cordons with numerous spurs, or by heading high (28 to 32 inches from the ground) with head-pruned vines.

In some soils, the extreme vigor of Dogridge is a drawback because it accents zinc deficiency and can induce shy bearing tendencies in its scions. In addition, clusters are often small and straggly, with many shot berries. Berry color with both Emperor and Tokay on Dogridge have tended toward a purple-red, rather than the desired bright red.

Zinc deficiency, which often shows in the symptom called "little leaf," can be overcome by putting zinc on pruning wounds, and pruning for more fruiting wood. Less frequent, or shallow irrigations help control excessive vine growth in late summer.

Salt Creek*

In fertile sandy-loam soils, vines grafted on Salt Creek rootstocks are extremely vigorous; as with Dogridge, this vigorous growth is often accompanied by "little leaf" symptoms of zinc deficiency, poor fruit set and lowered fruit quality, but the excessive growth is more easily controlled than that of Dogridge.

Cuttings from this stock are difficult to propagate. Special care is needed in the nursery to insure a good nursery take. Occasionally the grafted vines on this stock will start slowly, then develop rapidly after they are established.

When the excessive growth of this stock has been controlled by cultural practices, its performance with wine and raisin varieties has been quite satisfactory. It can be recommended for limited use with these varieties on the lighter, less fertile soils, and it should be included in any experimental rootstock plantings in nematode-infested soils.

Solonis x Othello 1613

This hybrid is the most useful nematode-resistant stock for grapes in California. It is well-adapted to fertile sandy and sandy-loam soils. Its moderate resistance to phylloxera as well as its resistance to nematodes is of great advantage in soils—such as the central San Joaquin valley—where both pests occur.

Fruiting varieties grafted on 1613 grow with moderate vigor and the characteristics of the fruit produced are generally good. The clusters tend to be medium-sized, well-formed, and loose; the berries are large and firm.

Rootstock cuttings of 1613 root easily in the nursery and graft easily to nearly all fruiting varieties.

In non-irrigated soils or very sandy soils of low fertility, 1613 has insufficient vigor, and vines grafted on it are often weak and low in productivity. In comparative tests under these soil conditions, the more vigorous Dogridge and Salt Creek performed much better than the 1613.

Some instances of late maturity, low acidity and poor coloring have been reported with 1613. However, most of these cases cannot be traced directly to the influence of the stock, but usually can be attributed to diseases transmitted by the mother vines. With the supply of certified, disease-free planting stock now available, this should not be a problem in the future.

This rootstock, 1613, is well adapted to the cultural practices used in the state's interior valleys. It is probably the best nematode-resistant stock currently available for California vineyards.

Nematode-infested vineyard site. Five-year-old Black Malvoisie vines grafted on Dogridge, on right; Black Malvoisie on their own roots, at left.



Solonis x Riparia 1616

This rootstock is mildly resistant to phylloxera as well as to nematodes. In California tests—which have been limited—it has been outstanding. In sandy-loam soils it has produced scions of moderate vigor that give good crops of high quality fruit. It has shown promise with Zinfandel in the Lodi area. It should be included in trial plantings of grafted vines in that district.

Berlandieri x Riparia 5-A

The 5-A is a hybrid that shows a moderate degree of resistance to nematodes and is noted for resistance to phylloxera as well. The stock is a vigorous variety that in several test plantings produced scions both strong and productive. Its tolerance to nematodes appears high enough to allow the stock to grow in sandy, infested soils. Because of the frequent good results with 5-A, this stock can be recommended for further use in test plots in nematode-infested soils.

The rootstock 420-A is one of low vigor, and its resistance to nematodes appears insufficient. It is *not* recommended for further testing in this state.

* (This stock will be renamed when it is positively identified. It has vine and fruit characteristics of the wild species *Vitis champini*, but the true Salt Creek variety is a seedling of *Vitis doaniana*.)

CAUTIONS!

1. Rootstock cuttings should be disbudded completely except for the top bud before nursery planting, to make them sucker-proof.

2. If scion roots and rootstock suckers develop, they should be carefully removed during the first 3 or 4 years in the vineyard.

3. Know the best pruning, irrigation and fertilization practices for your area, because these practices can affect both the quality and quantity of fruit produced on grafted vines.

4. Choose and maintain disease-free mother vines, because the combination of rootstock and scion increases the possibility of incorporating virus diseases in planting stock.

abnormal growth on the roots around the feeding sites of the nematodes. Often a series of knots resembling a string of beads will occur along a root. In other cases, the swellings will grow together, causing a continuous, rough thickening of the root.

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