Companion plants

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They repel pests, but may also reduce garden crop yields.

The use of companion plants has been widely recommended in popular gardening literature as an effective nonchemical means of pest insect control in home garden vegetables. Companion (sometimes called repellent) plants suggested are usually specific herbs or flowers, often with aromatic foliage or blossoms, and they are reported to act on pest insects mainly by repelling them. We evaluated several candidate companion plants by periodically sampling for pest insects in cabbage or beans grown in close association with anise, basil, catnip, marigold, nasturtium, sage, summer savory, or thyme. The experiments were conducted at the University of California Deciduous Fruit Field Station, San Jose, in the 1981-82 growing seasons.

Procedure

On raised beds, 16 to 18 inches wide, groups of four companion plants of the same species, grown from seed in small plastic pots, were transplanted about 14 inches apart in a square configuration to constitute a single plot. The plots were arranged in randomized complete block designs with 3 feet between plots.

In the first planting, established in September 1981, the companion plants were anise, basil, thyme, and sage. Cabbage seedlings were transplanted on October 9, one seedling in the center of each plot. For the first few weeks, plants were watered by hand with a sprinkling can as necessary, then they were furrow-irrigated weekly. Eggs of the imported cabbageworm, *Pieris rapae* (L.) deposited on the cabbage leaves were counted periodically.

A second planting, similar to the first in configuration, was established from transplants on April 27, 1982, with nasturtium, marigold, catnip, summer savory, and basil as companion plants. One young cabbage was transplanted into the center of each plot on May 27. Counts of eggs and larvae of the imported cabbageworm began on June 3. In late June, the cabbages were rated for worm feeding injury, the crop harvested, and the heads weighed.

On July 1, companion plants in the entire 1982 planting were thinned from four to two per plot, those remaining were sheared to reduce their height, and a single crop plant was transplanted into the center of each plot: bush bean seedlings in one part of the planting, and young cabbage plants in another. On beans, nymphs of the greenhouse whitefly, *Trialeurodes vaporariorum* (Westwood), were counted under magnification in a circular area 15 mm in diameter adjacent to the midrib on each of two leaves taken from each plant on July 26 and again on August 9. The cabbages planted July 1 were evaluated for imported cabbageworm damage and for yield on August 19.

In all tests, the control consisted of crop plants without companion plants.

Results

In 1981, anise as a companion plant significantly reduced the number of imported cabbageworm eggs deposited on nearby cabbage (average of 5.9 eggs per plant in anise plots; 7.3, 8.5, and 8.8 in basil, thyme, and sage plots, respectively; and 10.4 in plots without companion plants).

The following year, when counts of cabbageworm eggs and larvae were combined, the use of nasturtium, marigold, or catnip reduced insect numbers on the cabbage crop below those on the control, yet of those treatments, only marigold differed from the control in the amount of resultant worm injury to cabbage (table 1). All companion plants were associated with reduced weights of cabbage heads. It was for this reason that we reduced the number of compan-

TABLE 1. Effect of companion plants on cabbage and cabbageworm: four companion plants per plot, 1982

Companion plant	Eggs and larvae per plant*†	Worm injury rating†‡§	Avg. wt. of head†‡
			grams
Nasturtium	1.3 a	2.8 bc	15.1 c
Marigold	1.5 ab	2.0 a	12.1 c
Catnip	2.4 bc	2.8 bc	16.1 c
Summer savory	2.7 cd	2.3 ab	30.2 bc
Basil	2.8 cd	3.1 c	62.0 b
Control	4.0 d	2.9 c	182.3 a

* Average of counts made June 3, 11, and 18. Six replications of all treatments.
† Means in each column followed by the same letter are not significantly different at the 5% level, Duncan's new multiple range test.
‡ Ten replications of all treatments. Sampled June 29.
§ Average ratings from 1 (no, or trace of, worm feeding) to 5 (severe feeding injury).

TABLE 2. Effect of companion plants on cabbageworm injury and yield of cabbage and on whiteflies on beans: two companion plants per plot, 1982

Companion plant	Cabbage, Aug. 19*†		Beans†‡	
			Whitefly nymphs	
	Worm injury rating	Avg. wt. of head	July 26	Aug. 9
		grams		
Nasturtium	2.2 a	128 b	82 ab	301 c
Marigold	2.9 a	56 cd	40 a	172 ab
Catnip	2.4 a	24 d	105 b	194 abc
Summer savory	2.2 a	121 b	75 ab	194 abc
Basil	2.5 a	90 bc	100 b	214 bc
Control	2.9 a	301 a	32 a	123 a

* Ten replications sampled. Average ratings from 1 (no, or trace of, worm feeding) to 5 (severe feeding injury).
† Means in each column followed by the same letter are not significantly different at the 5% level, Duncan's new multiple range test.
‡ Eight replications sampled on July 26, six on Aug. 9. Average number of nymphs per 15 mm area.

ion plants in each plot from four to two before the second evaluation.

In that trial, no differences among the various treatments were evident in cabbage foliage injury by worms (table 2). Cabbage yield was again significantly depressed in all plots containing companion plants. On beans, significantly higher whitefly levels occurred on July 26 in plots planted with basil and catnip, and on August 9 in the basil and nasturtium treatments, than in other plots. Whitefly numbers were not significantly lower than those of the untreated control on either date in any of the companion plant treatments.

Conclusions

Although several species of companion plants reduced imported cabbageworm numbers by modest levels, such reductions did not necessarily result in diminished worm damage to cabbage. Any beneficial effects of companion plants were negated by substantial reductions in cabbage yields. Yield reduction probably resulted from competition for resources, such as sunlight and possibly soil moisture and nutrients.

Plant spacing different from the ones we used might well have diminished the effects of competition, yet probably would also have failed to produce the modest beneficial effects noted for several companion plant species. For beans, it is doubtful that any altered configuration of the companion plants used would have reduced whitefly levels, although the possibility must remain open that whiteflies fare better when plants are stressed than when they are vigorous. ■

Snail barriers

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All except one barrier tested worked well.

The brown garden snail is a destructive, annoying pest to many California home gardeners. Feeding on vegetables, fruits, or ornamentals of many kinds, a relatively few of these snails, *Helix aspersa* Müller, can cause much damage, particularly if the affected plants are seedlings or the foliage nondeciduous.

Commercial snail baits, formulated in several ways, are effective when used at proper times and locations, but some gardeners prefer not to use them because of possible hazards to small children or pets, or for other reasons. Alternative control measures that have been suggested include liquid traps of stale beer or fruit juice, barriers of rough or sharp substances, such as sand or ground glass, and hand-picking.

Evaluation of barriers

To evaluate the comparative efficacy of several types of snail barriers, we conducted a series of tests in the spring of 1982 and 1983 in Kensington, Contra Costa County. Each testing arena was 3 feet square and was installed on strips of plastic sheeting approximately 10 inches wide, laid on asphalt in a shaded location. Barrier materials were applied dry in a ridge approximately 3 inches wide and 1 inch high, except for the screening, which was 6 inches high and erected vertically. A 1-square-foot board placed horizontally in each arena was elevated several inches to provide cover for the snails. No food was provided.

At the start of each replication, 25 field-collected brown garden snails, half to fully grown, were placed beneath each board. Twenty-four hours later, snails remaining in each arena were counted and discarded. Positions of the arenas (plots) were re-randomized, and the process repeated for a total of four to five replications.

Evaluation of barriers to prevent brown garden snail movement

Barrier	Snails remaining*
1982 trial (March 8-25)	%
Hardwood ashes	93 a
Softwood ashes	89 a
"Copper" screening†	87 a
Diatomaceous earth	76 a
Sand	19 b
None (control)	12 b
1983 trial (May 2-20)	
Diatomaceous earth	91 a
Snailproof‡	42 b
None (control)	15 c

* Average percentage of snails remaining in test area. Means in each trial followed by the same letter are not significantly different at 5% level, Duncan's new multiple range test.
† Although purchased in a retail outlet as copper screening, analysis indicated about 30% zinc was present also.
‡ A commercial product consisting mostly of ground incense cedar sawmill by-products.

Results

Ashes, screening, diatomaceous earth, and, to a lesser extent Snailproof, were effective as snail barriers when compared with the untreated control (see table). Snailproof might have been more effective if it had been applied as a complete ground covering, as recommended by the manufacturer, rather than as a barrier, which we did in this test for purposes of comparison. Sand was worthless as a barrier.

During these trials it became apparent that measurable rain immediately impaired performance of barriers, except the screening. Several replicates were discarded after such weather, when snails readily left the test arenas. We did not investigate any means of keeping barriers dry. Unfortunately, snails are often most troublesome during rainy weather. The plastic strips helped prevent contact of the barriers by soil moisture.

Most garden soils in California are not benefited by addition of some of these barrier substances, such as ashes. Plastic or another substrate would aid in keeping such materials from contaminating soils.

Starvation of snails for one to seven days before they were placed in the test arenas had no consistent effect on their propensity to cross the barriers to escape. A period of hot weather near the end of the 1983 trial indicated that snails do not readily move during such times. We discarded those replicates.

An effective barrier would, of course, keep snails in as well as out. Normally, the resident snail population in the garden should be reduced by means such as baiting or hand-picking before the area is enclosed by a barrier. ■