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FACTORS INFLUENCING NEMATODE CONTROL WITH MARIGOLDS

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Marigolds, Tagetes spp. are well known and widely grown ornamental plants that also occur as indigenous weeds in subtropical and tropical regions. In India for centuries species of Tagetes have been grown between beds of solanaceous vegetables, with growers changing the direction of the marigold beds every year, perhaps without knowing completely the significance of this procedure (4).

Because of concern relating to the effects of certain pesticides on the environment and the lack of availability of nematicides, especially for homeowners, in recent years there has been a renewed interest in the potential use of marigolds for nematode control. As early as 1938 Tyler tested 29 varieties of marigolds and concluded that they were generally poor hosts for the root-knot nematodes tested (10). Since then, considerable research has been conducted in this area with some investigators obtaining evidence that marigolds effectively control nematodes, but some other researchers have observed poor nematode control with marigolds. Recent research has more clearly identified a number of factors affecting the effectiveness of nematode control by marigolds, and these should be understood by those who wish to use species of Tagetes for control of plant parasitic nematodes.

Variation in Control With Tagetes Species and Cultivars

There are about 20 species of Tagetes and 5 of these, T. patula L., T. erecta L., T. signata Cav., T. lucida Cav., and T. minuta L., have been commonly used in control studies. T. patula (French marigolds) and T. erecta (African marigolds) each consist of at least 30 cultivars, and these vary in effectiveness in controlling plant parasitic nematodes (6,7,8). In the Netherlands, French marigolds were found generally to be more effective than African marigolds against species of Pratylenchus Filipjev (lesion), Meloidogyne Goeldi (root-knot), and Tylenchorhynchus Cobb (stunt) nematodes. However, considerable variation between cultivars was observed, so that the least effective of the 8 cultivars of T. patula tested demonstrated similar control of nematodes as the most effective of the 6 cultivars of T. erecta tested (8).

Effectiveness of Control Depends on the Genera and Species of Nematodes Present

Research has been conducted on the influence of Tagetes species on at least 14 genera of plant parasitic nematodes. In general, there is evidence that populations of 2 of the types of nematodes that cause severe economic damage in home gardens, Pratylenchus species (lesion) and Meloidogyne species (root-knot) can be effectively suppressed with marigolds, especially cultivars of French marigolds (T. patula) (1,6,7,8). In one study, for example, after 9 weeks, populations of Pratylenchus penetrans Cobb (lesion) were reduced 99, 55, and 63% by T. patula, T. erecta, and T. minuta, respectively. Fallow resulted in only a 43% reduction from the initial population, and planting wheat, a suitable host, increased the population 260% (8).

The effectiveness of root-knot nematode control with marigolds varies with species of Meloidogyne present. In a study in North Carolina, marigolds controlled several species of root-knot nematodes, but the marigolds, T. erecta, 'Diamond Jubilee', and T. patula, 'Petite Harmony', were not effective against Meloidogyne arenaria (Neal) Chitwood (7). In another study a Georgia selection of the South American marigold, T. minuta, greatly suppressed root-knot nematode populations, Meloidogyne incognita Kofoid & White and M. javanica Treub, but did not suppress populations of M. arenaria (2).

Research has also indicated a suppression of Tylenchorhynchus (stunt) populations by one season's cultivation of T. patula. This suppression is less than that observed for root-knot and lesion nematodes, but fallow plots had a higher population of stunt nematodes than plots in which T. patula were grown (8). Populations of other plant parasitic nematodes may increase on certain species of marigolds. For example, at least one species of Tagetes has been reported as a good host for ring nematode, Criconemoides mutabile Taylor; stubby-root nematode, Trichodorus teres Hooper; sheath nematode, Hemicycliophora similis Thorne; spiral nematode, Rotylenchus robustus (de Mann) Filipjev; and pin nematode, Paratylenchus spp. Micoletzky (8).

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The burrowing nematode, Radopholus similis Cobb was reduced by T. erecta in some greenhouse tests, but this marigold failed to suppress nematode populations or act as a barrier when planted between healthy and infected grapefruit seedlings (9).

Thus it is apparent that the species of nematode present and the species and cultivar of marigolds planted will interact to determine subsequent crop response. In addition, since populations of plant parasitic nematodes are suppressed but not eradicated by marigolds, the number of plant parasitic nematodes in the soil prior to planting marigolds will determine the response of the crop that follows marigolds. If populations are very high initially, then even though marigolds may greatly suppress a nematode population, this may not be sufficient to prevent economic damage when a susceptible crop is planted.

Mechanism of Control

There is evidence indicating that certain marigolds suppress plant parasitic nematodes to a greater extent than fallow or other nonhost crops, and in some cases that marigolds may act as trap crops, i.e., allow penetration of nematodes without subsequent development and reproduction (1,8). Roots of marigolds also are known to contain compounds that in laboratory conditions are known to be nematicidal or nematistatic, but at present the role of the compounds in controlling nematodes when marigolds are grown in the field is not understood.

Suggestions for Use of Marigolds to Control Nematodes in the Home Garden

Although there are a few reports of marigolds reducing nematode damage when interplanted with susceptible crops, most investigators have found that nematode damage was not significantly reduced by interplanting (3,5,6,9). In fact, in many cases the marigolds may act as weeds and by competition reduce the growth of the crop plant. For the most effective nematode control marigolds should be rotated with susceptible crops. Marigolds should be seeded to obtain a high plant population, then grown for a full season, and at the end of the season they may be incorporated into the soil as a green manure and thereby increase soil organic matter (8). Weed control should be practiced, since many nematodes may reproduce on weeds. As previously discussed the cultivars of marigold selected is important. Generally, cultivars of French marigolds (T. patula) have been more effective than cultivars of T. erecta and T. minuta. 'Golden Harmony' and 'Tangerine' are cultivars of T. patula that have been reported to suppress populations of most species of root-knot and lesion nematodes that commonly occur in the home garden. Although marigolds will not eradicate nematodes, the number of many species of plant parasitic nematodes should be greatly reduced in the soil when marigolds are grown for a full season. This should reduce the risk of severe damage when a crop which is susceptible to nematodes is planted in the same area the following season.

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