Mapping for Orchard Appraisal

supplemental to other systems, survey maps provide complete picture of orchard condition, bearing potential, tree health

Edward Nauer and Paul Moore

A system of orchard appraisal mapping successfully used in an extensive survey of California orange orchards records in detail the specific causes of poor tree health and production.

Symbols are used to represent diseases—such as psorosis and gummosis—and the stage of development of the disease. Any tree of subnormal size or vigor is also recorded by an appropriate symbol.

The maps give a complete picture of the orchards including bearing potential, disease incidence, and general tree health. The need for a change in cultural practices, a better replant program, or treatment of diseased trees is often pointed up by an orchard survey of this type.

With an efficiency rating computed from them, the survey maps are used for appraisal of the orchards.

Graph paper with quarter-inch squares —with each square representing one tree space—is suitable for making these orchard appraisal maps. Each tree is examined and its condition indicated in the appropriate square. The largest, heathiest, and most vigorous trees are taken as normal, and—to avoid confusion of symbols—are represented by a blank square.

The severity of a disease such as psorosis—scaly bark—or gummosis has a marked effect on the bearing capacity of a tree; therefore, symbols representing the stages of development of these diseases are used. Trees showing only psorosis bark symptoms but no top damage—first stage—are represented by the symbols Ps^1. Ps^2 trees are those that show top deterioration, with up to one half of the bearing surface destroyed. Ps^3 trees are submarginal in production, be-

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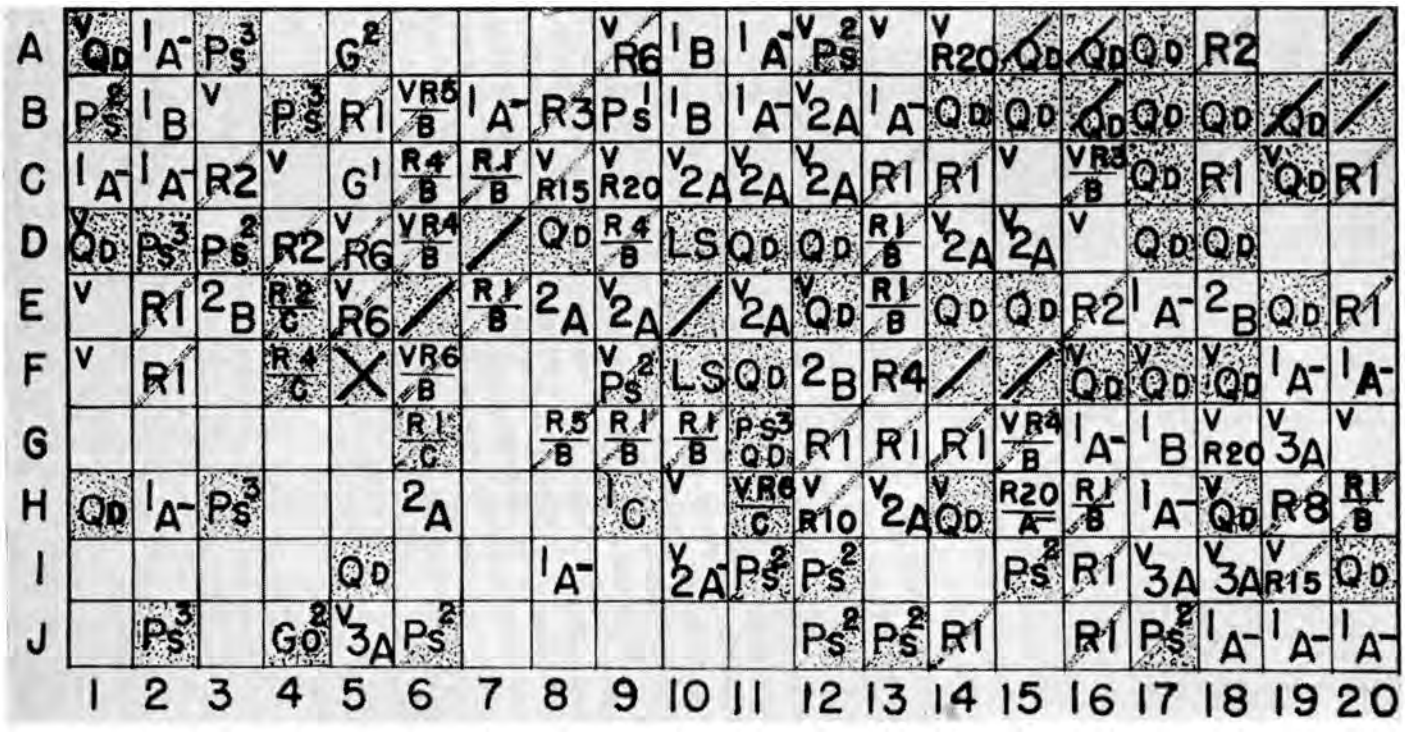
Efficiency Rating of Orchard to Be Used with Appraisal Map

	Number	Per cent
Total tree spaces: 200		
Bearing trees:		
Top bearing trees (1/A)	46	23.0
Diseased: Ps^1	1	0.5
Ps^2	11	5.5
G^1	1	0.5
G^2	1	0.5
Go^2	1	0.5
LS	2	1.0
B condition	7	3.5
Others (2/A, 1/A⁻, etc.)	37	18.5
Total bearing trees:	107	53.5
Non-bearing tree spaces:		
Replants	43	21.5
Blanks and stumps	12	6.0
Diseased: Ps^3	5	2.5
QD	28	14.0
Others (1/C)	5	2.5
Total non-bearing tree spaces:	93	46.5
Grand total:	200 trees	100.0%

Appraisal map of severely diseased navel orange orchard showing condition of each tree. Shading in squares represents colors.



MAPPING

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ing in an advanced stage of the disease and will need replacing in the near future. Ps^4 trees are no longer productive and should be pulled.

Through the use of this mapping system, Ps^1 trees can be easily detected and treated with DN 75 or scraped to prolong their productive life. As Ps^2 and Ps^3 trees may be expected to have limited productive lives, a large number of them in an orchard indicates a constantly decreasing yield potential in years to come and suggests the need for an adequate replant program.

Trees affected by gummosis are also placed in four classes, according to the severity of the disease. G^1 trees are affected by bark lesions but show no deterioration of the top. G^2 trees show top deterioration but are still bearing an adequate crop. G^3 trees are on the borderline of nonproductiveness; and G^4 trees are definitely unproductive.

Trees showing damage which can be definitely attributed to gophers are represented by the symbol Go in four severity classes.

Damage resulting from iron chlorosis is similarly treated, and the symbol Fe—the chemists' symbol for iron—is used. Damage due to windbreak competition is also divided into four degrees of severity with the symbol W.

Replants are represented by the letter R followed by the approximate age of the replant as well as can be estimated by size and vigor.

Trees showing symptoms of quick decline are represented by QD, and since quick decline kills affected trees in a relatively short time, severity classes are not used. Lemon sandwich trees are shown as LS.

A diagonal line— / —represents dead trees or stumps, while a cross— × —indicates a blank space.

When the cause of death of a tree is apparent, a symbol to indicate this cause is shown below the diagonal line, such as in square A15 in the illustration on page 5, which represents a tree killed by quick decline. A Valencia tree in a navel orchard is shown by a V, as in square C4, and, conversely, an N represents a navel tree in a Valencia orchard.

In most orchards there are some trees which are subnormal in size and vigor without exhibiting definite symptoms of disease. These trees are classified by symbols, using numbers to represent tree size and letters for tree condition. Tree size—excluding young replants for which R is used—is shown by numbers. Size 1 trees are those of maximum size for the particular orchard being mapped. Size 2 trees are those somewhat smaller than average but still large enough to be good producers. Size 3 trees are still smaller, generally with about one half the bearing surface of a number 1. Size 4 trees are definite runts, usually not bearing enough fruit to pay their way. Most of the healthy trees recorded as smaller than average are older replants or trees planted in poor soil. Trees made smaller by disease are represented by the appropriate symbol.

The condition of trees showing no easily identified disease or other trouble are graded by letters, according to their health and vigor. Trees of good health and vigor are graded A; those not quite so good, showing a little dead wood in the tops, are recorded A–. Trees in still poorer condition but probably bearing enough fruit to pay their way are called B, and those no longer paying for themselves are graded C or D—grade D being a nearly dead tree which should be pulled.

Extensive digging around the crown and roots of trees recorded B, C, and D revealed gopher damage, gummosis, or root rot in almost all cases examined. However, because of the time involved in digging, these below-ground causes of poor tree health were not investigated in most orchards, and trees showing no definite disease were recorded as B, C, or D.

Symbols for size and condition are combined on the map. Thus, a tree recorded as 2/B would be smaller than a normal tree, with thin foliage and dead brush.

Sometimes, in order to obtain a complete picture, a composite of three or more symbols is necessary. For example, tree square B6 in the illustration on page 5 is represented by the complex symbol VR5/B, which would indicate a five year old Valencia replant in B condition.

For a permanent record of the orchard surveyed, the field maps may be copied and colored. Squares shaded with red pencil are used to indicate and emphasize low-producing tree spaces. Symbols shaded in red include Ps^3, Ps^4, G^3, G^4, C, D, /, ×, QD, W^3, W^4, and size 4 trees. Trees still producing a crop but expected to decline in production in the near future are represented by a square shaded half red; these are Ps^3, G^3, and W^3 trees. Young replants bear little fruit but are coming into bearing rather than declining. Therefore, to distinguish nonbearing replants from declining trees, a diagonal red line is drawn through the square representing a replant.

Other colors are used to emphasize certain less commonly found conditions. Lemon sandwich trees are represented by squares shaded orange. Yellow shading is used for iron chlorosis symptoms. Fruit trees other than citrus which are often found scattered through orchards are indicated by a green square.

An efficiency rating—as a further aid to appraisal—can be made by tallying conditions such as psorosis, gummosis, and quick decline with such general information as the number of bearing trees, nonbearing trees, and total diseased trees. Each condition is then related to the total tree spaces on a percentage basis. With the tally and the colored maps, an accurate appraisal of the orchard can be made very quickly.

The map on page 5 represents part of a 10-acre navel orchard which is typical of the low-producing orchards found in the survey. This part of the orchard contains only 54% bearing trees. Only 23% of the trees could be considered to be in top-bearing condition. The large number of nonproducing trees, stumps, and blank tree spaces indicates the necessity for a good replant program which will need to be maintained over the years, as trees now in the early stages of psorosis get worse and go out. The replants in poor condition such as those in squares G6, G8, and G9 show that better care of replants is required, with perhaps special

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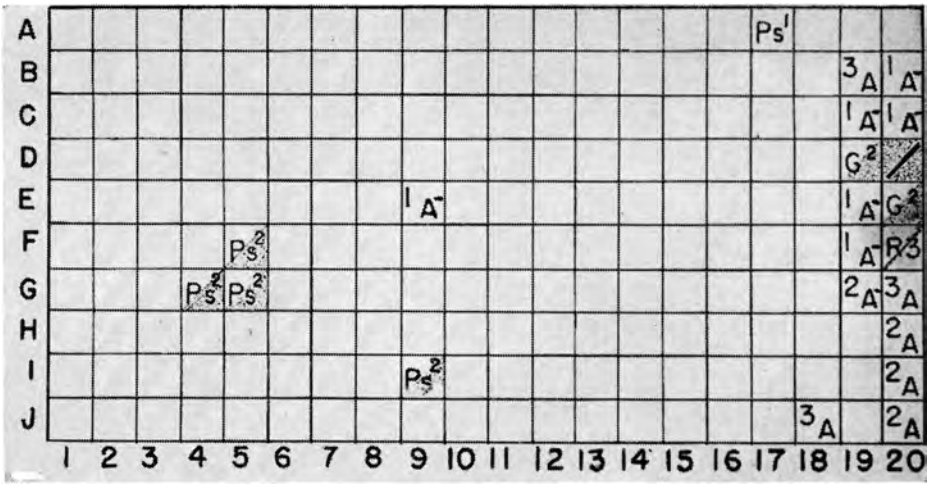
Valencia orchard showing only slight disease effect. Shading in squares represents color.



OLIVE

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fect flowers was reduced from 32% in the check to 17% by removing half of the leaves and to 11% by complete defoliation. On the other hand, the removal of potential inflorescences months before bloom resulted in a substantial increase in perfect flowers in the remaining buds. In 1952, where there were four leaves to each bud, the per cent of perfect flowers was as high as 63%, as compared with 24% where there was only one leaf for each inflorescence.

Although complete defoliation considerably reduced the per cent of perfect flowers, some normal ones still developed. Apparently this was because the reserve materials stored in stems and branches were translocated and utilized in the development of the flowers. However, if there are leaves nearby, they contribute toward even better development of the pistil, and this beneficial effect is increased as the number of leaves increase.

The experiments at Davis indicate that cultural practices—such as shading from overcrowding, nutrient deficiencies, or disease conditions such as peacock spot — *Cycloconium oleaginum* — that tend to cause loss of leaves and therefore a decrease in the number of perfect flowers should be avoided. Whereas, if cultural practices are directed toward the retention of as many healthy leaves as possible, a higher proportion of perfect flowers—and thus a greater fruit set—can be expected.

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DEER

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cated starvation or to starvation brought on by the deterioration of their teeth.

The sex ratio of fawns at birth was determined from a sample of fetuses to be 11 males to eight females, giving a ratio of 137.5 males to 100 females. Even though the sample was small, it was considered fairly indicative.

However, during the die-off in the exceptionally severe winter of 1951–52, early and midwinter fawn losses ran to nearly 400 males to 100 females, but later in the winter more females died to bring the over-winter average to 210 males to 100 females.

The winter of 1951–52 had a high rate of rainfall, low temperatures and heavy parasite infections. During the three subsequent winters, conditions were generally milder, with the exception of the 1954–55 winter which was cold but with little rainfall. The average sex ratio of the fawn losses from natural causes for these three winters was 100 males to 100 females, which indicates that fundamental differences appear to mitigate variously against the sexes, depending on environmental circumstances.

In general, it is evident that under the conditions encountered at Hopland, parasites can contribute significantly to losses of fawns during their first winter and, to a lesser extent, to the losses of yearlings during their second summer. Few older deer carry sufficient number of worms to be affected. Likewise, the magnitude of losses involving parasitism can be increased by severe weather and overstocked conditions.

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AIR POLLUTANTS

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of unfumigated trees was 9⅛″ with an average increase in diameter of 0.16″. Although the stem diameter in the fumigated trees was significantly smaller than in the unfumigated ones, there was no real difference in the height of the two sets of trees.

Reduced growth in the Mexican seedlings has been caused in six months by exposure to ozonated gasoline. Because the effects produced by controlled air pollution are usually indistinguishable from those caused by natural pollution, growth reduction in field-grown trees may be expected. Field tests are scheduled to determine the effects of pollution on growth and production of commercial avocado varieties.

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The above progress report is based on Research Project No. 1633.

WALNUT

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pean red mite became noticeable on July 29. Controlling the pest at this time did not appear to greatly influence the quality of the crop at harvest. Regardless of mite control, better quality was obtained from OMPA treatments than from the plot treated with Systox. The same situation held in orchard *B* where plots treated with OMPA produced better quality nuts than the Systox plot.

Serious spider mite populations have failed to develop where Systox has been used in the spring to control the walnut aphid. However, its direct use to control spider mite infestations in late season is in need of further investigation. This is particularly true in regard to the dosage required.

OMPA applied in the spring to control the walnut aphid has in all cases resulted in excellent control of the Pacific spider mite. This has not proved to be the case in regard to the European red mite, and threatening populations of this species have developed where OMPA has been used.

Serious spider mite populations are not likely to develop before August. Where it is apparent that natural enemies will not take care of the situation, control measures should be applied. Adequate control of the Pacific spider mite with conventional sprayers has been obtained where 15% wettable aramite powder was used at the rate of 1.5 pounds per 100 gallons of water and applied as a thorough coverage spray.

Control of the Pacific spider mite should result from treatment by air carrier sprayers with 12 to 14 pounds of aramite 15% wettable powder applied in from 400 to 500 gallons of water per acre. For the control of the European red mite, the aramite wettable powder should be increased to two pounds per 100 gallons where applications are made with conventional sprayers. With air carrier sprayers the amount should be increased to 15 to 18 pounds per acre. In all cases, satisfactory control of spider mites is dependent upon thorough coverage.

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The above progress report is based on Research Project No. 1314.

MAPPING

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attention to watering. Preplanting fumigation or change of rootstock may also be indicated.

The relatively high incidence of B condition trees points toward root trouble and suggests further investigation of cultural and irrigation practices as they affect root health.

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The above progress report is based on Research Project No. 1612.