EFFECT OF SOME SOIL MULCHING SYSTEMS ON WEED CONTROL AND PRODUCTION OF STRAWBERRY IN NEW EL SALHIA REGION

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ABSTRACT

On weed infestation area in New El Salhia, six soil mulching systems, were investigated to estimate the ability of mulch types to combat weed infestation. The bare soil and corn stalks showed a weed infestation which increased and appeared in few weeks later after cultivation, compared with other others covering systems. While a significant reduction in weed infestation with black and white sheets treatments was occurred. In the 1st period on 2nd of October, no remarkable weeds infestation was appeared, it was 43.10 g/m² in all treatments. On 2nd of November, a remarkable existence of the weeds was found, it was 210 g/m² for bare soil, while it was 19 g/m² for black sheet treatment. Through the last period on 2nd of December, the weed infestation was clearly found, the bare soil, corn stalks and rice straw were represented the higher values as compared with the other treatments, the conventional treatment of bare soil was represented by 310 g/m². The highest yield was in the treatment of black sheet due to the lowest infestation of weeds by 40 Mg/ha, compared with the white sheet and transparent sheet treatments which were 25 and 22 Mg/ha, respectively. Comparing the water use efficiency under the investigated treatments it can be observed that treatment of black sheet was the one where water use efficiency was the highest being with an average value nearly 11.17 kg/m³. Plastic mulches are now an indispensable part of the modern vegetable production system, specially that the black sheets, than natural covering such as corn stalks and rice straw:

INTRODUCTION

Strawberry is one of the most popular vegetable crops in Egypt, it occupies an important attitude among the untraditional vegetable crops due to its varied use as local fresh consuming, food processing and exportation. The crops is ordinarily grown in sandy soils

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for getting early yield and good fruit fineness. Mulching is a popular agronomic pursuit in agriculture and it has many merits which include: to prevent loss of soil moisture, to control weeds by tent them and diseases by preventing soil contact with the plant foliage, to control soil temperature, either by keeping it cool or keeping it warm, to add to soil richness and increase soil organic matter content when organic mulch is used and retro gradation takes place. Some mulch materials such as the reflective mulches are efficient in hold off insects (AVRDC, 1990). The influence of organic mulches on crop yield is incommensurate. Mulching improves plant growth, yield and yield quality (Sharma & Sharma, 2003; Singh et al., 2007). Some mulches (straw, peat, sawdust) may negatively affect crops by drying up soil nitrogen due to a wide C:N ratio (Johnson et al., 2004; Sønstebly et al., 2004). Mulch progresses soil conditions, especially reduces water evaporation from soil and helps to maintain steady soil temperature (Ji and Unger, 2001; Kar and Kumar, 2007). There are three major colors of plastic mulch used in merchant vegetable production: black, clear and white mulches. White mulch can cause a a little lower soil temperature in comparison with bare soil because the mulch suck less radiant energy and it reflects back into the plant shade most of the incoming solar radiation (Ham et al., 1993 and Lamont, 2005). The black mulch is being the predominant color used for vegetables (Gordon et al., 2010; Hochmuth et al., 2012). In relation to the effect of mulching types on the cucumber yield, the results showed that the cucumber yield values were 5.57, 9.34, 11.65,12.52 and 12.77 Mg/ha. under soil bare, straw, black, yellow and transparent respectively. With plastic mulch, the high soil temperature in the planting bed will enhance faster crop growing and early yield (El- Shaikh et al., 2008). The present investigation was carried out to study the effect of different mulching material on soil temperature, growth, and yield of strawberry and weed control.

**MATERIALS AND METHODS**

Field experiments were carried out during the autumn season of 2016 at a private farm in New El Salhia (Long 32° 05’ 29’’ – Lat 30° 48’ 18’’). The soil of the experimental plots was classified as sandy loam (63.49% sand, 29.07 % silt and 7.44 % clay). Particle size distribution of soil was determined according to (Klute 1986). Experiments were performed in an
infested site by annual weeds such as *Eleusine indica* and *Cynodondactylon*.
The variety "Florida" of strawberry was used in this experiment. The irrigation system was applied using drip irrigation with a discharge rate of 4 lit/h. and volume of applied water was 3578 m$^3$/ha . The local climate is like semiarid/Mediterranean with mild winters and hot, rainless summers. The mean monthly temperatures are 30 °C (October), 24 °C (November) and 18 °C (December).

Six treatments were tested in this work as follow : back sheet, white sheet, transparent sheet, rice straw, corn stalks and bare soil. The experiments were designed in a randomized complete blocks with three replicates to evaluate the different mulching types.

Weed dry biomass was estimated by sampling the aerial part of the plants at three random square sampling areas in each plot. Squares had dimensions of 50 cm. The dry weed mass were weighed and samples were oven dried at 220 °C for 48 h. The samples were taken three times during the season, after 7, 30 and 60 days of transplanting. The plot size was 3m by 15 m. During autumn, plots were 6 m wide and 6 m long with four double row beds with 150 cm apart with 35 cm inter-row spacing and 33cm plants spacing to give a density of 15.8 plants/m$^2$. plots were covered with 5 types of covering, black, white and transparent plastic sheets (30 micron thick). Corn stalks and rice straw(15 cm thick) from October 2, to December 2, 2016.

Seedlings were transplanted by making holes of 5 cm diameter on the plastic sheet, corn stalks, rice straw and bare soil.

**Soil temperature measurement**
Soil temperature was taken during the experiment with the help of digital soil thermometer. Soil temperature was taken at 5 and 10 cm depth by inserting sensor rod of digital soil thermometer below the soil surface. Observation was recorded to know the effect of different mulches on soil temperature which indirectly affect the crop production. The daily records of soil temperature were taken at 9:00 am and 2:00 pm.

**Water use efficiency:**
The water use efficiency (WUE) was determined as follows:

$$\text{WUE (kg/m}^3\text{)} = \frac{\text{Yield (kg/ha)}}{\text{Volume of applied water (m}^3\text{/ha)}}$$
RESULTS AND DISCUSSION

Effect of mulch types on dry mass of weeds:

There were significant differences in total weed dry mass among the treatments. In general, weed dry mass were significantly higher at bare soil and corn stalks mulch compared to the others treatments. Fig. (1) shows that In the bare soil plots, there was a significant amount of weeds and a new infestation appeared few weeks later and the problem persisted throughout the whole growing period. Despite the significant reduction in weed infestation with corn stalks and rice straw covers, there were also serious weed problems during the period of development of the crop. In the plots of white and transparent sheet plastics, the weeds were generally more than black sheets. In this method, a few of weeds persisted in the field after applying the planting operation. In the 1st period on 2nd of October, no remarkable weeds infestation was happened, dry mass of the weeds was 43.10 g/m² in all treatments, during the 2nd period of the strawberry production on 2nd of November, a remarkable existence of the weeds was found, it was 210 g/m² under treatment of bare soil, while it was 120 g/m² for others treatments.

Fig. (1): Effect of mulch types on dry mass of weeds.

Through the last period of the field operations and before harvesting the weed infestation was clearly found, the conventional treatment of bare
soil was represented the higher value as compared with the other treatments, it was 310 g/m², while the by black sheet was 33 g/m². The other covering treatments were in near value ranged between 181 and 266 g/m². Data collected were similar as clarified by (Giovanni and Antonino, 2005). Organic mulches are not effective in controlling weeds as plastic mulch (Bushnell and Welton, 1993). Black polyethylene mulch most effective in weeds and clear polyethylene mulch has an adverse effect on weed control (Johnson and Fenimore, 2005).

**Effect of mulch types on soil temperature:**

Table (1) shows the soil temperature through October, November and December 2016 into soil depths of 5 and 10 cm. Data collected revealed that, using transparent sheets showed the largest soil temperature for both soil depths through the cultivated season. This was due to the effect of green house effect which led to increase of the soil temperature. On the other hand, using corn stalks for covering showed the lowest soil temperature for both soil depths through the cultivated season as compared with all treatments. This was due to large voids between the corn stalks which facilitate air exchange and decrease heat conservation. In case of bare soil, recorded soil temperatures showed higher records than corn stalks, rice straw and white sheet because of direct expose to sun radiation through all periods as compared with other treatments which they have relative shadow to prevent the sun light to raise the soil temperature. In the black sheet plots, there was a significant amount of soil temperature, which were higher than all treatments except the transparent sheet treatment. Using black sheets appear a relative heat conservation effect because of the black color ability to absorb more heat than other colors, which increase the soil temperature by convection heat transfer effect. In all previous cases, October was the highest month in all recorded temperature as compared with November and December respectively, While the recorded data at period of 14:00 were higher than taken at 9:00 because of the more sun radiation after noon as compared with in morning. From other point, the temperature at 5 and cm soil depths, were noticed to be gradually increased for the 2 depths on the morning, then decreased gradually after noon, that’s may be due to the
heat transfer phenomena through soil voids specially in the fine texture soils.

Table (2): Effect of mulch types on soil temperatures:

<table>
<thead>
<tr>
<th>Period</th>
<th>02-Oct</th>
<th>02-Nov</th>
<th>02-Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At 9:00</td>
<td>At 14:00</td>
<td>At 9:00</td>
</tr>
<tr>
<td>soil depth (cm)</td>
<td>5 10 5 10</td>
<td>5 10 5 10</td>
<td>5 10 5 10</td>
</tr>
<tr>
<td>Trans. sheet</td>
<td>42.0 42.5</td>
<td>47.5 45.5</td>
<td>35.0 35.5</td>
</tr>
<tr>
<td>Black sheet</td>
<td>36.5 37.5</td>
<td>43.5 43.0</td>
<td>29.5 30.5</td>
</tr>
<tr>
<td>bare soil</td>
<td>34.5 35.5</td>
<td>41.5 41.0</td>
<td>27.5 28.5</td>
</tr>
<tr>
<td>White sheet</td>
<td>33.5 34.0</td>
<td>41.0 40.0</td>
<td>26.5 27.0</td>
</tr>
<tr>
<td>Rice straw</td>
<td>32.5 34.0</td>
<td>40.5 40.0</td>
<td>25.5 27.0</td>
</tr>
<tr>
<td>Corn stalks</td>
<td>31.5 33.0</td>
<td>39.0 38.5</td>
<td>24.5 26.0</td>
</tr>
</tbody>
</table>

**Effect of mulch types on crop yield:**
A significant yield increasing was found when a reduction of weed infestation was happened in all treatments except the bare soil (Fig 2). The highest yield was in the treatment of black sheet due to the lowest infestation of weeds by 40 Mg/ha, compared with the white sheet and transparent sheet treatments which were 25 and 22 Mg/ha, respectively. In the treatments of rice straw and corn stalks, 20 and 16 Mg/ha were achieved respectively, because soil cover conditions allowed to appear greater weeds competition with the strawberry, which cause probably factors that led to this yield reduction. In general it can be seen that during harvest the black sheet technique gave the higher yields than all the other treatments. Data represented was in familiar with (Stapleton, 2000).

**Effect of mulch types on water use efficiency:**
Regarding to water use efficiency under the investigated study, Fig (3), showed that through different covering systems that there is a better improvement in the water use efficiency with respect to that recorded on bare soil as conventional practice. Comparing the water use efficiency under the investigated treatments it can be observed that treatment of black sheet was the one where water use efficiency was the highest being with an average value nearly 11.17 kg/m$^3$. These data fully support those obtained by (Samia et al., 2017). The presented data also indicate that the yield production is highly affected by the type of covering systems. This is clearly demonstrated by considering the variations in the yield between
different treatments. This is again confirmed by considering the yield in treatment of bare soil being the lowest hence no cover was included in the soil management.

![Graph showing the effect of mulch types on crop yield.](image)

**Fig. (2): Effect of mulch types on crop yield.**

![Graph showing the effect of mulch types on water use efficiency.](image)

**Fig. (3): Effect of mulch types on water use efficiency.**

**CONCLUSION**

In order to validate some covering systems, experimental results of six treatments were examined to estimate ability of covering systems to combat weed infestation which widely used in New El Salhia region. The bare soil and corn stalks showed a weed infestation which increased and appeared in few weeks later after cultivation, compared with other covering systems. While a significant reduction in weed infestation during black and white sheets treatments was occurred. In the 1st period on 2nd of October, no remarkable weeds infestation was happened, dry
mass of the weeds was 43.10 g/m² in all treatments, on 2nd of November, a remarkable existence of the weeds was found, it was 210 g/m² for bare soil, while it was 80 g/m² for corn stalks and rice straw treatments. Through the last period on 2nd of December, the weed infestation was clearly found, the bare soil, corn stalks and rice straw were represented the higher values as compared with the other treatments, it was 218 g/m², while the conventional treatment of bare soil was represented by more than 310 g/m². The crop yield values under studied treatments were ranged between 13 to 40 Mg/ha under studied treatments. Comparing the water use efficiency under the investigated treatments it can be observed that treatment of black sheet was the one where water use efficiency was the highest being with an average value nearly 11.17 kg/m³. Plastic mulches are now an indispensable part of the modern vegetable production system, specially that the black sheets, than natural covering such as corn stalks and rice straw.

REFERENCES


الملخص العربي
تأثير بعض نظم تغطية للتريلة على كفاءة الحشائش وإنتاج الفراولة
في المنطقة الصالحية الجديدة

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تم استخدام خمسة معاملات مختلفة لتغطية التريلة في ارض موطبة بالحشائش ومنطقة الصالحية الجديدة ومقارنتها بالطريقة التقليدية وهي التريلة بدون تغطية من أصل الوصول إلى أسفل الطرق لتقليل انتشار الحشائش وزيادة إنتاجية المحصول والحصول على أعلى كفاءة في استخدام المياه عند زراعة شتلات الفراولة. وتم استخدام أنواع التغطية التالية: ثلاث أطقم بلاستيكية شفاف وهلاة، واسود أبيض وطريقة عشوائية، وهي قشرة الزيتون وحطب النبات مع المعاملة التقليدية وهي التريلة بدون تغطية وقد أظهرت النتائج الآتي:

لم يكن استخدام عديد الذرة وقش الأرز كافياً لخفض انتشار الحشائش وكذا أيضا المعاملة التقليدية السائدة بالمنطقة وهي بدون تغطية. في حين كان هناك انخفاض كبير في كمية الحشائش عند استخدام معاملات التغطية باللونين الأسود والأبيض. وفي الفترة الأولى (2 أكتوبر 2016) لم تكن هناك اصابة واضحة في اغلب المعاملات باستثناء المعاملة بدون تغطية حيث كانت الكتلة الجافة للحشائش 0.1 جم/م². وفي 2 نوفمبر 2016، كانت كمية الحشائش 0.11 جم/م² للتريلة بدون تغطية، في حين كانت 0.8 جم/م² في معاملات عديد الذرة وقش الأرز. وفي خلال الفترة الأخيرة في 2 ديسمبر 2016، كانت كمية الحشائش كبيرة بشكل واضح في معاملات النترية بدون تغطية، عديد الذرة وقش الأرز والتي مثلت القيم الأعلى بالمقارنة مع المعاملات الأخرى، حيث كانت كمية الحشائش 0.18 جم/م²، في حين كانت المعاملة التقليدية للتريلة بدون تغطية 0.1 جم/م².

وقد ارتفعت درجة حرارة التريلة على اترواق مختلفة مع استخدام الأغطية البلاستيكية مقارنة بالانواع الأخرى وكانت أعلى في درجات الحرارة مع الغطاء الشفاف وليلي الغطاء الأسود واقل قيم مع حطب الذرة مما أثر على نمو الحشائش وبالتالي إنتاج المحصول. كان إنتاج محصول الفراولة عند استخدام التغطية السوداء أكبر من باقي المعاملات حيث وصل إلى 0.5 ميجا جرام / هكتار في حين كانت المعاملة بدون تغطية هي الأقل في الاتجاه حيث اعطت 0.13 ميجا جرام / هكتار.

وقد أدى استخدام الأغطية البلاستيكية إلى اعتماد كفاءة في استخدام مياه الري حيث كانت كفاءة استخدام المياه الأعلى مع الغطاء السوداء 11.7 جم/م² في حين كانت أقل كفاءة مع الثريلة المكتوفة حيث كانت 3.63 جم/م².

وبشكل عام، وجد أن الأغطية البلاستيكية وخاصة السوداء كانت أكثر فاعلية في تقليل انتشار الحشائش أكثر من الأغطية النباتية مثل عديد الذرة وقش الأرز في ظل ظروف منطقة الصالحية الجديدة.

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