cost of gleaning the cotton left by the palletless module mover on the ground area that had been beneath the module (usually 20 to 30 pounds of seed cotton per module).

General conditions

The palletless system eliminates handling, storing, and repairing pallets, and the total equipment investment is much less than with the pallet system. With no empty pallets in the field, there is greater flexibility in positioning the module builder for each new module to best fit the picking progress. There are no pallets (or conventional trailers) to be relocated because of wrong predictions as to where they would be needed. The palletless module mover truck is easier to maneuver and position for loading than is a pallet-module trailer towed by a truck.

With palletless modules, the bottom cotton may get wet from rain unless each module is stored on a raised area having good drainage away from the module (whether stored in the field or elsewhere). More planning and care are needed in preparing a central storage area for palletless modules than for pallet modules, especially if the soil in the storage area is fairly heavy and substantial rains are likely to occur during the storage period.

Firm compacting of each module near the ends is especially important with the palletless system. The top and at least the upper 2 feet of the sides and ends of both palletless and pallet modules should be covered during transport. If the modules are to be stored, each module should be covered in the field within a day after being built. If some modules are left uncovered because they are to be hauled directly to the suction station within a few days, a tarp should be installed as part of the loading operation.

To maximize annual use, module movers should be owned and operated by a gin. This is especially important with the palletless mover. A gin should either own more than one palletless mover or have temporary access to a second unit so the ginning operation is not dependent on a single mover. Night operation of palletless movers is feasible and is desirable to increase the annual use.

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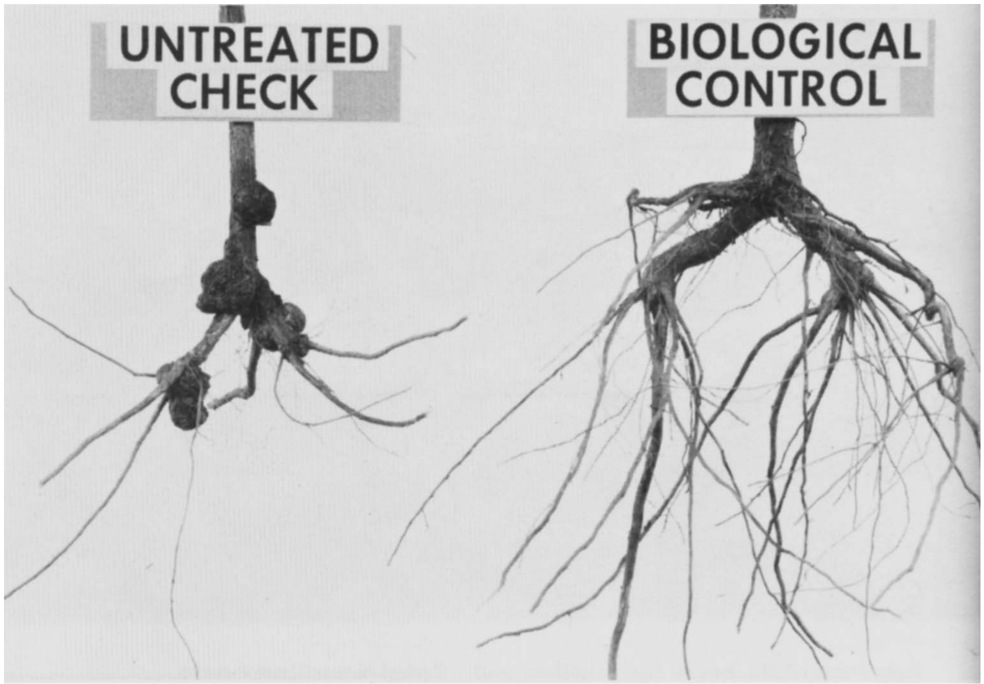

Effect of biological control treatment on Marianna plum compared with an unprotected check.

Biological control of crown gall

William J. Moller • Milton N. Schroth

A non-gall-forming bacterium may provide the much-needed biological method of controlling this serious disease in new deciduous fruit orchards.

Spectacular biological control of crown gall was achieved last year in an experiment carried out on young almond, peach, plum, and apricot trees in a California nursery. This new approach to control of a difficult disease is of interest to West Coast nurserymen producing woody perennial plants, and also to growers planting new deciduous fruit orchards.

Crown gall is a bacterial (*Agrobacterium tumefaciens*) disease of worldwide importance on many woody plants; it can be especially serious in deciduous fruit nurseries. Heavy, rough overgrowths develop on the basal trunk, the roots, and occasionally the aerial parts of plants following entry of the bacteria through wounds made during planting or other cultural practices.

Gall formation can disrupt food- and water-conducting tissues of the plant so that infected young trees become stunted and grow poorly. On older trees, the galls can also serve as entry points for secondary wood rots, which weaken the tree.

An Australian researcher, Dr. Allen Kerr, recently reported on the effectiveness of a non-disease-producing form of the crown gall bacterium for protecting seeds and seedlings against the gall-forming strain. Kerr found that, by dipping seeds or seedlings in a suspension of this biological agent before planting, healthy trees could be grown, even in crown-gall-infested soil. Dr. Larry Moore of Oregon State University tested this approach in the field and obtained spec-

CROWN GALL DEVELOPMENT ON YOUNG STONE FRUIT TREES SIX MONTHS AFTER TREATMENT WITH BIOLOGICAL OR CHEMICAL AGENTS

Stone fruit rootstock	Treatment	Trees planted	Survivors	Number of surviving trees with gall rating as shown:							Average galls/tree
				>6	5	4	3	2	1	0*	
Almond	Untreated check	50	39	18	2	1	2	4	5	7 a	3.62
	Biological control	50	37	0	0	0	2	3	6	26 b	0.49
	Dowco 3,000 ppm	50	29	16	2	3	0	3	1	4 a	4.31
	Dowco 6,000 ppm	50	17	8	0	1	1	3	1	3 a	3.65
Peach	Untreated check	50	34	26	0	0	2	4	1	1 a	5.03
	Biological control	50	46	1	1	0	5	4	10	25 b	0.96
	Dowco 3,000 ppm	50	19	10	3	2	0	4	0	0 a	4.79
	Dowco 6,000 ppm	50	22	5	6	3	1	2	3	2 a	3.73
Plum	Untreated check	90	84	40	9	8	11	11	3	2 a	4.46
	Biological control	90	87	0	0	0	0	0	19	68 c	0.22
	Dowco 3,000 ppm	90	85	13	5	6	20	20	13	8 a	2.82
	Dowco 6,000 ppm	90	76	0	1	1	7	16	30	21 b	1.21
Apricot	Untreated check	70	45	7	3	2	3	4	12	14 a	2.09
	Biological control	70	41	0	0	0	0	4	8	29 b	0.39
	Dowco 3,000 ppm	70	43	0	0	0	0	3	2	38 b	0.19
	Dowco 6,000 ppm	70	26	0	0	0	0	1	3	22 b	0.19

* Values followed by different letters are significantly different at the .001 level.

tacular control for a number of plant varieties.

These reports seemed almost too good to be true, so a severe test was devised during the late winter of 1974-75 in a U.C. Plant Pathology nursery to evaluate the procedure. A comparison was also made at the same time with two rates of Dowco 242 (tetraisopentyl-ammonium bromide), a potential crown gall control chemical.

More than 1,000 one-year-old, budded stone fruit seedlings were used in the experiment. These were obtained from commercial nurseries in late winter and "heeled in" in sawdust until treatment and planting in field plots at the end of the dormant period.

Each stone fruit species (almond, apricot, peach, or plum) was first divided into four groups, and large roots were pruned back. To make more potential infection sites, the young trees were then lined up side by side on the ground and damaged on the crown and roots with rakes. The plants were then immediately spray-inoculated with a heavy mixture of infectious crown gall bacteria before being tied into bundles of 50 plants.

After inoculation, the bundles of plants were treated in one of the following four ways:

- Check — dipped for 5 seconds in water.
- Biological control — dipped for 5 seconds in a 30-gallon drum containing approximately 10 million cells/ml of the non-gall-forming bacterium supplied by A. Kerr.
- Chemical control, 1 — dipped for 5 seconds in a 30-gallon drum containing 3,000 ppm Dowco 242.
- Chemical control, 2 — dipped for 5 seconds in a 30-gallon drum containing 6,000 ppm Dowco 242.

The young trees were then individually planted in unfumigated nursery rows, with treatments kept separate. After six months the trees were dug up, and gall development was assessed. The number of galls per tree was recorded, up to five galls (see table); dead trees were not evaluated.

Control achieved with the biological treatment was excellent (see photo), especially considering the drastic nature of the test conditions. During standard nursery and grower handling, plants are repeatedly damaged between the time of initial nursery planting and final establishment in commercial orchards. Normally, however, the plants would not be subject to the extensive injury and large doses of crown gall bacteria used in this experiment. It therefore seems reasonable to conclude that, under normal cultural practices, treatment with the biological agent might have provided almost 100 percent control.

Furthermore, the data in the table are quite conservative in that numbers of galls on untreated check trees ranged up to 30 and were too numerous to count during harvest; thus a >6 rating generally represents a much higher level of disease than indicated, especially in the check trees. Whether the effectiveness of the biological treatment is due to production of an antibiotic is not yet clear; this aspect will be the subject of further study.

Dowco 242 showed excellent promise on apricots, but had minimal effect on plums, almond, and peaches. We do not know the reason for this difference in effectiveness of the chemical on stonefruit species.

Further tests are in progress to test the biological control agent with other plant species such as walnut, cherry, and grape. The data from investigators so far indicate that the concept offers exciting possibilities. There are now numerous practical and effective methods of biological control of insect pests in crops, but examples of commercially feasible biological control for plant disease microorganisms are few and far between.

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