Effect of Different Mulch Materials on Weed Control in Cucumber (Cucumis sativus L.) Hybrid “Multistar” Under Shade Net Conditions

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ABSTRACT

Research conducted in an greenhouse during late rabi to determine the effect of different mulch materials on weed control in Cucumber seedlings (Cucumis sativus L. F1 hybrid “Multistar”). Among the different mulches i.e Black-black, Black-silver, Black-white, organic mulches like paddy straw, paddy husk, ground nut shells and pre-emergence herbicide (pendimithaline @ 1.0 kg a.i/ha) on weed control study showed significant differences on weed density (5.00 m⁻², 7.33 m⁻² and 6.00 m⁻²) and weed dry weight (2.20 g m⁻², 2.43 g m⁻² and 2.50 g m⁻²) were the lowest with the use of Black-black polythene mulch whereas control recorded the highest weed density (37.00 m⁻², 40.00 m⁻² and 39.00 m⁻²) and weed dry weight (27.93 g m⁻², 28.20 g m⁻² and 27.83 g m⁻²) at 30, 60 and 80 days after sowing respectively. Highest weed control efficiency (92.12%, 91.38% and 91.01%) was registered with Black-black polythene mulch whereas lowest weed control efficiency (55.93%, 56.02% and 56.88%) was registered with paddy straw mulch at 30, 60 and 80 DAs respectively. Weed index (74.83%) was significantly highest in Pre-emergence herbicide (Pendimithaline @ 1.0 kg a.i/ha⁻¹), while lowest (3.65%) Weed index was registered with Black-silver polythene mulch.

Key words: Weed Density, Weed dry weight, Weed control efficiency, Paddy straw mulch, Pendimithaline.

INTRODUCTION

Cucumber (Cucumis sativus L.) is an important summer vegetable in all parts of India. It is a thermophilic and frost-susceptible Horticultural crop usually cultivated in fields during spring-summer period or in greenhouse in different seasons. It is considered as fourth most important vegetable crop after tomato, cabbage and onion in Asia.
It closely resembles the wild form *Cucumis hardwickii*, which is a native of Himalayas and originated in India and belongs to the family cucurbitaceae. Now it is grown all around the world and is thought to be one of the oldest vegetable crops being grown for at least five thousand years. European cucumber (*Cucumis sativus*) hybrid “Multistar” is a seedless type, commercially cultivated in countries like Canada, California, Arizona, and Ohio. In India it is also gaining importance at a quicker pace. It is a product that originated from European greenhouses and is called as English cucumber. In India it is cultivating in an area of 43,280 ha, with a production of 6.78 lakh MT. Like many other vegetable crops, cucumber cultivation has several constraints in cucumber production, of which weeds often pose a serious problem by competing for space, light, water and nutrients, weakening crop stand and reduce harvest efficiency. The losses due to weeds depend upon type of weed flora, their density, agro-climatic conditions, fertility, moisture status, soil type and type of growth of the crop etc.

Though manual weeding is the effective method of weed control, it is cumbersome and uneconomical due to hike in wages and labour scarcity in these days. Mulches are effective alternatives to herbicides, and there are several materials commonly used. Studies have found that mulch treatment is effective for increasing soil moisture and temperature, which hastens earlier fruit maturity. Early germination has also been observed with the application of black polyethylene as well as increased agricultural yields. Non-synthetic “natural” mulches contain fibers or residues from plants or animals and are used as an alternative method which can provide many benefits including weed suppression, soil moisture conservation, improved water filtration, enhanced soil stabilization and porosity, microbial population activity and decreased plant disease. Straw mulch which contributes organic matter to the soil has additional advantages including reduced tillage, reduced soil evaporation and reduction of soil runoff and wind erosion.

**Mulching is a non-chemical weed control crop production technique that involves placement of organic or inorganic materials on the soil surface so as to provide a more favourable environment for plant growth and development. This in turn may affect plant growth and yield.** Moreover, now-a-days most of the farmers showing interest to grow the cucumber under protected conditions to improve the yield, quality and for year round supply. Hence the present study is designed with the following objective to study the effects of different mulch materials for controlling weeds.

**MATERIAL AND METHODS**

A field experiment was conducted during *rabi*, 2015-16 laid out at the “College Farm”, Sri Konda Laxman Telangana State Horticulture University, Mojerla in naturally ventilated greenhouse condition. The area of the shade net used for experimentation was 525 m² in which 24 beds of 15 m length and a width of 1 m each were prepared. The experiment was laid out in Randomized Block Design replicated thrice with eight treatments consisting Black-black polythene mulch-T₁, Black-silver polythene mulch-T₂, Black-white polythene mulch-T₃, Paddy husk-T₄, Paddy straw mulch-T₅, Ground nut shells-T₆, Pre-emergence herbicide (Pendimithaline @ 1.0 kg a.i/ha)-T₇ and Control-T₈ which replicated thrice.

Black polythene, silver and white, polythene mulch was spread over on raised beds on which the seedlings holes of 4–5 cm diameter were made with recommended spacing 50 × 50 cm and 3–5 cm of moist soil was put at the base of stem of transplanted seedling to conserve moisture. The organic mulches like paddy straw, paddy husk, ground nut shells mulch of 5 cm thickness was created manually by spreading straw as carpet on raised beds on respective treatments at 5 days after planting. Mulch material was kept in the respective beds until the final harvest of cucumber.

All practical management included: mulching weeding and other agronomic treatments were
Weed density (number)
In each experimental plot, two quadrates of 1 x 1 m were selected in the middle of plot and the weeds from each quadrate were counted. The weed density was expressed as number per square meter.

Weed dry matter (g m⁻²)
Weed samples were taken from the sampling area and dried in shade for 2 days, followed by sun drying for three days. After sun drying, the samples were kept in oven at 70°C till they recorded the constant weight and dry weight of weeds was recorded for each treatment and expressed in g m⁻².

Weed Control Efficiency (%) The weed control efficiency (WCE) was calculated by the following formula suggested by Patil and Patil¹⁶ and expressed in percentage.

\[
WCE = \frac{DMC - DMT}{DMC} \times 100
\]

Where, DMC= Dry Matter of weed in control plot
DMT= Dry Matter of weed in treatment plot
WCE=Weed Control Efficiency

Weed control index (%)
The weed index (WI) defined as the reduction in yield due to the presence of weeds in comparison with no weed plot was worked out

\[
WI = \frac{X - Y}{X} \times 100
\]

Where, X = yield from minimum weed competition plot
Y = yield from the treated plot
WI= Weed index.

RESULTS AND DISCUSSION
Weed density (m⁻²)
The results on weed density (Table 1) revealed that Black-black polythene mulch (T₁) has recorded significantly lowest weed density at 30 DAS (5.00 m⁻²), 60 DAS (7.33 m⁻²) and 80 DAS (6.00 m⁻²) which was on par with Black-silver polythene mulch -T₂ at 30 DAS (5.67 m⁻²), 60 DAS (8.67 m⁻²) and 80 DAS (8.33 m⁻²). However, unweeded control (T₈) has recorded highest weed density of 37.00 m⁻², 40.00 m⁻² and 39.00 at 30, 60 and 80 DAS respectively. As black polythene mulch act as physical barrier and prevents light to enter the soil, which is required for germination and nourishment of weed seeds, the weed density was found minimum. The higher weeds density in weedy check plots may be attributed to the open soil surface and niches available to weeds for free and aggressive growth. These results are in line with the earlier workers, Ngouajo et al.¹⁴ who reported complete elimination of weeds with the use of black polythene mulch and Schonbeck¹⁸ reported black plastic mulch blocked the weeds, except a few, which emerged through the planting holes.

Weed dry matter (g m⁻²)
Black-black polythene mulch (T₁) has recorded significantly lowest weed dry matter
control as minimum weed dry matter was observed. The results are in agree with the findings of Aniekwe and Nwite\(^5\) in cucumber who reported that Black polythene mulch was effective totally in suppressing weed growth. Similar results are also reported by Sha and Karuppaiah\(^{19}\) in brinjal, Vijay \textit{et al.}\(^{25}\) and Rajablariani \textit{et al.}\(^{17}\) in tomato, Ashrafuzzaman \textit{et al.}\(^5\) in chilli while Choudhary \textit{et al.}\(^8\) in capsicum.

### Table 1: Effect of different mulch materials on weed density (number m\(^{-2}\)) and Weed dry matter (g m\(^{-2}\)) at different growth stages in cucumber hybrid “Multistar”

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Weed Density (number m(^{-2}))</th>
<th>Weed Dry matter (g m(^{-2}))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 DAS</td>
<td>60 DAS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T(_1)</td>
<td>5.00</td>
<td>7.33</td>
</tr>
<tr>
<td>T(_2)</td>
<td>5.67</td>
<td>8.67</td>
</tr>
<tr>
<td>T(_3)</td>
<td>7.00</td>
<td>9.00</td>
</tr>
<tr>
<td>T(_4)</td>
<td>17.33</td>
<td>19.67</td>
</tr>
<tr>
<td>T(_5)</td>
<td>20.67</td>
<td>22.33</td>
</tr>
<tr>
<td>T(_6)</td>
<td>18.33</td>
<td>19.33</td>
</tr>
<tr>
<td>T(_7)</td>
<td>13.00</td>
<td>13.67</td>
</tr>
<tr>
<td>T(_8)</td>
<td>37.00</td>
<td>40.00</td>
</tr>
<tr>
<td>SE (m)(^2)</td>
<td>1.05</td>
<td>0.98</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>3.17</td>
<td>2.97</td>
</tr>
</tbody>
</table>

**Weed Control Efficiency (WCE) (%)**
Weed control efficiency (WCE) was calculated on the basis of weed dry matter recorded at 30, 60 and 80 DAS in comparison to unweeded control and presented in the Table 2.

The results on weed control efficiency indicated that highest weed control efficiency was observed at 30 DAS (92.12%), 60 DAS (91.38%) and 80 DAS (91.01%) in Black-black polythene mulch (T\(_1\)) which was followed by Black-silver polythene mulch (T\(_2\)) which has recorded 88.79%, 88.40% and 89.22% of weed control efficiency at 30, 60 and 80 DAS respectively. Among the organic mulches Ground nut shells (T\(_6\)) has recorded lowest weed control efficiency of 60.97%, 58.40% and 58.67% at 30, 60 and 80 DAS respectively. While under control T\(_8\)-Control zero WCE were recorded.

Lesser weed germination and weed infestation by restricting the penetration of solar radiation under black polythene mulch resulted in higher weed control efficiency. Similar results were reported by Aniekwe and Nwite\(^4\) in cucumber, Hartmann \textit{et al.}\(^1\) in tomato and Choudhary \textit{et al.}\(^8\) in capsicum.

**Weed Index (WI) %**
The weed index was zero percent (Table 2) in T\(_1\)-Black-black polythene mulch followed by T\(_2\)-Black-silver polythene mulch (3.65 %) and T\(_3\)-Black-white polythene (11.45 %). The significantly highest (74.83 %) weed index was recorded in T\(_7\)-Pre-emergence herbicide (Pendimethalin @ 1.0 kg a.i/ha\(^3\)) followed by control T\(_9\)-Control (49.68 %) respectively. Among the organic mulch treatments T\(_6\)-Ground nut shells showed lowest weed index (34.07 %) followed by T\(_7\)-Paddy straw and T\(_8\)-Paddy husk (36.14% and 37.12%) respectively.

The lowest weed index observed in the treatments T\(_1\)-Black-black polythene mulch and T\(_2\)-Black-silver polythene mulch might be...
due to suppression of all types of weeds at critical periods. Similar results were reported by Aniekwe and Nwite in cucumber, Sha and Karuppaiah in brinjal and Choudhary et al. in capsicum.

Table 2: Effect of different mulch materials on Weed control efficiency (WCE) and Weed Index (WI) at different growth stages in cucumber hybrid “Multistar”

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Weed Control Efficiency (%)</th>
<th>Weed Index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 DAS</td>
<td>60 DAS</td>
</tr>
<tr>
<td>T1</td>
<td>92.12</td>
<td>91.38</td>
</tr>
<tr>
<td>T2</td>
<td>88.79</td>
<td>88.40</td>
</tr>
<tr>
<td>T3</td>
<td>88.43</td>
<td>88.19</td>
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<tr>
<td>T4</td>
<td>59.43</td>
<td>58.26</td>
</tr>
<tr>
<td>T5</td>
<td>55.96</td>
<td>56.02</td>
</tr>
<tr>
<td>T6</td>
<td>60.97</td>
<td>58.40</td>
</tr>
<tr>
<td>T7</td>
<td>68.85</td>
<td>62.41</td>
</tr>
<tr>
<td>T8</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>SE (m)±</td>
<td>1.44</td>
<td>1.30</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>4.36</td>
<td>3.94</td>
</tr>
</tbody>
</table>

CONCLUSION
From the present investigation it can be concluded that use of Black-black polythene mulch resulted in minimum weed density, weed dry matter and maximum weed control efficiency and with minimum weed index followed by Black-silver polythene mulch and ground nut shells.

REFERENCES