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Analysis of the degradation of biodegradable mulches in a pepper crop under organic management

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The use of biodegradable mulch materials (biopolymers and papers) as an alternative to polyethylene is increasing nowadays, particularly in organic farming, due to environmental factors. It is necessary to test their functionality under field conditions by identifying, for example, the undesirable early degradation which commonly takes place in some of these biodegradable materials. In this sense, it is quite common and easy to apply the use of visual scales to estimate the level of deterioration of mulches, which can be subjective. Therefore, the objectives of this work are: i) To study the degradation of different mulch materials under field conditions by measuring the soil surface they covered. ii) To compare these soil surface values with the overall assessment of their functionality obtained by visual scales.

The trial was performed in an organically grown pepper crop in Ciudad Real (Central Spain) in the 2014 spring-summer season. The mulch materials used were: 1) black polyethylene (15 μm); black biopolymers (15 μm): 2) Mater-Bi® (corn starch based), 3) Sphere 4® (potato starch based), 4) Sphere 6® (potato starch based), 5) Bioflex® (polylactic acid based), 6) Ecovio® (polylactic acid based), 7) Mimgreen® (black paper, 85 g/m2). A randomized complete block design with four replications was adopted. The crop was drip irrigated following the water demand of each treatment.

To assess the evolution of the soil surface covered by the mulches, a total of 560 photographs of the superficial (exposed) part and 196 photographs of the buried part of the materials (1415x2831 pixels, 28 pixels/cm) were analyzed by using Adobe Photoshop CS at 15, 30, 45, 60, 90,120, 145 days after transplanting. Additionally, four experts evaluated the functionality of these materials based on the photographs according to a scale from 1 (completely deteriorated material) to 9 (intact material).

The results show: i) The superficial part corresponding to the polyethylene and the Mimgreen® paper remained practically intact or with little damaged until the end of the crop season, while biopolymers suffered further deterioration, especially Bioflex®. ii) The buried part of the Mimgreen® paper underwent a rapid and complete degradation, while biopolymers presented a variable behavior, from practically intact, similar to polyethylene (Ecovio®), to an important decrease of the soil covered (Mater-Bi® and Sphere 4®). iii) A visual understatement of the functionality of the material (subjective scales) was observed when compared with the numerical value of the percentage of the soil covered by the mulch.

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