Effect of some Soil Preparation Systems on the Amount Water Added and Emergence Percentage for Egyptian Clover

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ABSTRACT

Field experiments were carried out in a clay soil during season of 2020 at Arumon village, Kafr El-Sheikh Governorate. The aim of this work was to achieve effect of some soil preparation systems on the amount of water added with three irrigation conditions (irrigation for agriculture, irrigation for urgency and irrigation after 12 days of previous irrigation) and seeds emergence percentage for Egyptian clover yield so productivity of the first mowing. To fulfill this goal, the following experiments were used; the chisel plow at a depth of 15 cm (one pass) followed by laser land leveling (T₁); the chisel plow at a depth of 15 cm (one pass) followed by traditional land leveling (T₂), and the used land with rice residues left on it without leveling (T₃). The planting was carried out by manual broadcasting (30 kg / fed) on all experiments, and all planting treatments were content under all above variables. The minimum height and amount of water on the breeding surface after irrigation were 51 mm and 214.2 m³/fed, respectively, these results was obtained by using T₁, while for the maximum values were 152 mm and 586.6 m³/fed, respectively, these results were obtained by using T₃. - The maximum seeds emergence percentage, productivity of the first mowing and water use efficiency were 65%, 29.1 Mg/fed and 0.14 Mg/m³, respectively, these results was obtained by using T₁, while for the minimum values were 33%, 16.4 Mg/fed and 0.028 Mg/m³, respectively, these results was obtained by using T₃.

Keywords: tillage systems, Egyptian clover, land leveling, saving irrigation water.

INTRODUCTION

In the past ten years a great deal of efforts had directed to improve farm irrigation in Egyptian fields, especially with the increased horizon of the agriculture and lack of water resources. Clover is one of the major animal feeding crops in Egypt. It is used fresh during winter and spring seasons (from November to May), or conditioned as hay or silage to feed animals in summer. It is also the main source of plant protein resources. Clover is one of the major animal feeding crops in Egypt. Ministry of Agriculture and Land Reclamation, (2012) mentioned that clover cultivated area yearly is about 1.908 million feddan. Rickman (2002) showed that it’s sowing is directly after harvesting rice as zero tillage. Therefore, before sowing seeds, it is necessary to create a suitable seedbed for good seed germination. Thus, a correct seedbed will ensure the adequate moisture, air quantities and soil bed needed by clover plant. Land leveling saves irrigation water, facilitates field operation, and increases yield. Bahnas (2010) found that the minimum tillage at the precision land leveling slope of 0.02% achieved higher beet yield of 28.65 Mg/fed with a sucrose yield of 22.04%, and complemented the higher total dry (14% moisture content d.b.) clover yield of 16.71 Mg /fed, in five mowing (2.12, 3.32, 4.04, 4.36 and 2.87 Mg/fed) respectively. El-Hadad (2000) reported that the precision land leveling by laser improved water use efficiency. It increased from 2.7 to 4.7 kg / m² of water for wheat. El Saharigi et al. (2001) concluded the highest grain productivity (1.5 – 1.95 Mg / fed) was obtained by using straight band sowing by grain drill with straight distributors and laser land leveling and the lowest yield (0.966 Mg / fed) was obtained using manual broadcasting and traditional land leveling. Awad et al. (2004) found that the laser leveling increases field irrigation efficiency by 29.3%, saves water by 19-39%, increases maize yield by 3.67% and consequently increased crop water use efficiency by 18 - 26% compared with traditional leveling. El tanyahu et al. (2006) concluded that the laser leveling was effects on both of the applied water and soybean yield. The highest saving applied water percentage was 29.74% at laser leveling with 0.05% slope. Meanwhile, the highest percentage value of soybean yield was 30.2% at laser leveling with 0.05% slope compared with the traditional leveling. The highest value of water use efficiency was about 1.22 kg/m² at laser leveling with 0.05% slope sown on two sides of the ridge.

Metrally and El-Atawy (2015) found that it is necessary to produce more rice with less water using new planting methods and less submerged head of irrigation water. Results indicate that irrigation water applied in rice fields could be significantly reduced without sacrificing rice yield or without increasing the production cost by using the treatment dₓ L₁ x L₂ (depth of 5cm x Planting in bottom of beds x precision land leveling ). The objective of the present paper is to study the effect of some soil preparation systems for Egyptian clover on water quantity added to soil surface after irrigation, seed emergence percentage, clover forage productivity and water use efficiency.

MATERIALS AND METHODS

The experiments were carried out in clay soil at Arumon, village Kafr El-Sheikh Governorate, during 2020 season.
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**Field layout:** The field layout was 30 x 15 m (450 m²), which was divided into three plots. Each plot has 10 m width and 15 m length.

**Soil properties:** The experiments were carried out in clay soil texture. The mechanical analysis and soil properties are given in Table (1).

**Table 1. The soil mechanical analysis and son properties**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Depth of</th>
<th>Clay</th>
<th>Silt</th>
<th>Sand</th>
<th>MC</th>
<th>Bulk density, g/cm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
<td>49</td>
<td>29</td>
<td>22</td>
<td>21.75</td>
<td></td>
<td>1.35</td>
</tr>
</tbody>
</table>

**Soil preparation systems (sps):** To achieve the goal of search, following treatments were used and tested:
1. Chisel plow at depth 15 cm (one pass) followed by laser land leveling (T₁).
2. Chisel plow at depth 15 cm (one pass) followed by traditional land leveling (T₂).
3. Direct using on soil with rice residues (T₃).

**Sowing method and seed variety:** Sowing was by manual broadcasting in all experiments at seed rate of 30 kg/Fed (seeds mass of 4.16 g for 1000 seeds) of the variety of Meskawy.

**Measurement height and amount of water:** When water is turned into the field and reached the downstream end of field, the heights of water over breeding surface were measured at different places of field. Then, amounts of water added were calculated as follow:

\[ q = \left( \frac{\text{the mean of heights (mm)}}{1000} \right) \times 4200 \text{ (m²)} \]

Where: \( q \) : amount of water, m³/Fed.

**RESULTS AND DISCUSSION**

**Height (H) and amount of water (q) over breeding surface**

Table 2 and Fig. 1 show the mean values heights and amounts of water over breeding surface for different soil preparation systems (sps). The minimum height and amount of water on the breeding surface after irrigation were 51 mm and 214.2 m³/Fed, respectively. These results were obtained by using T₁, while, the maximum height and amount of water on the breeding surface after irrigation was 152 mm and 586.6 m³/Fed, respectively. These results were obtained by using T₃. This may be due that in the case laser land leveling usually improves the uniformity of water application especially in heavy clay soil.

**Table 2. Heights and amounts of water on the breeding surface at the first three irrigations (I) for different soil preparation systems (sps).**

<table>
<thead>
<tr>
<th>s.p.s</th>
<th>H(mm²)</th>
<th>Mean (m)</th>
<th>S.D</th>
<th>(q)m³/Fed</th>
<th>Mean (m³)</th>
<th>S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>52</td>
<td>51</td>
<td>51</td>
<td>214.2</td>
<td>210</td>
<td>218.4</td>
</tr>
<tr>
<td>T₂</td>
<td>120</td>
<td>112.7</td>
<td>6.7</td>
<td>504</td>
<td>466.2</td>
<td>449.4</td>
</tr>
<tr>
<td>T₃</td>
<td>152</td>
<td>139.7</td>
<td>11.2</td>
<td>638.4</td>
<td>575.4</td>
<td>546</td>
</tr>
</tbody>
</table>

**Fig. 1. Effect of soil preparation systems on height "H" (mm) and amount "q" (m³) water added, so S.D in either case.**

**Seeds emergence percentage and productivity of the first mowing**

Fig. 2 shows the emergence percentage and forage productivity from different soil preparation systems. Results showed that the maximum seeds emergence percentage and productivity of the first mowing were 65% and 29.1 Mg/Fed, respectively. These results were obtained by using T₁, while, the minimum seeds emergence percentage and productivity of the first mowing were 33% and 16.4 Mg/Fed, respectively.

**Emergence percentage, % = Seed emergence (N/ m²) / seed rate (N/m²)**

The emergence of clover plant was evaluated by taking 6 samples (1 m²) randomly selected from each plot as the number of clover stalks (N).

**Productivity:** The clover productivity was evaluated by taking 6 samples (1 m²) randomly selected from each plot. The plants were mowed by hand sickle then weighed for the first mowing.

**Productivity (Mg/Fed) = (W × 4200) / 1000**

Where: \( W \) : mass of mowed clover, kg/Fed.

**Water use efficiency (Mg/m³) = productivity (Mg/Fed) / water added (m³/Fed).**

These results were obtained by using T₃. This may be due to the roots of rice left after harvesting obstructing the clover seed growing and increasing seed losses which decrease the numbers of plants emerge in first mowing. The sequence of the different methods according to the germination percent and productivity were found to be in the descending order:

\[(T₁ (65 \%) > T₂ (52 \%) > T₃ (33 \%) )\]

\[(T₁ (29.1 Mg/Fed) > T₂ (24.16 Mg/Fed) > T₃ (16.4 Mg/Fed))\]

**Fig. 2. Effect of soil preparation systems on emergence percentage "E" (%) and productivity "P" (Mg/Fed).**

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Water use efficiency

Water use efficiency is expressed as Mg of forage productivity/m² of water added. Results showed that the maximum water use efficiency was 0.14 Mg/m² was obtained by using T₁, while, the minimum water use efficiency was 0.028 Mg/m² was obtained by using T₃. The sequence of the different methods according to water use efficiency was found to be in the descending order:

(T₁ (0.14 Mg/m²) > T₂ (0.051 Mg/m²) > T₃ (0.028 Mg/m²))

CONCLUSION

- Studies show that tillage and leveling land provide a more uniform elevation of water flow. Therefore, laser land leveling was save water more than others systems.
- Reducing water addition by using chisel plow (one pass) followed by laser land leveling 19.33% and 63.48% comparing with traditional land leveling and unleveled land with rice residues, respectively.
- Studies recommend using chisel plow (one pass) followed by laser land leveling to give highest productivity and increase from water use efficiency.

REFERENCES


