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Summary

Mycorrhizas can produce negative crop responses when phosphorus availability is sufficient in agricultural soils because fungi are of no benefit in nutrient acquisition yet continue to colonize roots and invoke parasitic costs. Benomyl fungicide was used to test this prediction in the field by limiting mycorrhizal colonization of 2-yr-old Valencia orange trees (*Citrus sinensis* (L.) Osbeck) on four rootstocks of varying mycorrhizal dependency in P-deficient soil fertilized with and without phosphate. No known fungal pathogens of citrus controlled by benomyl were present on the trees or in the field soil. Young trees with and without P fertilization and benomyl treatment remained sufficient in P („ 0.10% leaf P) throughout the 27-month study. Root zone drenches of benomyl reduced mycorrhizal colonization and leaf P status of Valencia orange trees on the three slower-growing rootstocks, trifoliate orange (*Poncirus trifoliata* (L.) Raf.), Swingle citrumelo (*Citrus paradisi Macf. x P. trifoliata*) and sour orange (*Citrus aurantium* L.), for the duration of three growing seasons. Benomyl affected root colonization and P status of trees on the faster-growing rootstock, Volkamer lemon (*Citrus volkameriana* Tan. and Pasq.), less than for trees on the slower-growing rootstocks and the effects were sustained for only two seasons. The shorter duration of benomyl effect for trees on Volkamer lemon rootstock compared with the slower-growing rootstocks was explained by the loss of inhibition of mycorrhizal activity when roots grew out of the drench zone and mycorrhizas were no longer in direct contact with the fungicide. Benomyl treatment increased growth rate of Valencia orange on the slow-growing rootstocks from 5 to 17% after three seasons, and from 2 to 9% on Volkamer lemon rootstock after two seasons compared with the non-benomyl treated trees. The benomyl effects was attributed to reduction of costs of root colonization over time, and consequently, a greater availability of carbon assimilate for shoot growth of trees. Since mycorrhizal fungi are ubiquitous in fertilized agricultural soils and obligate biotrophs on the roots of most crop species, these results indicate a need to further investigate whether negative growth responses of P-sufficient plants in the field occur because mycorrhizal fungi are no longer behaving as mutualist.