Sensitivity of Vegetable Crops, Weeds, and a Soilborne Pathogen to Wild Radish

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PROBLEM ADDRESSED

Herbicides are used extensively in vegetable production to minimize weed interference, achieve maximum yields, and allow efficient harvest of high quality crops. Due to the limited number of herbicides registered in most vegetable crops, hand labor for weeding is a necessary and costly component of vegetable production (Mayberry et al. 1995). Furthermore, fungicides routinely used to ensure crop quality and yield are a major production cost as well as an environmental risk. Rising labor costs, increased environmental awareness, and extensive use of pesticides makes development of alternative pest management strategies of utmost importance.

OBJECTIVES

To investigate the effect of wild radish residues on ten vegetable crops, three weeds, and a plant pathogen in bioassays.

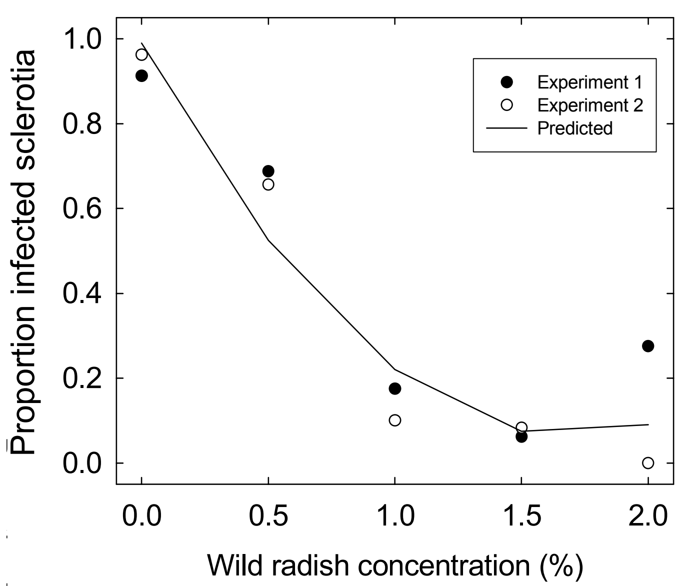
METHODOLOGY

A replicated study was conducted in a greenhouse to assess the tolerance of direct-seeded and transplanted vegetables to a wild radish mulch. Crops evaluated as transplants included bell pepper and tomato, whereas southern pea, lima bean, okra, cucumber, cantaloupe, watermelon, squash, and sweet corn were direct seeded. Weeds evaluated included Palmer amaranth, large crabgrass, Texas panicum, and purple nutsedge. The screening technique used the methods reported by Norsworthy (2003). Oven-dried, ground wild radish was mixed with soil at rates of 0, 0.5, 1, 1.5, and 2% (by weight). All crops and weeds were then seeded at known seed quantities, while transplants were placed in pots containing each of the wild radish rates. Twenty sclerotia were placed in nylon mesh bags filled with soil amended with the different concentrations of ground wild radish and then buried in pots in the greenhouse. At intervals of 0.5, 1, and 2 weeks after burial, bags were retrieved and sclerotia assayed for germination on semi-selective agar (Papavizas and Collins 1990), germination on soil (Ristaino et al. 1991), and ability to infect bean stems (Papavizas and Collins 1990). For weeds and crops, percentage emergence (direct-seeded crops only), height, and shoot fresh weight reduction relative to a non-treated control was calculated. Regression analysis was used to assess the affect of wild radish amendment rate on crop and weed growth (Figures 1, 2). In addition, percentage germination and infectivity will be regressed against concentration of wild radish residue at each time interval and over time for each residue level. The wild radish concentration that inhibits weed and crop biomass or germination and infectivity 50% (ED_{50}) will be calculated and used to establish selectivity indices for various crop:pest complexes.

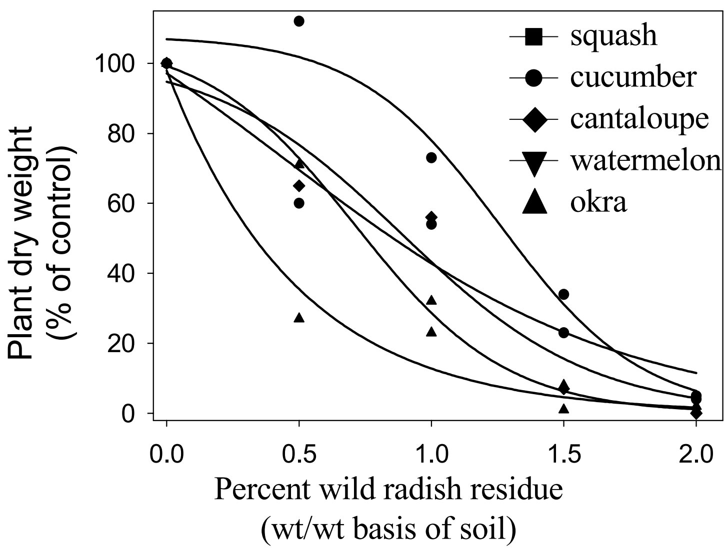
Soil Pathogen. Although the effect of wild radish residues varied between the two experiments, increasing concentrations of wild radish residue reduced germination of sclerotia of *Sclerotium rolfsii* in both experiments. In the first experiment, there was a significant linear decrease (P=0.0001) of germination of sclerotia of *S. rolfsii* on agar as the percentage wild radish residue was increased from 0% to 2% in soil. Germination decreased from a mean of 94% for sclerotia buried in soil amended with 0% residue to a mean of 55% with 2% residue. There were no differences between the three sampling times. In the second experiment, there was a significant sampling time-by-treatment interaction (P<0.01). Percentage germinated sclerotia decreased in a cubic, quadratic, and linear fashion at the first, second, and third sampling, respectively, as the percentage wild radish residue increased.

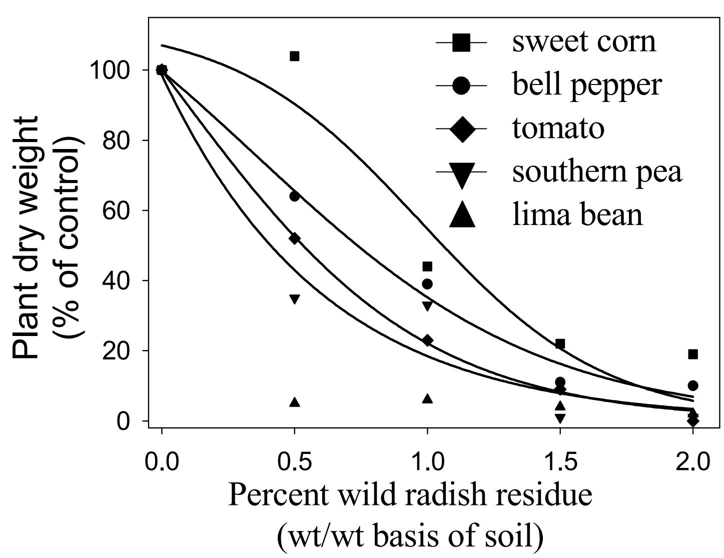
Wild radish conc.	Germinated sclerotia (%)		
(%)	Sampling 1	Sampling 2	Sampling 3
0.0	69	96	93
0.5	74	54	75
1.0	6.3	19	28
1.5	1.3	3.8	0.0
2.0	22	0	0.0
R^2	82.6	81.1	61.4

In the first experiment, there was no effect of wild radish residue on infectivity of sclerotia. In the second experiment, wild radish residues also reduced the percentage of sclerotia that were able to infect green bean stems. A quadric equation described the effect of increasing concentrations of wild radish residues: $y = 0.99 – 1.09x + 0.32x^2$, where y = proportion infective sclerotia and x = percentage wild radish residue. Wild radish residues at a concentration of 1.5 to 2% reduced infectivity of sclerotia by 90%.

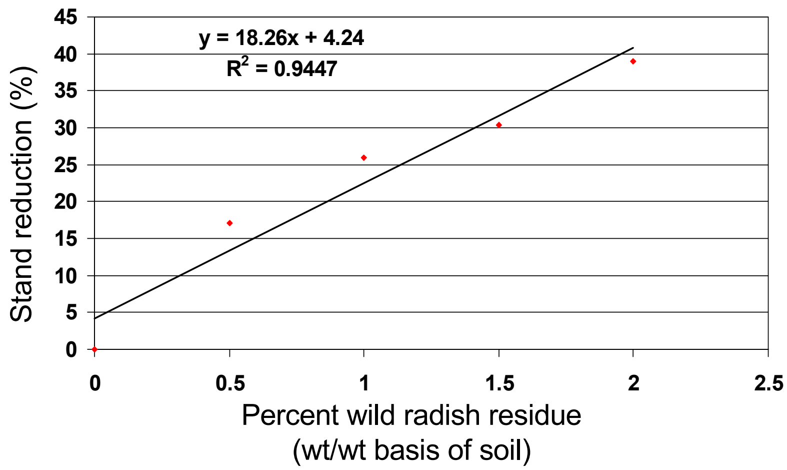


Crop Tolerance to a Wild Radish Mulch. The sigmoidal model y = a/(1 + exp(-x-c)/b)) was fitted to describe the response of plant dry weight to rates of the wild radish amendment. Crops varied in tolerance to wild radish amendment rate based on total plant dry weight. Based on a 50% growth reduction with the amendment rate in parenthesis, tolerance by crops was as follows: squash (1.30%) > sweet corn (1.06%) > cantaloupe (0.89%) > cucumber (0.86%) > watermelon (0.76%) > bell pepper (0.64%) > tomato (0.53%) > southern pea (<0.5%) > okra (<0.5%) > lima bean (<0.5%). Tolerance by the crops does not appear to be related to seed size since southern pea, okra, and lima bean were high sensitive to wild radish, while these are three of the larger seeded crops. Although transplants were used for bell peppers and tomatoes, the tomato and bell pepper transplants had only 1 to 2 leaves which is smaller than those used by commercial growers. Large transplants with greater root mass would have likely increased the tolerance of these crops to the wild radish amendment.





Weed Suppression by a Wild Radish Mulch. Wild radish residues were not suppressive of large crabgrass, Texas panicum, or purple nutsedge based on aboveground, belowground, and total plant dry weight 21 days after planting. Similarly, plant densities were not negatively affected by wild radish. Palmer amaranth density, however, was reduced linearly as the residue rate increased, indicating it may be at least partially suppressed by wild radish. Stand reduction at the 2 % residue rate 39% compared to the nontreated control. Based on this and earlier studies, it appears weed sensitivity to wild radish residues is not a function of seed size, but depends mostly on whether the species is a monocot or dicot, with dicots being more susceptible.



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