Effect of different colours of polyethylene mulch and sticky paper traps on disease incidence and yield of bell pepper under protected cultivation

RS Spehia, Sumitra Phurailatpam, Shweta Sharma, Meera Devi, Ajender Negi, Sukhpreet Singh And JC Sharma

Abstract
Aphid and aphid borne virus diseases cause extensive losses to many horticultural and agricultural crops. A study was conducted to evaluate the efficacy of different colours of polyethylene mulch and coloured sticky paper traps in combination with insecticide imidacloprid (0.25ml/l) for the management of aphid and aphid borne virus disease (Bellpepper Mosaic Virus) and its effect on bellpepper yield. The studies revealed that use of reflective mulch in combination with insecticide and yellow trap resulted in minimum mean aphid population 2.33 per leaf/plant, lower disease incidence (3%) of bellpepper mosaic virus with maximum fruit yield (5.5kg/plant) whereas highest aphid population 20.11 per leaf/plant with maximum disease incidence (15%) and minimum fruit yield (1.5 kg/plant) were recorded in control. Results from the present study suggests that combination of insecticide imidacloprid (0.25ml/l) with reflective mulch can suppress aphid population thereby reducing the disease incidence of bellpepper mosaic virus as well as help in increasing fruit yield of bellpepper.

Keywords: Aphid, Bellpepper Mosaic Virus, fruit yield, reflective mulch, insecticide

Introduction
Capsicum (Capsicum annuum var. frutescens) which is also known as sweet pepper, bell pepper or green pepper is one of the most popular and highly remunerative vegetable crops grown throughout the world. It differs from hot chilli in size, fruit shape, capsacin content and usage. About 35 species of insect and mite pests reported in capsicum, a few viz., thrips, aphids, whitefly, fruit borers and mite causing severe problems. In addition to injuries from direct feeding, problems from this pest are intensified because it vectors over 100 plant viruses (Jones, 2003) [11]. Several studies demonstrated are reduction in infestation by insect pests and incidence of insect-vectored viral infection in vegetable crops by the use of reflective mulch (Kousik et al., 2008) [13]. The primary targeted insects in reflective mulch studies have been virus vectors such as aphids, thrips and whiteflies. Silver or gray reflective mulches have been used successfully to delay and reduce the incidence of aphid borne virus diseases in squash and other crops (Brown et al., 1993 [5]; Stapleton and Summers, 1997; Stapleton et al., 1994; Summers and Stapleton, 1998, 1999 [16]; Summers et al., 1995 [17]; Webb and Linda, 1992). These mulches reflect short-wave light which repels incoming alate aphids, thus reducing their incidence of alighting on plants (Kring, 1969) [12]. Brown et al. (1993) [5] and Summers et al. (1995) [5] found silver (aluminum) plastic mulch superior to white in repelling aphids. Plants grown over reflective mulch produced significantly higher yields of marketable fruit than did those grown on bare soil (Brown et al., 1993 [5]; Summers et al., 1995) [15]. Additional advantages of mulches include soil moisture and temperature modifications which may result in increased crop earliness, growth, and yield, providing greater benefit and cost effectiveness to the grower (Stapleton et al., 1993) [15]. Halima and Hamouda (1994) [19] reported that aphids are the major pests of capsicum. Lately, white fly has also emerged as the major pest in the protected conditions causing huge losses to the farmers. Imidacloprid is widely recommended for the control of white fly and aphids inside polyhouses. Imidacloprid is a systemic insecticide which acts as an insect neurotoxin and belongs to a class of chemicals called the neonicotinoids which act on the central nervous system of insects, with much lower toxicity to mammals. The chemical works by interfering with the transmission of stimuli in the insect nervous system. Specifically, it causes a blockage of the nicotinergic neuronal pathway. By blocking nicotinic acetylcholine receptors, imidacloprid prevents acetylcholine from transmitting impulses between nerves, resulting in the insect's paralysis and eventual death. It is effective on contact and via stomach action (Anonymous, 2012) [13]. Because imidacloprid binds much more strongly to insect neuron receptors than to mammal neuron receptors,
this insecticide is more toxic to insects than to mammals (Anonymous, 2005) [2].

As of 1999, Imidacloprid was the most widely used insecticide in the world (Anonymous, 2010) [3]. Although it is now off patent, the primary manufacturer of this chemical is Bayer Crop Science (part of Bayer AG). It is sold under many names for many uses; it can be applied by oil injection, tree injection, application to the skin of the plant, broadcast foliar, ground application as a granular or liquid formulation, or as a pesticide-coated seed treatment (Anonymous, 2013 [4]; Brown et al. 1993) [5]. Imidacloprid is widely used for pest control in agriculture. Recent research suggests that widespread agricultural use of imidacloprid and other pesticides may be contributing to honey bee colony collapse disorder, the decline of honey bee colonies in Europe and North America observed since 2006 (Irwin and Ruesink, 1986 [10]; Halima and Hamouda, 1994 [9]; Gervais, et al., 2010) [8].

As a result, several countries have restricted use of imidacloprid and other neonicotinoids (Gervais, et al., 2010) [8]. In January 2013, the European Food Safety Authority stated that neonicotinoids pose an unacceptably high risk to bees, and that the industry-sponsored science upon which regulatory agencies’ claims of safety have relied, may be flawed, or even deceptive (Kring, 1969 [12]; Jones, 2003 [11]). At present, it is feared that the repeated applications and indiscriminate use of different pesticides by the farmers for the control of pests may lead to the development of resistance in whitefly, aphid and mite. In order to impede the development of insecticide resistance and its harm on the beneficial insects (read bee) apart from human health, it is always advisable to use insecticides in rotation as well as in combination with other cultural practices. The objective of this study was to assess the effectiveness of different colours of polyethylene mulch and sticky paper traps for the management of aphid and aphid borne virus in bell pepper under protected cultivation.

**Materials and Methods**

The investigation was conducted in the experimental field of the Precision Farming Development Centre, Department of Soil Science and Water management, Dr. Y S Parmar University of Horticulure and Forestry, Nauni Solan during 2013-2015 in a pollyhouse measuring 200m². Capsicum seedlings were transplanted in the month of March during 2013-14 and 2014-15 under pollyhouse with a plot size of 6m² (3 m × 2 m) under Completely Randomized Block design in three replications. Different coloured sticky traps were placed in every plot @ 2 per replication except in two plots and were placed horizontally at a height of 25.0 cm. For mulch treatment black and reflective polyethylene mulch of 25 µ thickness having holes of 60 mm diameter was spread over the prepared plots and capsicum seedlings were transplanted in the holes. Treatments were replicated thrice in a completely randomized design. One spray of insecticides imidacloprid (0.25ml/l) was included in all the treatments. The various treatments included – T1- Reflective mulch + insecticide, T2- Black mulch+ insecticide, T3- Reflective mulch + insecticide+ yellow trap, T4- Reflective mulch + insecticide+ orange trap, T5- Reflective mulch + insecticide+ blue trap, T6- Black mulch + insecticide+ yellow trap, T7- Black mulch + insecticide + orange trap, T8- Black mulch +insecticide+ blue trap, T9 (Control) insecticide + yellow trap. Plants were sampled weekly, beginning at the first true leaf stage, by selecting one young, fully expanded leaf per plant, gently turning it over, and visually counting the number of

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<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. of aphids/leaves/plant</th>
<th>Disease Incidence (%)</th>
<th>Yield (Kg/Plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>5.0</td>
<td>6.0</td>
<td>4.9</td>
</tr>
<tr>
<td>T2</td>
<td>10.0</td>
<td>11.0</td>
<td>2.4</td>
</tr>
<tr>
<td>T3</td>
<td>2.3</td>
<td>3.3</td>
<td>5.5</td>
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<tr>
<td>T4</td>
<td>5.1</td>
<td>4.1</td>
<td>4.6</td>
</tr>
<tr>
<td>T5</td>
<td>4.1</td>
<td>5.1</td>
<td>4.5</td>
</tr>
<tr>
<td>T6</td>
<td>11.0</td>
<td>9.0</td>
<td>3.8</td>
</tr>
<tr>
<td>T7</td>
<td>10.0</td>
<td>11.0</td>
<td>2.5</td>
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<tr>
<td>T8</td>
<td>11.1</td>
<td>13.0</td>
<td>2.4</td>
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<tr>
<td>T9</td>
<td>20.1</td>
<td>21.1</td>
<td>1.5</td>
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<tr>
<td>SE (±)</td>
<td>0.401</td>
<td>0.386</td>
<td>0.200</td>
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<td>CD₅₀,₆₅</td>
<td>1.202</td>
<td>1.157</td>
<td>0.599</td>
</tr>
</tbody>
</table>

Acknowledgements

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References