Effectiveness of Mulching Plastic Film to Control Corky Rot and Some Viruses of Tomato

F. Lops, A. Carlucci and I. Camele
Dipartimento di Scienze Agro-ambientale, Chimica e Difesa Vegetale (DiSACD)
Università degli Studi di Foggia
Via Napoli, 25, 71100 Foggia
Italy

M.L. Raimondo and S. Frisullo[a]
Dipartimento di Biologia, Difesa e Biotecnologie Agro-forestali
Università degli Studi della Basilicata
c/da Macchia Romana, 85100 Potenza
Italy

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Abstract

We report the results obtained from an experimentation in open field to control both corky rot and some viruses of tomato by use of different mulching films. Experiments were carried out in agricultural areas of Cerignola (FG) using seven plastic films for mulching soil of 'Talent' tomato plants. The plastic films compared were the following: black film, black biodegradable film, silver film, fumé film, green FSL film, green translucent film and reflecting with black layer film. During the vegetative cycle, the tomato plants received the ordinary agricultural cure. Visual surveys were carried out weekly in order to evidence plant tissues alterations. Foliar samples from each treatment were taken and subjected to analyses to ascertain viruses presence (CMV, TSWV, PZSV, EMDV and TYLCV). At the end of the agricultural cycle, all plants were pulled out, and in laboratory their roots subjected to visual and mycological analyses. Yield of tomato plants differently mulched was considered such as quality indicator. Results obtained from molecular analyses showed occurring TSWV and CMV infections on 30% plants mulched with green translucent film. While, TSWV infections were observed with percentages of plants from 20 to 15% from parcels mulched with white biodegradable film, Fumè film, green FSL film, black biodegradable film and black film. Rare plants (lower 1%) infected by PZSW or EMDV were observed. *Pyrenochaeta lycopersici* was the fungal species more frequently isolated from roots showing necrotic symptoms and corky rot. Statistical analyses allowed to evidence significantly that silver and reflecting with black layer films are more efficacious than other mulching films used to control corky rot while, black, black biodegradable, fumé, green FSL and green translucent films resulted more efficacious to repel vector of TSWV and CMV.

INTRODUCTION

Generally, to mulch the soil during cultivation is a relevant practice in agriculture in order to improve the yield and to reduce agronomic operations. The first mulching was used to limit the weed growth in cultivations by natural origin materials (as straw, wood chips, peat, etc.) and artificial origin (as gravel, expanded clay, paper, cloth, plastic films, etc.) (Petti, 2004). Their effectiveness induced to the formulation and the experimentation of new materials able to control weed growth, to reduce the forming of crusts and the compaction of soil, as well as reducing the evaporation and the loss of nutrients by leaching (Schut, 2001; Sportelli, 2004; Pasotti and Bolognesi, 2004). In the last years, plastic photoselective films are available. They are able to mulch the soil and to offer a valid contribution to integrated management (Momol et al., 2003, 2004; Myron et al., 2004).

In this paper the results are reported obtained in a trial carried out to evaluate the effectiveness seven plastic films, as black film, black biodegradable film, silver film, fumé film, green FSL film, green translucent film and reflecting with black layer film in

[a] s.frisullo@unifg.it

order to control viral diseases (by reflecting effect of the mulching plastic film on viruses vectors) and fungal root diseases (*Pyrenochaeta lycopersici*) of tomato in Foggia pedoclimatic conditions.

MATERIAL AND METHODS

The experiments were carried out in open field in Foggia province in 2008 and 2009. A randomized blocks scheme with three replicates was chosen. Each replicate included eight parcels, seven of which covered with films, (black film, white biodegradable film, black biodegradable film, silver film, Fumé film, green FSL film, green translucent film - Verlene), and one without film. Tomato plants of the cultivar 'Talent' were transplanted in each parcel consisting in three double lines (0,40/0,40/ 1,20 m) of 25 m length. Tomato plants received ordinary agronomic treatments during cultural cycles. Viral infections (CMV, TSWV, PZSV, EMDV and TYLCV) were diagnosed at 45 and 75 days after transplanting, by DAS-ELISA and/or immune electron microscopy. Observations on fungal infections on roots were performed at the end of each cultural cycle by using an empiric evaluation scale including five severity classes (from 0=no symptoms to 4=symptoms on more 80% root surface) applied to brown streaking and cortical suberification of tomato roots. The data obtained were statistically elaborated by variance analysis (ANOVA) and the means were compared with Tukey-Kramer HSD test.

All root samples were subjected to isolation analysis according to Fisher et al. (1992). The fungal species were morphologically characterized and indentified.

RESULTS

The results obtained from viral analyses are reported in Table 1 and indicate TSWV and CMV (no necrotic strain) infections were observed on 30% of tomato plants grown on soil mulched with green translucent film (Verlene). TSWV infections were observed on percentage of plants from 20 to 15% from parcels mulched with white biodegradable film, Fumè film, Green FSL film, black biodegradable film and black film. CMV infections interested a lower percentage of plants from parcel mulched with white biodegradable film (9%) and green FSL film (7%). The percentage of plants showing TSWV and CMV symptoms was higher than 45 and 12% respectively, when they were from not mulched parcels (control), while, no TSWV and CMV infections were observed on plants from parcel mulched with silver film. Rare plants (lower 1%) infected by PZSW and EMDV were observed in one parcel control.

From isolation analyses carried out on roots of plants from all parcels mulched and not mulched, fungal species more frequently isolated were *P. lycopersici*, *Fusarium solani*, *Fusarium oxysporum*, *Rhizoctonia solani*, *Macrophomina phaseolina*, *Alternaria* spp.

Particularly, corky rot symptoms, caused by *P. lycopersici*, were observed on roots of tomato plants from white biodegradable film, green translucent film (Verlene), Fumè film, green FSL film, black biodegradable film and black film, with disease severity indices variable from 3,57 to 1,6. Disease severity index was reduced on plants from parcel mulched with silver film and from parcel not mulched (control) of 1,07 and 1,05 respectively.

DISCUSSION AND CONCLUSION

On the based of results obtained during open field experiments, it is possible to hypothesize that silver film has been more efficacious to control viral infections, as it is a mulching film able to repel insects vector of TSWV and CMV.

Tomato plants, grown on soil mulched with all films except silver film, resulted affected by corky rot (*P. lycopersici*), although those grown on soil with black film showed a lower disease severity index than registered with others films.

Ineffectiveness of all mulching films to control corky rot is probably due to high temperatures reached under mulching. Indeed, the high temperatures (as shown in Table 1)

into soil can inactive and/or kill the both pathogenetic and antagonistic mycoflora which are, generally, sensible to temperatures higher than 30°C. In these conditions, as it is known *P. lycopersi* is a very thermo-tolerant pathogen, it could more abundantly grow and easily infect tomato plant roots.

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Tables

Table 1. Effectiveness of six mulching films to control of Corky rot and TSWV and CMV.

Parcel treated with mulching film	Corky rot		% Plants with viral symptoms	
	Disease severity index	Temperature reached under mulching film (°C)	TSWV	CMV
White biodegradable film	3,57 E	40,7	20	9
Green translucent film (Verlene)	3,23 E	41	30	30
Fumè film	2,93 DE	40	20	Absent
Green FSL film	2,69 CD	39	15	7
Black biodegradable film	2,59 C	39,3	22	Absent
Black film	1,6 B	38	15	Absent
Silver film	1,07 A	33,3	Absent	Absent
Control not mulched	1,07 A	33	45	27