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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 (T_1); the chisel plow at a depth of 15 cm (one pass) followed by traditional land leveling (T_2), and the used land with rice residues left on it without leveling (T_3). 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 m^3/fed, respectively, these results was obtained by using T_1, while for the maximum values were 152 mm and 586.6 m^3/fed, respectively, these results were obtained by using T_3. - The maximum seeds emergence percentage, productivity of the first mowing and water use efficiency were 65%, 29.1 Mg/fed and 0.14 Mg/m^3, respectively, these results was obtained by using T_1, while for the minimum values were 33%, 16.4 Mg/fed and 0.028 Mg/m^3, respectively, these results was obtained by using T_3.

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 for animals 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 / m^3 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 tantawy *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 comparing with the traditional leveling. The highest value of water use efficiency was about 1.22 kg/m^3 at laser leveling with 0.05% slope sown on two sides of the ridge.

Metwally 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 d_3 x M_3 x L_2 (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 m^2), 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

Depth of sample	Clay %	Silt %	Sand %	MC, %	Bulk density, g / cm^3
0 - 15	49	29	22	21.75	1.35

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 (T_1). 2- Chisel plow at depth 15 cm (one pass) followed by traditional land leveling (T_2). 3- Direct using on soil with rice residues (T_3).

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 = (the mean of heights (mm) / 1000) × 4200 (m^2)

Where: q: amount of water, m^3/fed.

Emergence percentage, % = Seed emergence (N/ m^2) / seed rate (N/ m^2)

The emergence of clover plant was evaluated by taking 6 samples (1 m^2) randomly selected from each plot as the number of clover stalks (N).

Productivity: The clover productivity was evaluated by taking 6 samples (1 m^2) 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 / m^2.

Water use efficiency (Mg/m^3) = productivity (Mg/fed) / water added (m^3/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 m^3/fed, respectively. These results were obtained by using T_1, while, the maximum height and amount of water on the breeding surface after irrigation was 152 mm and 586.6 m^3/fed, respectively. These results were obtained by using T_3. This is 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).

s.p.s	(H)"mm" at			Mean (m)	S.D	(q)"m^3/fed" at			Mean (m)	S.D
	I_1	I_2	I_3			I_1	I_2	I_3		
T1	52	50	51	51	1	214.2	210	218.4	214.2	4.2
T2	120	111	107	112.7	6.7	504	466.2	449.4	473.2	27.9
T3	152	137	130	139.7	11.2	638.4	575.4	546	586.6	47.2

H : average of water height, q : amount of water, I_1 : the first irrigation

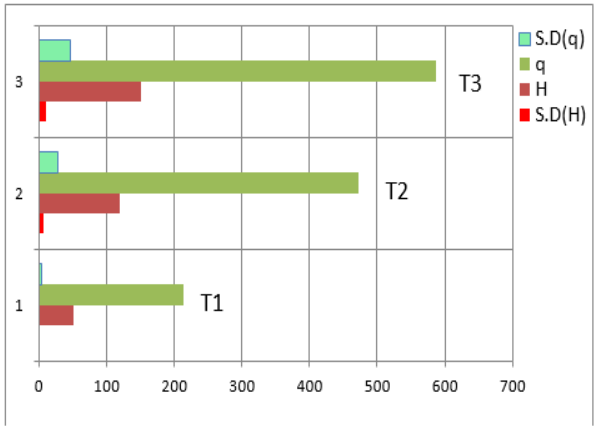

Fig. 1. Effect of soil preparation systems on height "H" (mm) and amount "q" (m^3) water added, so S.D in either case.

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 T_1, while, the minimum seeds emergence percentage and productivity of the first mowing were 33% and 16.4 Mg/fed, respectively. These results were obtained by using T_3. 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) >T 3 (16.4 Mg/fed)

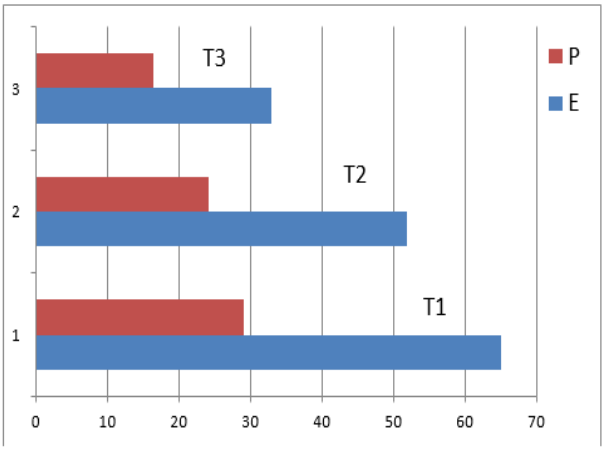

Fig. 2. Effect of soil preparation systems on emergence percentage "E" (%) and productivity "P" (Mg/fed).

Water use efficiency

Water use efficiency is expressed as Mg of forage productivity/m^3 of water added. Results showed that the maximum water use efficiency was 0.14 Mg/m^3 was obtained by using T_1, while, the minimum water use efficiency was 0.028 Mg/m^3 was obtained by using T_3. The sequence of the different methods according to water use efficiency was found to be in the descending order:

(T1 (0.14 Mg/m^3) > T2 (0.051 Mg/m^3) > T3 (0.028 Mg/m^3)

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.

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تأثير بعض نظم إعداد التربة على كمية المياه المضافة ونسبة الإنبات لمحصول البرسيم المصري

رأفت علي أحمد وربي[1] و عاطف موسى إبراهيم موسى[2]

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تم إجراء هذا البحث خلال موسم 2020 في أرض طينية بقرية أريمون- كفرالشيخ , وذلك لدراسة تأثير بعض نظم إعداد التربة على كمية المياه المضافة لثلاث ريات (رية الزراعة - رية المحاياه – رية بعد 12 يوم من رية المحاياه) ونسبة الإنبات لمحصول البرسيم المصرى وأيضاً إنتاجية الحشة الأولى ، وذلك من خلال إجراء التجارب الآتية:1 - الحرث بمحراث حفار (فك)علي عمق 15 سم ، ثم التسوية الدقيقة (بالليزر(T_1). 2 - الحرث بمحراث حفار (فك)علي عمق 15 سم ، ثم التسوية التقليدية (T_2). 3 - استخدام أرض بها بقايا محصول سابق(أرز) بدون تسوية (T_3). هذا مع الزراعة في كل التجارب بواسطة النثر اليدوي ، وباستخدام 30 كج / فدان من تقاوي برسيم من نوع (المسقاوي) .وكانت أهم النتائج كالأتي: 1- إرتفاع وكمية المياه: وجد أن أقل قيم لارتفاع وكمية المياه فوق سطح الزراعة بعد الرى مباشرة كانت 51 مم ، 214.2 م^3 / فدان على الترتيب ، وذلك مع استخدام الحرث بمحراث حفار (فك) ثم التسوية الدقيقة بالليزر(T_1). وكانت أعلى قيم لارتفاع وكمية المياه فوق سطح الزراعة بعد الرى مباشرة كانت 152 مم ، 586.6 م^3 / فدان على الترتيب ، وذلك مع استخدام الأرض التي بها بقايا محصول سابق بدون حرث وبدون تسوية (T_3) . 2 - نسبة الإنبات: وجد أن أعلى نسبة إنبات للبذور كانت 65 ٪ مع إستخدام المعاملة T_1 ، وأقل نسبة لإنبات البذور كانت 33 ٪ مع استخدام المعاملة T_3. 3- الإنتاجية وكفاءة استخدام المياه: وجد أن أعلى قيم للإنتاجية (الحشة الأولى) وكفاءة استخدام المياه كانت 29.1 ميجا جرام / فدان ، 0.14 ميجا جرام / م^3 على الترتيب ، وذلك مع إستخدام المعاملة T_1. وكانت أقل قيم للإنتاجية (الحشة الأولى) وكفاءة استخدام المياه كانت 16.4 ميجا جرام / فدان ، 0.028 ميجا جرام / م^3 على الترتيب ، وذلك مع إستخدام المعاملة T_3.