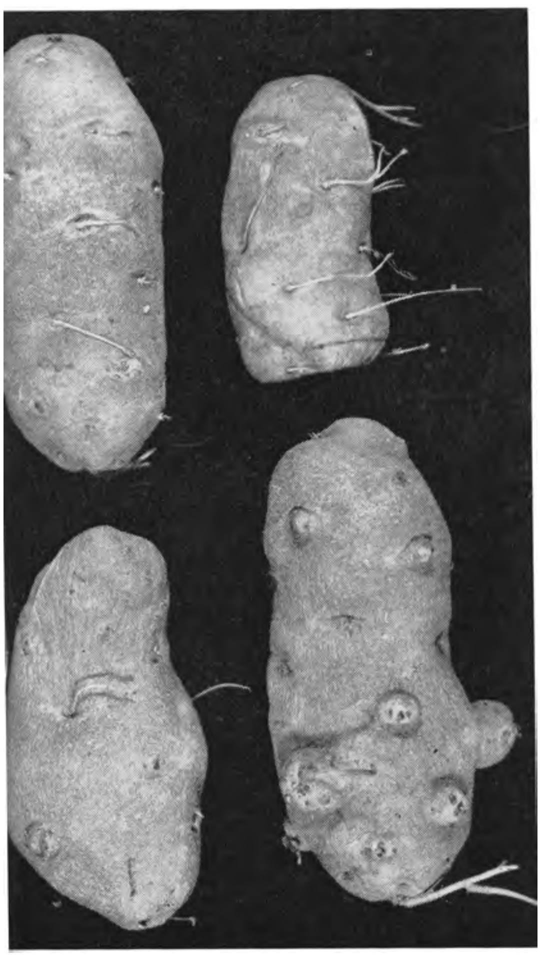
ing plants showed wilting, or death, of the grafted stem only or remained apparently healthy. One or more spindling-sprouted tubers were produced on 10 of the 25 symptomatic plants, but an additional 28 of the remaining grafted plants also produced abnormal tubers. Typical spindling sprouts were produced on 150 of the 324 tubers—46%—from plants giving rise to abnormal tubers. The severity of infection and symptoms did not increase the percentage of tubers with abnormal sprouts. Therefore it was possible to verify the influence of aster yellows in the production of spindling-sprouted tubers, but the incidence of the tuber disorder could not be predicted wholly by plant symptoms.

roduced on a White Rose potato plant graft- llows virus. Note loss of apical dominance in outs on tubers from graft-inoculated Russet plant.



Spindling-sprouted tubers were produced by one-to-four of the 10 Russet Burbank plants from each of the grafting dates in the time of infection study, totaling 13 of 50 plants with tuber symptoms. Only five White Rose plants, three from the 30-day and one each from the 58- and 72-day graft dates produced spindling-sprouted tubers. Weights and numbers of tubers indicated that infections initiated 30 days from planting resulted in tubers reduced in size and number, but nearly 100% subject to spindling sprouts. Infections initiated 44 or more days after planting produced tubers of normal number, but slightly reduced in size, of which approximately 50% sprouted abnormally.

Tubers producing spindling sprouts were not distinguishable from normal tubers by external or internal appearance. Abnormal tubers could be identified only by their characteristic elongated and weak sprouts after germination. Tubers predisposed to spindling sprouts germinated earlier than non-affected tubers and sprouted from all eyes concurrently, indicating a loss of apical dominance.

Several rapid tests were conducted to evaluate a reliable method for detecting and separating spindling-sprouted tubers from seed stock or commercial samples. These tests were made on sprouted tubers to provide known spindling- and normal-sprouted samples. Specific gravity measurements of individual tubers provided a gross separation of the abnormal tubers due to their low—1.050–1.065—specific gravity value. Normal tubers generally measured in the higher—1.065–1.090—specific gravity ranges. Hand refractometer readings for percentage soluble solids expressed as sucrose appeared reliable to separate abnormal tubers by high readings—7%–12%—and normal tubers by lower values—4%–8%.

Microscopic examination of tubers verified the presence of excessive callose deposits in the internal phloem of spindling-sprouted tubers. Comparable callose deposits were not evident in normal-sprouted tuber tissues.

It appears from the data obtained in these studies and from those reported by other investigators that spindling sprout is an expression of an abnormal condition in the tuber caused by a number of varied conditions or diseases, and is not to be considered a separate disease. Available evidence indicates that abnormal development within the phloem tissues is most directly responsible for the weakened sprout development.

The aster leafhopper is unable to extract and transmit virus from infected potato plants, so secondary spread in the field is not a problem. The extent of spindling sprout incidence due to aster yellows virus is dependent on leafhopper populations and on sources of virus in perennial weed and ornamental hosts. No satisfactory method has been developed to eliminate spindling sprouts.

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stock for the distribution program in the University Insectary.

The California State Department of Agriculture, County Agricultural Commissioners and County Farm Advisors of the University of California Extension Service assisted in the distribution and release of the parasitic wasp in scale infested olive orchards.

W. H. LANGE and L. K. MANN

Fumigation controls

Microscopic Mite

attacking garlic

A microscopic eriophyid mite—*Aceria tulipae* (Keifer)—causes virus-like symptoms on garlic: a distorting, twisting, and yellow and light-green streaking of the leaves. Severe attacks of this mite occurred in several California localities in 1960.

Most of the damage caused by the mite is due to feeding of the mites on the surfaces of the cloves while the bulbs are in storage, a scarifying and drying of the growing surfaces. Mites attain entrance to the growing points of the garlic and usually concentrate their attacks on such new growth. From several to thousands of mites can occur on individual bulbs.

Extent of mite damage depends upon

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the population of mites present and length and time of storage. The mites extend their feeding to the protective folds of the leaves and leaf bases, but in most cases damage in storage appears to be the most important rather than field spread from plant to plant.

In addition to the presence of mites on the cloves during storage, the damage in the field can be recognized as a stunting, twisting and yellow and light-green mottling of the foliage. There may be a permanent disfigurement of the plants, but in most cases, particularly in light attacks, there is a tendency to outgrow the damage. One instance has been observed where damage caused by a post-emergence herbicide resulted in twisting and curling of the foliage, allowing mites to cause extensive field damage.

Mite Widespread

The mite attacks many liliaceous and graminaceous plants and is widely distributed in North America and Europe. It is often called the wheat-curl mite and is a vector of streak-mosaic of wheat. In California it has caused damage to garlic in Monterey, San Benito, Santa Clara and Yolo counties, but undoubtedly occurs in most of the garlic growing areas.

The female mite is spindle-shaped, whitish, and about 1/100″ long and 1/500″ wide. Two bulb mites—*Rhizoglyphus callae* Oudm. and *Glycophagus domesticus* deGeer—also feed on stored garlic. Bulb mites, much larger than *Aceria*, are readily visible by the naked eye, and are robust with long hairs. Bulb mites often enter mold and mite damaged tissues, and infection can occur in the field or in storage.

Results of Methyl Bromide Fumigation and Sulfur Dusting of Garlic Bulbs to Control *Aceria tulipae*

Three months' storage, then cloves planted in flats and examined one month later

Treatment	Plants examined	Range mites/plant	Total mites	Average mites/plant
Check	30	1–1,285	2,064	68.60
Sulfur dusted...	30	0–6	7	0.23
Methyl bromide fumigation, 2.5 lbs./1,000 cu. ft., 80°F., 2 hours	40	0	0	0.00

Stored at 20°C. from April 16 to July 15; treated July 15; plonts examined August 11.

Results of Methyl Bromide Fumigation and Sulfur Dusting of Garlic Bulbs to Control *Aceria tulipae*

Ten bulbs examined following two months' storage

Treatment	Cloves examined	Cloves clean	Cloves infested, live mites	Infested, live mites	
				Bulbs	Cloves
Check[1]	233	170	63	80.0%	27.0%
Check[2]	164	137	27	70.0	16.5
Methyl bromide fumigation, 2.0 lbs./1,000 cu. ft., 80°F., 2 hours ...	192	146[3]	0	0.0	0.0
Sulfur dusted	162	131[4]	12	40.0	3.1

Treatments made November 5; examined December 15–28. [1] Stored at room temperature. [2] Stored in Vegetable Crops bulb shed (common storage). [3] 46 cloves with dead mites. [4] 19 cloves with dead mites.

Fumigation of the infested bulbs after harvest and before storage appears to be the most satisfactory control found to date for all mites attacking garlic. An atmospheric fumigation of methyl bromide, using 2.0 to 2.5 pounds per 1,000 cubic feet at 80°F. for two hours, gave excellent control with no injury to the garlic.

Treating the bulbs before storage with enough dusting sulfur to form a thin film over the bulbs is successful in killing mites and in preventing spread from bulb to bulb. Once mites are established inside the bulbs, sulfur does not kill all the mites present.

Bulbs for seed should be disease and mite free and—preferably—from fields free of mite injury.

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Left—Fall garlic damaged by the eriophyid mite of garlic, showing stunting and twisting of the leaves; *right*—undamaged.