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Effectiveness of Living Ground Covers for Managing Spread of Geminiviruses in Tomato by *Bemisia tabaci* in Costa Rica

Staked tomatoes in Costa Rica are grown mainly on small plots (<0.5 ha) and often severely affected by the Tomato Yellow Mottle Virus (ToYMoV), vectored by *Bemisia tabaci* biotype C. The impact of the disease on crop yield depends on plant age at time of infection, and is greatest during the first eight weeks after germination. Therefore, management should focus on minimizing contact between the vector and the tomato plant during this period. Consequently, a two-phase preventative management scheme has been proposed: (1) protection of seedbeds with fine netting (Tildenet IN50, Tildenet Ltd., Arkansas) to produce high-quality, virus-free seedlings, and (2) masking the crop after transplanting from immigrating viruliferous whiteflies with living ground covers. This second phase is presently under investigation. Living ground covers are locally available, economical to establish and could provide resource-poor tomato growers with extra income through sale of seed, forage, or other products, organic matter to enrich the soil, and refugia for beneficial insects.

Three field experiments were recently conducted, one in Turrialba (Caribbean watershed) and two in Grecia (Pacific watershed), Costa Rica. Each experiment was actually a replicate of a single experiment to be replicated four times. A total of about 2400 m^2 in each location was divided into six, 400 m^2 plots randomly assigned to six ground cover treatments: *Arachis pintoi* (perennial peanuts) (Leguminosae), "cinquillo" (*Drymaria cordata*, Caryophyllaceae), coriander (*Coriandrum sativum*, Umbelliferae), silver plastic, bare ground treated with imidacloprid (commercial standard), and bare ground untreated (absolute control). Living covers were established well before tomatoes were transplanted. Silver plastic (silver/black, coextruded, 56" x 1.25 Mls; Olefinas S.A., Guatemala) was put in place over the 30 cm-wide bed two weeks before transplanting. Imidacloprid (Confidor 70 WG; Bayer) was applied to the foliage at the recommended rate (9 g/ 40 m^2 of seedbed surface) a week before transplanting, and two drench applications (250 g/ha) two and four weeks later. No other insecticides were used in any plot during the rest of the season.

So far, silver plastic has been the best treatment in terms of reduction of incoming whitefly adults, delay of ToYMoV dissemination, reduction of disease severity, and highest tomato yields. It was followed by living covers, but their degree of effectiveness varied with each experiment. For Guayabo, area under the disease progress curve (AUDPC) was calculated for disease incidence at 2594 (silver plastic), 2027-2864 (living covers), imidacloprid (3290), and 4149 (bare soil), and for disease severity at 951, 791-1087, 1611, and 2402, respectively. Yields were 46, 25-40, 25 and 5 t/ha, respectively. For Grecia (I), corresponding AUDPC values were 511, 553-2845, 2002, and 5197 for disease incidence, and 260, 294-1624, 1170 and 3378 for disease severity. Yields were 28, 12-16, 11 and 10 t/ha, respectively. Vector pressure was highest during the second experiment at Grecia where the experimental plot was very close to a 2.5-ha commercial field heavily infected by the ToYMoV. There values for both disease incidence and severity were large for all treatments (1323-3899 and 512-2651, respectively) and yields were poor (1-13 t/ha).

Thus, both living and inert covers provided effective control of whitefly colonization and ToYMoV spread under moderate whitefly pressure, but control broke down under extremely high pressure. This result underlies the need to supplement both preventative and curative management tactics applied by the individual grower with area-wide preventative approaches, such as planting dates and crop-free periods, in order to successfully manage whitefly-vectored geminiviruses in Costa Rica.