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IRRIGATION MANAGEMENT FOR MAIZE CROP IN SANDY SOILS

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ABSTRACT: Laboratory experiments were carried out at the National Irrigation Laboratory of Agricultural Engineering Research Institute (AEnRI), ARC, Dokki, Giza to test the performance of trickle irrigation. The emitters were tested and calibrated under different operating pressure (0.50, 0.75, 1.00 and 1.25 bar). All measurements were done according to ISO 9621 for evaluating drip flow rates. Also, the emitter flow variation, emotion uniformity and coefficient of variations were measured. In sandy soils, deep percolation, decrease in retention of moisture, compost condoner, rice straw and polymer were added to improve the physical properties of soil for keep water along time. Maize grows best on fertile and well-drained loamy soils. Proper management of inputs particularly irrigation water using modern technology is essential for maximizing production and for providing high return to farmers. This study were done for management of maize crop in sandy soil with three types of emitters (GR, antiroot GR and T-tape). While fields experiments were carried out during the agricultural season 2014/2015 at El-Husien farm in Alexandria-Cairo desert road. In harvest stage, ears were counted in all lines and weighted to know the yield. This study were done for management for maize crop in sandy soil with three types of emitters (GR, antiroot GR and T-tape). Compost condioner, rice straw and polymer was added to improve the physical properties of soil for keep water along time. Field results showed that antiroot GR emitter was the highest productivity with compost (3762 kg/fad.) whereas stalk lengh was 1.9 m and diameter was 37mm and has 17 leaves. The lowest productivity was antiroot emitter with polymer which valued 990kg/fad., and stalk lengh was 1.5 m and diameter was 35 mm and has 14 leaves. The middle in productivity was t-tabe with compost (2354 kg/fad.) and stalk lengh was 1.77 m and diameter was 35mm and has 15 leaves. Using compost with t-tape sub-surface drip system give good yield but using compost with antiroot GR sub-surface drip system give the best yield. Using compost with antiroot GR sub-surface drip system give good yield but using compost with antiroot GR sub-surface drip system give the best yield. Using polymer with antiriot GR sub-surface drip system give the lowest yield value.

Key words: Maize, soil condioners, corn, irrigation managemen.

INTRODUCTION

Desert soils suffer from high temperature, lack of water, and poor plant nutrients. These problems made it essential to use the most efficient irrigation system for conveying water to the plant without wasting any of the scarcely-found water resources.

According to this, the drip irrigation system is the most suitable system to desert condition, due to its high conveying efficiency, water conservation, and due to the precise ability of fertilizers and chemicals addition through it. So as to enrich the desert soil's poverty in plant essential nutrients. Maize is one of the most important crops in the world. It is grown almost all over Egypt under varied soil and climatic conditions. It grows best on fertile and well-drained loamy soils. Proper management of inputs particularly irrigation water using modern technology is essential for maximizing production

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and for providing high incom return to the farmers.

El-Mashriki (2013) studied some hydraulic properties of emitter discharge, uniformity and manufacture variation, for five kinds of emitters used in Yemen. The results indicated that the coefficient of variation (Cv) decreased with increasing pressure for all emitters, while the dipper without pressure valve achieved minimum difference in manufacturer factor.

Matter (2013) said that subsurface irrigation systems offer advantages over other types of irrigation systems, wherease It saves water and energy.

Mohendran *et al.* (2013) stated that the subsurface irrigation is an efficient method to deliver water and nutrients to the root zone of plants because water is directly applied in subsoil layer to the effective root zone of crop. Since the loss of water was minimum, the water requirement was less in the subsurface drip irrigation system compared to surface irrigation.

Enujeke (2013) indicated that higher fruit mass was obtained from cucumber plants that received 20 t ha^{-1} of poultry manure possibly because higher rates of manure improved the soil conditions for crop establishment as well as released adequate nutrient elements for yield enhancement.

Akelah (2013) indicated that, there are various natural and synthetic materials used for soil reclamation. They are added to the soil surface or around the seedling roots at the time of planting, thereby improving the soil's physical properties. These are particularly important for improving the crop-growing potential of sandy soils.

The use of these materials for the purpose of soil improvement also contributes positively to solving the problem of waste materials disposal from the full range of human activities.

Paradelo *et al.* (2013) introduced that composting is a natural way of recycling. It turns on farm waste and other organic materials into a farm resource enhancing soil fertility and soil quality that brings about increased agricultural productivity, improved soil iodiversity, reduced ecological risks and a better environment.

Brouwer *et al.* (2000) confermed that good irrigation scheduling means applying the right amount of water at the right time. In other words, making sure water is available when the crop needs it. Scheduling maximizes irrigation efficiency by minimizing runoff and percolation losses. These often results in lower energy and water use and optimum crop yield.

Abo Amera (1999) said that the contour maps of moisture distribution for the different depths of sub-trickle lateral showed that, 20 cm depth produce the most uniform distribution for the moisture content. The values of wetted distance in the vertical direction increased with increasing the depth of sub-trickle lateral.

Sultan (2001) said that the moisture distribution under trickle system in sandy soil increasing in depth; decrease between point source equilibrium in between two axis.

El-Gindy *et al.* (2001) reported that adding manure to the sandy soil resulted in highly significant increase in maize seed yield and water use efficiency compared with adding polymer and control, where ear length, ear diameter, 100 kernel weight, grain yield and ear yield was highly significantly affected by the type of soil conditioner added to the studied soil under sprinkler irrigation system.

Sultan (2001) reported that there was a uniformity distribution of water in the soil layers at top, and bottom of lateral due to the laterals of manure, which buried down each laterals depth. Under sandy soil condition, the good water management can be efficient by using layers of manure down each lateral depth, buried the lateral line of irrigation systems at depth of 10 cm to minimize the water loss from soil surface.

Abdelaty (2006) found that under subsurface trickle irrigation using manure with sand increased the net yield of pea which was 8360 $kg.fad^{-1}$ than that with sand only which was 8070 $kg.fad^{-1}$ the net increase was 290 $kg.fad^{-1}$.

Awady *et al.* (2008) mentioned that generally sandy soils lost gained moisture after irrigation, thus requiring irrigate twice-a-day. Buried trickle line at depth of 10 cm was the best in soil moisture-distribution.

Shawky *et al.* (2011) found that the application efficiency values were 92.9, 92.56, 81.48 and 65.7% for subsurface drip, surface drip, sprinkler and furrow systems, respectively.

Abdel-Aal and Hassan (2013) conducted a study to determine the irrigation efficiency, water saving, cowpea yield, yield components, water use efficiency and net profit for traditional, drip and subsurface irrigation systems in sandy soil conditions, the experimental results revealed that, the application efficiency; distribution uniformity and irrigation efficiency for subsurface irrigation increased by 4.2, 13.5 and 60.1%, 47.57, 15.97 and 8.99, 31.70 and 109.75% compared with drip, sprinkler and tradional systems. Drip systems increased the pod yield and water use efficiency (WUE) by 14.98 and 9.47%, 40.42 and 57.58% and 61.76 and 188.89% compared with subsurface, sprinkler and tradional systems.

Attaher *et al.* (2003) studied the performance of subsurface and surface drip irrigation systems and its effects on the yield of potato. They found that, with surface drip irrigation, the soil moisture content decreased gradually in the horizontal direction and reached field capacity at a distance of 25 and 30 cm from T-tape and GR emitters, respectively .The moisture content was higher than field capacity with subsurface drip irrigation (SDI) by up to 22 and 25% near the T-tape and GR emitters, respectively, in the horizontal direction and throughout 30 cm in the vertical direction. The highest yield (13.8 Mg.fad^{-1}) was obtained with T-tape surface drip system as combined with the highest water use efficiency “WUE “(12.4 kg.m^{-3}).

The main objectives of this study are to:

1. Study the effect of using soil conditioner (polymer, compost and rice straw) on system application.
2. Evaluate management of trickle irrigation system.

MATERIALS AND METHODS

Materials

Laboratory experiments

Laboratory experiments for drip irrigation were carried out at the National Irrigation Laboratory of Agricultural Engineering Research Institute (AEnRI), ARC, Dokki, Giza. The emitters were tested and calibrated under different operating pressure (0.50, 0.75, 1.00 and 1.25 bar) during the period from 2014 to 2015. All measurements were done according to ISO 9621 for evaluating drip flow rates by using drip irrigation test facility as shown in Fig. 1. The experiments were carried at three types of emitters (T-tape, built in GR and antiroot).

Hydraulic test bench

Apparatus was used to compare and evaluate emitters as shown in Fig. 1. The following components were divided to: hydraulic system description, water temperature and filtration, supporting frame, catch can water from emitter and measuring devices.

Field Experiment

A field experiment was carried out on a sandy soil in Al-Hussein on the Cairo-Alexandria road.the soil was digged in a trenches prepared by hand, and soil condoners (rice straw, polymer and compost) were sown at depth of 20cm then drip lines were put at depth 15 cm then maize seeds were put at depth of 5-7 cm, class single hybrid 10 was sown. The lines spacing was 0.8 m, the line length was 10 m, with 0.30 m emitters distance ,area of one treatment was 8m^2 and area of all treatments was 96 m^2, then the trenches were carefully backfilled with the previously removed soil. In all stages the moisture content, the plant measurements such as stalk length, leaf length, diameter of stalk and leaf number were measured. The moisture content was measured before and 24 hr., after irrigation. In harvest stage ears were counted in all lines and weighted to determine the yield. The measurements such as diameter of stalk were measured with Venire. Three types of soil conditioners were used under the irrigation lines compost 10 ton.fad^{-1}; rice straw, 10 ton.fad^{-1} and polymer 1.760 ton.fad^{-1}.The third section was control (without soil conditioners). In all area had three types of subsurface drip irrigation (T-Tape, anti roots and built in (GR)) (q= 4L.hr^{-1} for all types). Nitrogen fertilizers were injected into irrigation water along the growing season according to the recommended doses mentioned by the Ministry of Agriculture, Egypt. Fertilizers were 25.2 kg.fad.$^{-1}$ chicken dung, 50.4 kg.fad.$^{-1}$

(urea with 46%N), 63 kg.fad^{-1} k_2O, 75.6 kg.fad.$^{-1}$ P_2O_5 and 126 kg.fad.$^{-1}$ N were injected through subsurface drip irrigation system.

Irrigation system

Subsurface drip irrigation system was used to irrigate maize. The irrigation system consists of the following items:

1- Control head unit is located at the source of water supply. It consists of centrifugal pump, pressure gauge, flow meter, back flow prevention device and screen filter.

2- Main and sub-main lines 110 mm diameter unplasticized polly vinyl chloride (UP.V.C) pipes is used for the main to convey water from water source and 63 mm (UP.V.C) for the sub-main.

3- Manifold 32 mm (UPVC) pipes is used to supply water to constructed laterals.

4- Laterals lines of 16 mm diameter Polyethylene (LDPE), built in drip line with flow rate 4 L.hr^{-1}.

Methods

Pressure- flow rates

A total of three types of emitters (T-tape, built-in GR and Antiroot) of value pieces each were picked up from three reputed firms handling trickle equipment for studying hydraulic performance. Emitter flow rates were measured at seven operating pressures from 0.5 to 1.25 bars. Emitter flow as a function of pressure can be expressed as following according to **Keller and Karmeli (1974)**.

$$q = kp^x \quad (1)$$

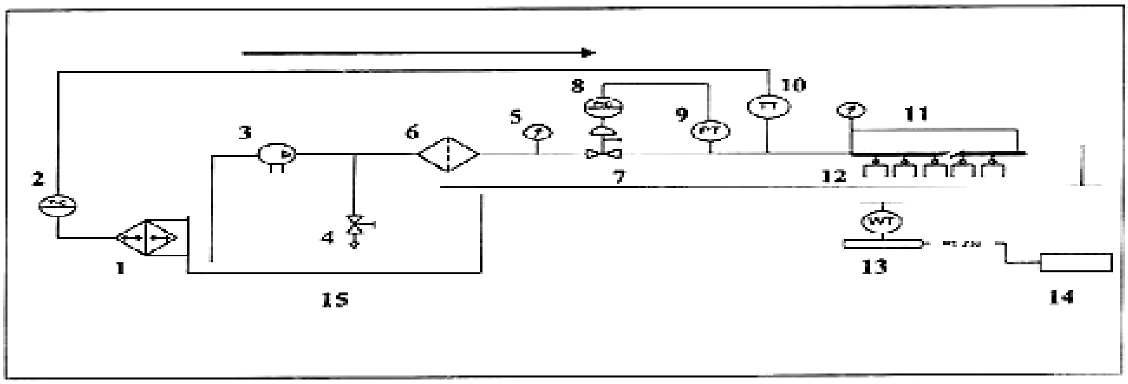
Where,

q : the emitter flow rate in lhr^{-1},

k : a dimensionless constant of proportionality that characterizes each emitter,

p : pressure at the emitter in bar, and

x : a dimensionless emitter flow rate exponent that is characterizes by the flow regime, it measures how sensitive the emitter flow rate is to the pressure.



1. **Temperature conditioning.**
2. **Temperature regulator.**
3. **Multi-stage pumping unit.**
4. **Manual discharge valve.**
5. **Direct reading pressuregauge.**
6. **Screen filter.**
7. **Pressurized air regulating valve.**
8. **Pressure regulator.**
9. **Pressure transmitter.**
10. **Temperature transmitter.**
11. **Lines of pipes including tested emitters.**
12. **Water collectors for each emitter in test.**
13. **Weighing scale.**
14. **Personal computer.**
15. **Water tank.**

Fig.1. Hydraulic test bench

Emitter manufacture's coefficient of variations

The manufacture's coefficient of variation "CV" indicates the unit to unit variation in flow rate for a given emitter. The emitter manufacture's coefficient was calculated by measuring the flow rate from a sample of the new emitter after **(Keller and Karmeli, 1974)**, as follows:

$$CV = s/q_a)x\ 100 \quad (2)$$

Where:

CV: Manufacturer's coefficient of variation in percent,

S : Standard deviation of emitter flow rates at a reference pressure head, and

q_a : Mean flow rate of emitter at that reference pressure head in ($L.hr^{-1}$).

The coefficient of manufacture variability measures the variation in flow rate for a given emitter model at a normal operating pressure ranging from 0.2 to 2 bars and a water temperature of (20-23)°C.

The "CV" is one of the statistical terms, which can be used to show the trickle irrigation system uniformity. Numbers guidelines have been suggested for "CV", but those recommended by **ASAE (1996)** shown in Table 1.

Emission uniformity

Keller and Karmeli (1974 and 1975) revealed that a statistical uniformity could be used to indicate performance for emitters. Values were calculated according to the following equation:

$$EU = (q_n/q_a)\ x\ 100 \quad (3)$$

Where:

EU: the emission uniformity in (%),

q_n : the average of lowest ¼ of the emitter flow rate, in ($L.hr^{-1}$), and

q_a : the average of all emitter flow rates, in ($L.hr^{-1}$).

RESULTS AND DISCUSSION

Laboratory Experiments

Results indicated that the relationship between flow rate and operating pressure depends on the type of emitters. Fig. 2 illustrated that, the relationship between flow rate and operating pressure for built in GR emitter with flow rate 4 $l.hr^{-1}$. Fig. 3 illustrated that the relationship between flow rate and operating pressure for Antiroot built in emitter with flow rate 4$L.hr^{-1}$ with 0.06 exponent that (compensating) and Fig. 4 illustrated that the relationship between flow rate and operating pressure for T-tape in emitter with flow rate 4 $L.hr^{-1}$ with 0.5 exponent (turbulent flow).

From Fig. 2, when pressure was 0.5 bar the flow rate was 2.8 $L.hr^{-1}$, then when the pressure increased to 0.75 bar the flow rate was 3.6 $L.hr^{-1}$, then when the pressure increased to 1 bar the flow rate was 4 $L.hr^{-1}$, then when the pressure increased to 1.25 bar the flow rate was 4.4 L.hr-^{1} and the equation of this emitter was $q=4.0994\ p^{0.5}$ with 0.5 exponent (turbulent flow).

From Fig. 3, it was shown that this emitter was compensate which mean in all pressures (0.5, 0.75, 1, 1.25 bar) and the equation of this emitter was 062 $q = 3.434\ p^{0.5}$ bar the flow rate was 2.8 $L.hr^{-1}$, then when the pressure increased to 0.75 bar the flow rate was 3.4 $L.hr^{-1}$, then when the pressure increased to 1 bar the flow rate was 3.9 $L.hr^{-1}$, then when the pressure increased to 1.25 bar the flow rate was 4.2 $L.hr^{-1}$ and the equation of this emitter was $q= 4.0994\ p^{0.5}$ with 0.5 exponent (turbulent flow). Variation in both emission uniformity (EU) and CV for the different types of emitters were displayed in Table 2.

From Fig. 4 and Table 2 it could be seen that when pressure increased from 0.5 to 1.25 bar, flow rate increased from 2.89 to 4.71 $L.hr^{-1}$ and when pressure was one bar the flow rate was 4.09 $L.hr^{-1}$. The value of x was 0.5 means that the flow is turbulent, CV was 1.49 which mean excellent emitter according to classification ASAE and EU was 93% which mean excellent emitter according to Classification ASAE.

Plant Components

Stalk length

From Fig. 5, using rice straw conditioner in cultivation stage, results illustrated that T-tape drip line gave the highest value in stalk length (1.8 m) then antiroot drip line was (1.7 m) and

Table 1. List of ASAE recommendation for classifying the CV

Emitter type	CV range (%)	Classification
Point source	**Below 5**	Excellent
(trickle emitter and micro sprinklers)	**5 to 7**	Average
	7 to 11	Marginal
	11 to 15	Poor
	Above 15	Unacceptable
Line source	**Below 10**	Good
(trickle tubes)	**10 to 20**	Average
	Above	Unacceptable

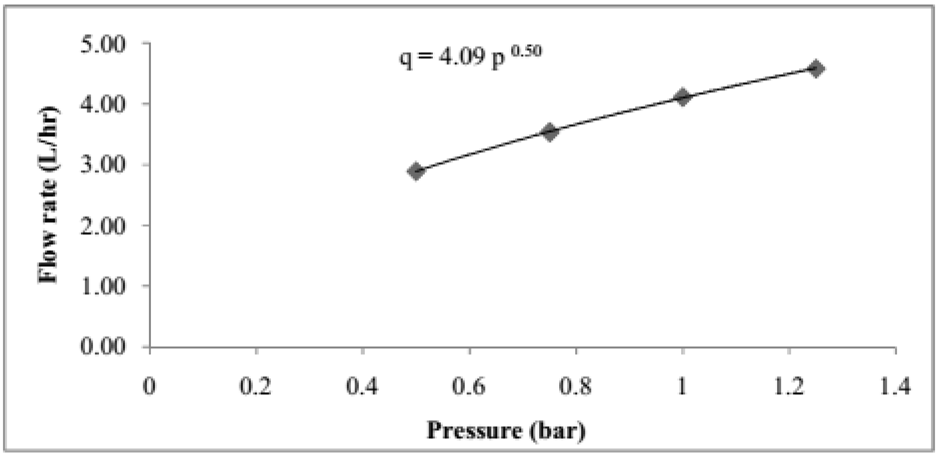


Fig. 2. Flow rate with pressure for built in GR emitters (4 L.hr^{-1}) curve

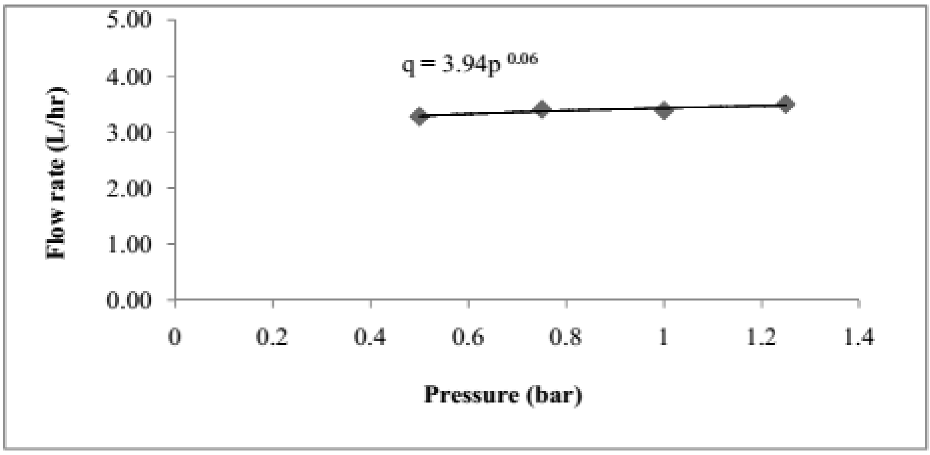


Fig. 3. Flow rate with pressure for GR Antiroots emitters (4 L.hr^{-1}) curve

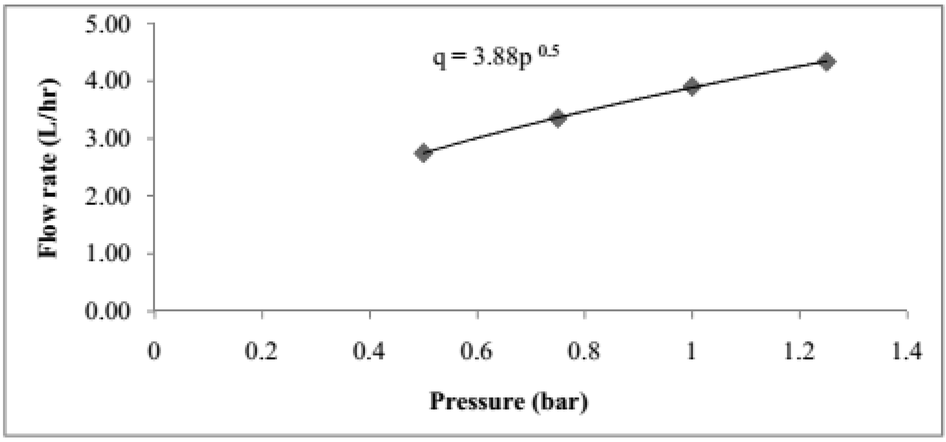


Fig. 4. Flow rate with pressure for T-tape emitters (4 L.hr^{-1}) curve.

Table 2. Hydraulic characteristics of emitters and classifications according to ASABE

Emitter	X	CV	EU(%)	Classification according to ASAE		
				X	CV(%)	EU(%)
Built in GR	0.5	1.49	93	Turbulent flow	excellent.	excellent.
Antiroot GR	0.062	3.15	96	Compensating	excellent.	excellent.
T-tape	0.5	2.96	94	Turbulent flow	excellent.	excellent.

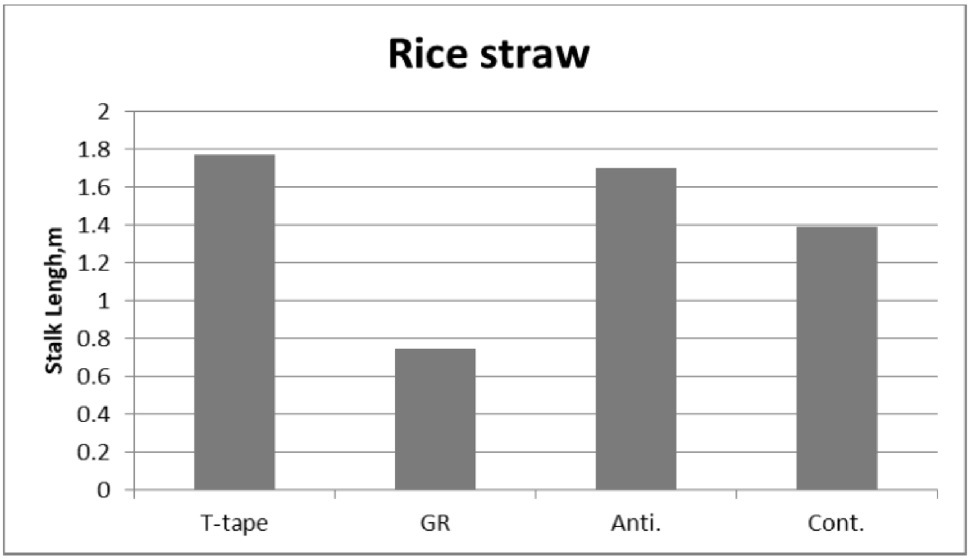


Fig. 5. Effect of lateral drip types on stalk length when using rice straw condioner at cultivation stage

control treatment was higher than GR drip line (1.39 m), (0.75 m). From Fig. 6 using polymer in cultivation stage reuslts illustrated that GR emitter was the highest value in stalk length (1.6 m) followed by antiroot emitter and T-tape were (1.5 m) and control (1.39 m) and from Fig. 7 in cultivation stage using compost conditioner antiroot emitter line and T-tape drip line were the highest in stalk length (1.9 m) then GR drip line (1.82 m) and control treatment was the lowest value (1.39 m).

Leaf length

From Fig. 8 in cultivation stage, using rice straw and GR emitter line was the highest in leaf lengh (91 cm) then control treatment (89 cm) then antiroot was (83 cm) and T-tape was the lowest in leaf lengh (77 cm), from Fig. 9 in cultivation stage using polymer T-tape drip line was the highest in leaf lengh (95 cm) then control and GR drip line treatment were the same (89 cm) then antiroot drip line was (86 cm) and from Fig. 10 in cultivation stage using compost, control treatment was the highest in leaf lengh (89 cm) then Gr drip line (88.6 cm) then antiroot (86.6 cm) and T-tapeemitter line was the lowest value (86 cm).

Diameter of stalk

From Fig. 11 in cultivation stage using rice straw and GR drip line was the highest value in diameter (35 mm), T-tape was 34.1 mm and antiroot drip line and control treatment was 33 mm, from Fig. 12. In cultivation stage using polymer antiroot GR and T-tape drip line was the same value in diameter (35 mm), control was 33 mm and GR emitter line treatment was 32 mm and from Fig. 13 in cultivation stage using compost, antiroot drip line was the highest value (37 mm) then control treatment 33 mm, then T-tape was 32 mm and GR drip line was the lowest value (30 mm).

Leaf number

From Fig. 14 when using rice straw results had the same number (15 leaves), from Fig. 15 when using polymer and T-tape and GR had 16 leaves, control 15 leaves and antiroot was 14 leaves and from Fig.16 when using compost T-tape had 18 leaves, antiroot GR 17 leaves, GR (16 leaves) and control was 15 leaves.

Maize yield

From Fig. 17 the results illustrated that compost had the highest value in yield because it had all nutrients and made good air and water for soil to absorb them, antiroot had the highest total yield (3762 kg fad^{-1}) then T-tape (3590.4 kg fad.$^{-1}$) then GR (3432 kg fad.$^{-1}$). But when using rice straw and t-tape was (2354kg fad.$^{-1}$) then GR (2112 kg.fad.$^{-1}$), control (1760 kg fad.$^{-1}$) and results illustrated that antiroot drip line was the lowest yield (1584 kg.fad.$^{-1}$). But when using polymer and T-tape yield was (2785.2 kg.fad^{-1}) then control (1760 kg.fad.$^{-1}$), GR (1326.6 kg.fad.$^{-1}$), and results illustrated that antiroot drip line was the lowest yield (990 kg.fad.$^{-1}$).

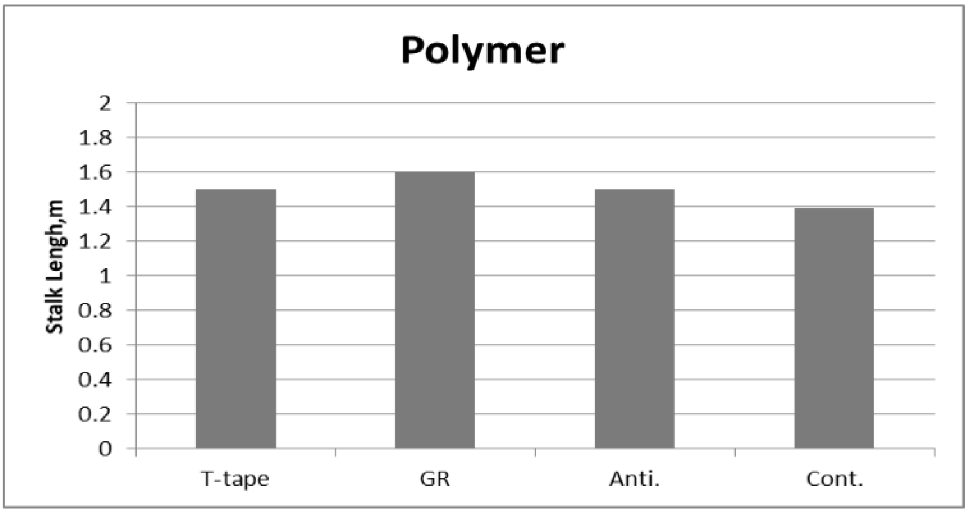


Fig. 6. Effect of lateral drip types on stalk length when using polymer condioner at cultivation stage

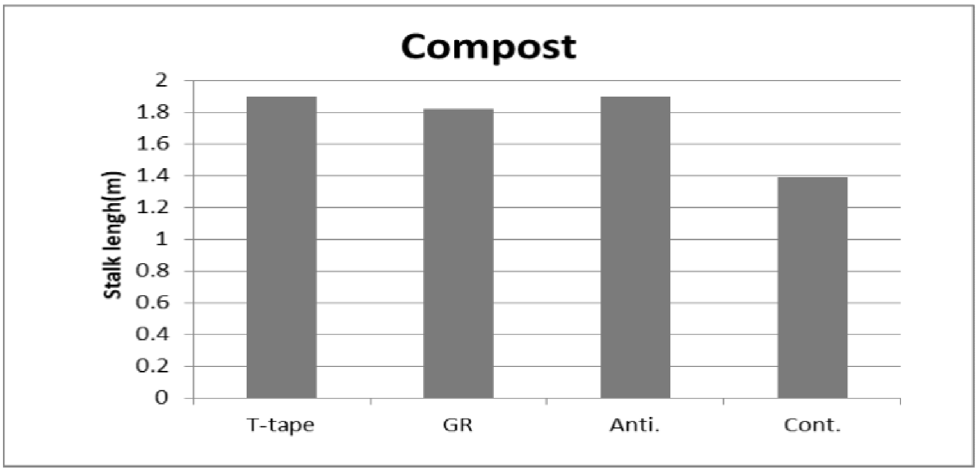


Fig. 7. Effect of lateral drip types on stalk length when using compost codioner at cultivation stage

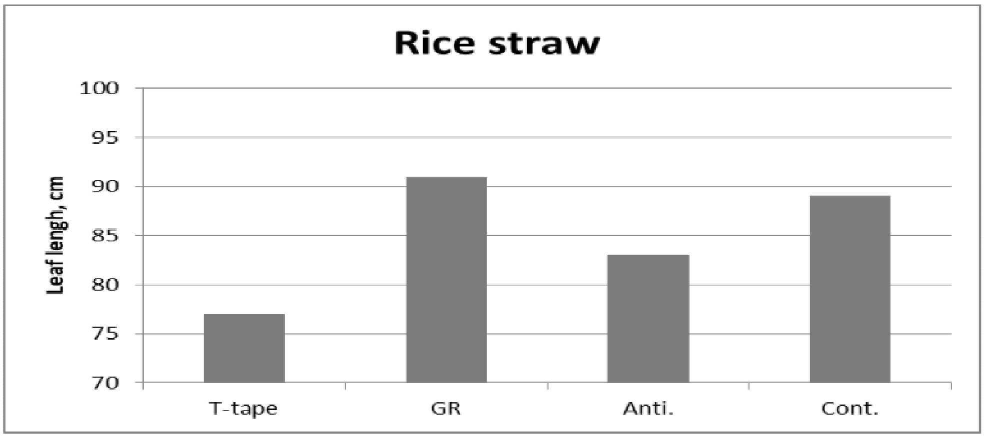


Fig. 8. Effect of lateral drip types on leaf length when using rice straw condioner at cultivation stage

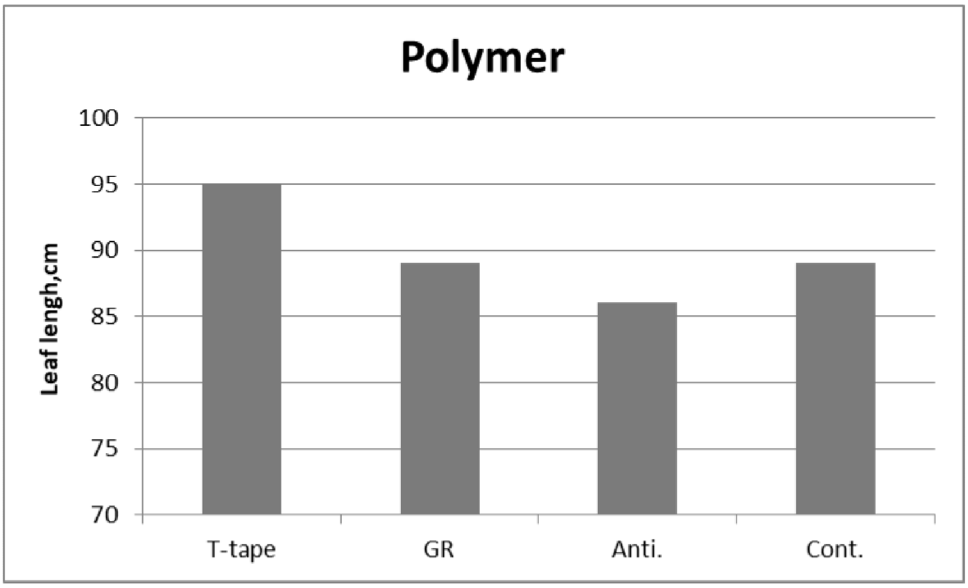


Fig. 9. Effect of lateral drip types on leaf length when using polymer at cultivation stage

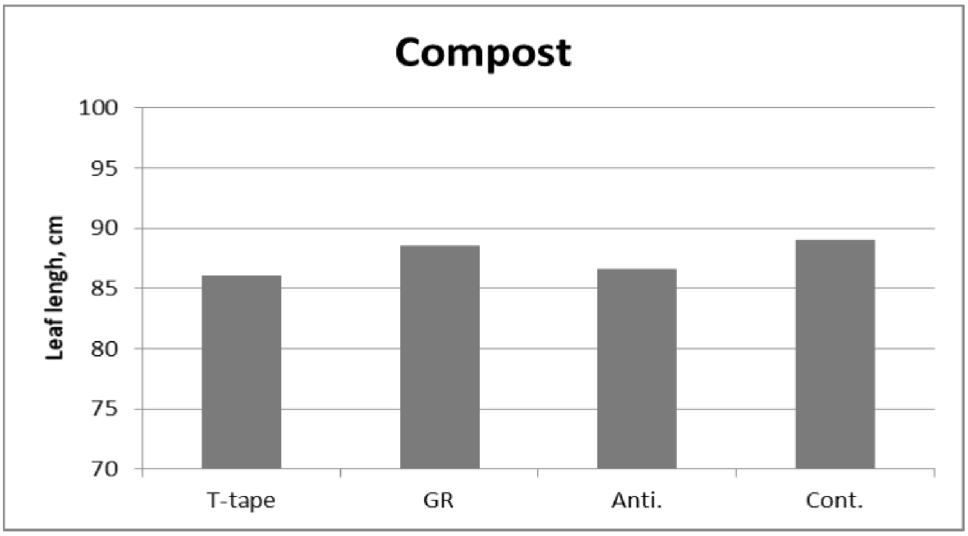


Fig. 10. Effect of lateral drip types on leaf length when using compost at cultivation stage

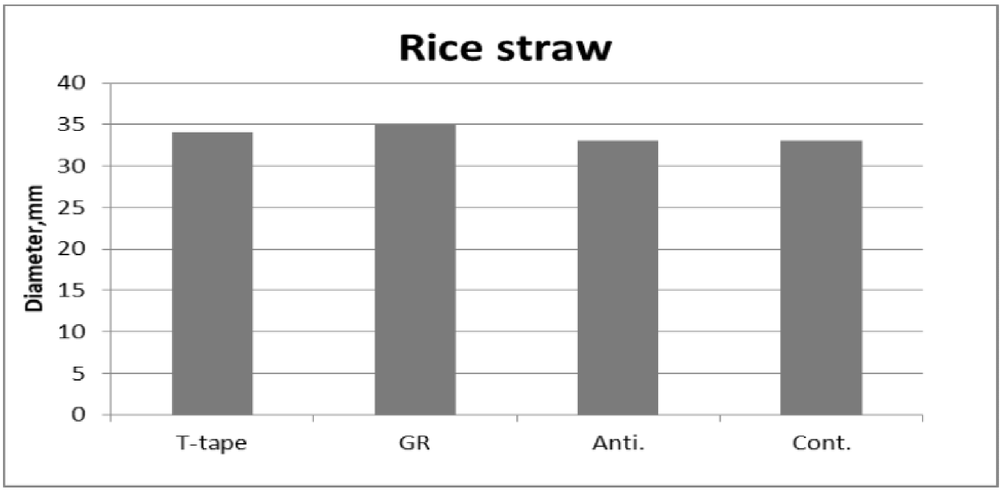


Fig. 11. Effect of lateral drip types on stalk diameter when using rice straw at cultivation stage

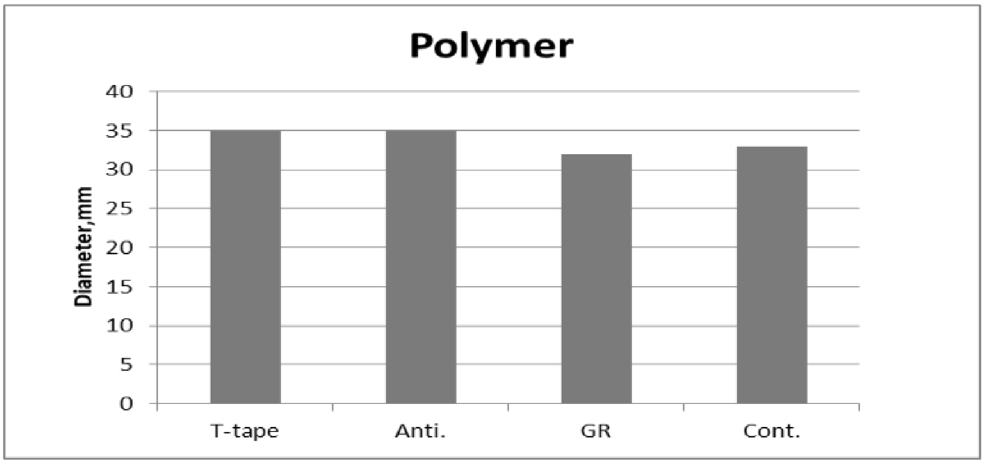


Fig. 12. Effect of lateral drip types on stalk diameter when using polymer at cultivation stage

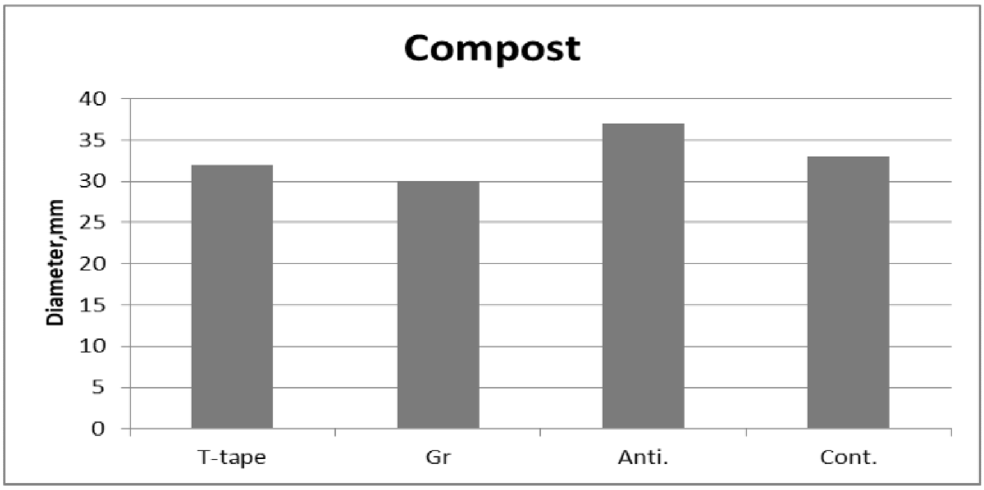


Fig. 13. Effect of lateral drip types on stalk diameter when using compost at cultivation stage

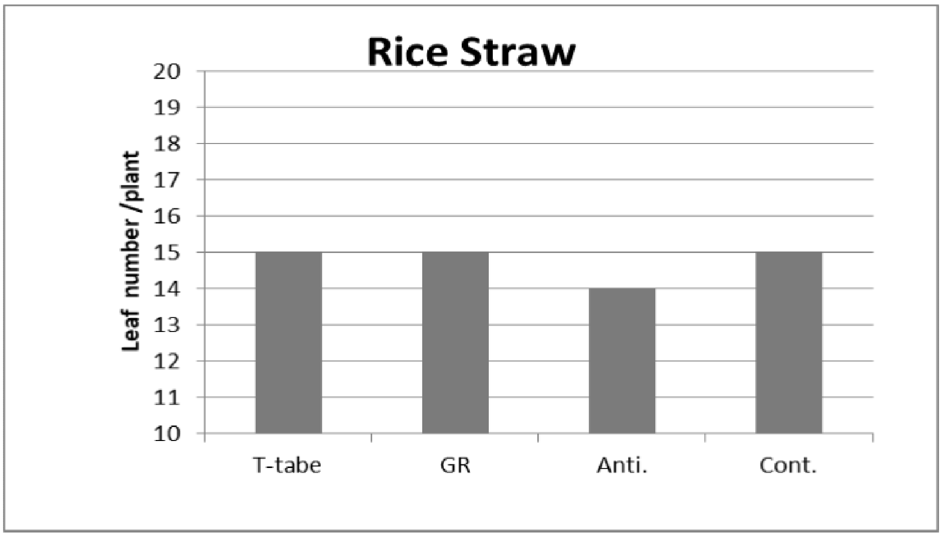


Fig. 14. Effect of lateral drip types on leaf number/plant when using rice straw at cultivation stage

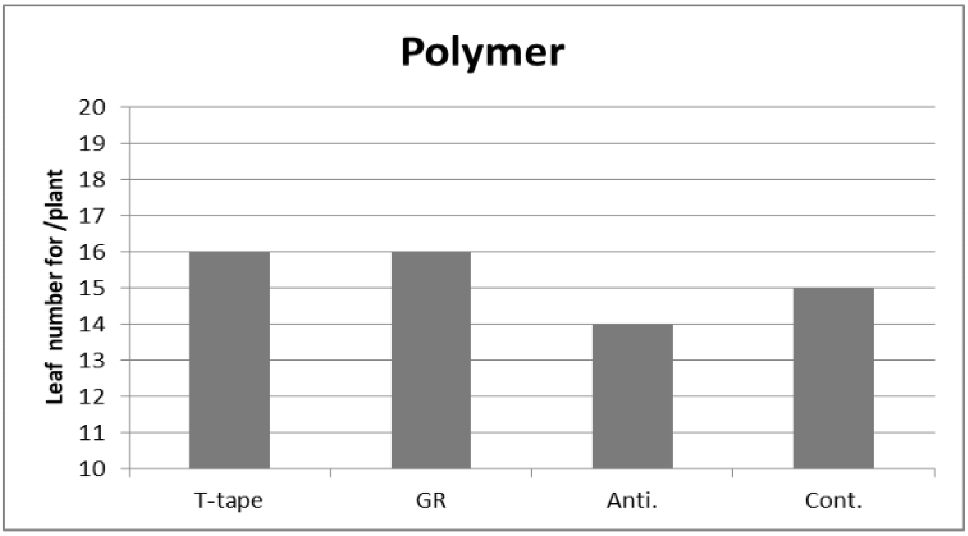


Fig. 15. Effect of lateral drip types on leaf number/plant when using polymer at cultivation stage

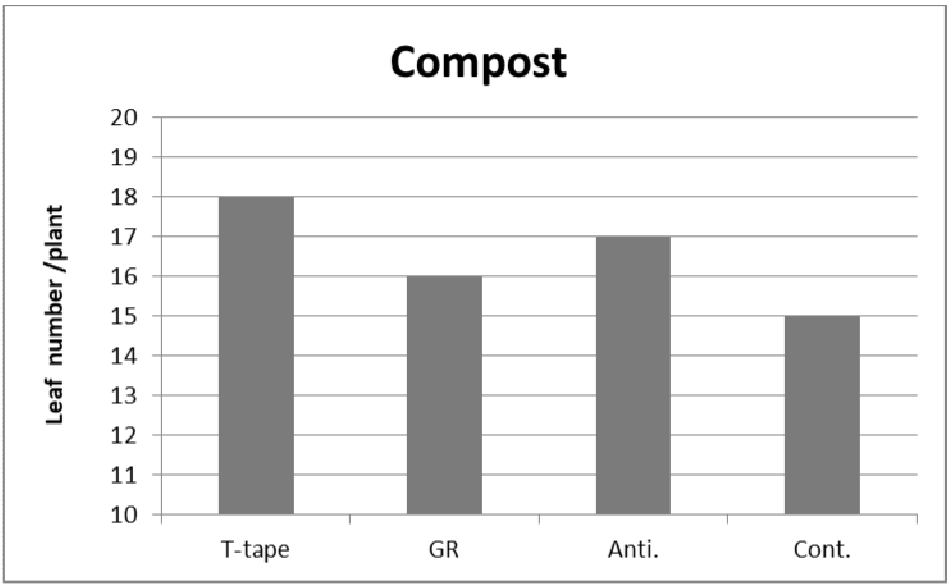


Fig. 16. Effect of lateral drip types on leaf number/plant when using compost at cultivation stage

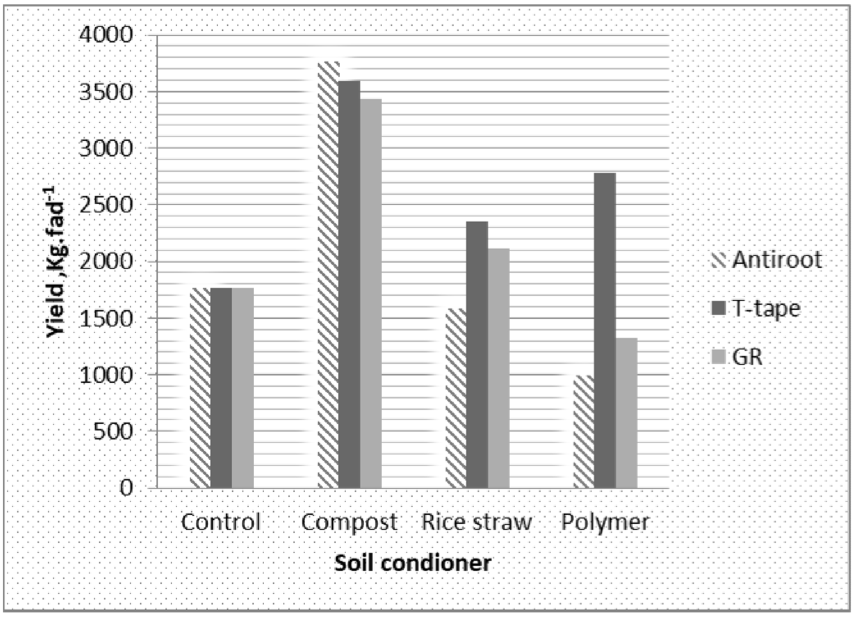


Fig. 17. Effect of soil condioners on total yield at different lateral drip types

Table 3. Total ET of all treatments

Stage	T(day)	Avr.(ET0)	kc	Etc(mm/day)	T.ET(mm/season)	T.ET(m^3/fad.)
Initial	20	6.42	0.35	2.247	44.94	188.748
Dev	35	6.44	1	6.44	225.4	946.68
End	40	6.73	1.2	8.076	323.04	1356.768
Mid	30	6.04	0.6	3.624	108.72	456.624
Sum.						2948.82

Table 4. Water use efficiency of all treatments

Treatments	Etc(m^3/fad.)	Yield(kg/fad.)	WUE (kg/m^3)
T-tape compost	2948.82	3590.4	1.22
T-tape polymer	2948.82	2785.2	0.94
T-tape rice straw	2948.82	2354	0.8
T-tape control	2948.82	1760	0.6
GR compost	2948.82	3432	1.16
GR rice straw	2948.82	2112	0.72
GR control	2948.82	1760	0.6
GR polymer	2948.82	1326.6	0.45
Antiroot GR compost	2948.82	3762	1.27
Antiroot GR control	2948.82	1760	0.6
Antiroot GR straw	2948.82	1584	0.54
Antiroot GR polymer	2948.82	990	0.35

Conclusions

This study was done for management for maize crop in sandy soil with three types of emitters (GR, antiroot GR and T-tape). compost condioner, rice straw and polymer was added to improve the physical properties of soil for keep water along time. The Conclusions were:

1. The best treatment was using compost with antiriot GR sub-surface drip system which gave the best yield.
2. Using compost with t-tape sub-surface drip system gave good yield but, using compost with antiroot GR sub-surface drip system gave the best yield.
3. Using compost with antiroot GR sub-surface drip system gave good yield but, using compost with antiroot GR sub-surface drip system gave the best yield.
4. Using polymer with antiriot GR sub-surface drip system gave the lowest value of yield.

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إدارة الرى لمحصول الذرة الشامية فى الأراضى الرملية

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نظرًا للتناقص المستمر فى حصة مصر من المياه مع التغيرات المناخية وزيادة عدد السكان مما يتطلب استخدام انظمة توفر مياه الرى للاجيال القادمة وهى انظمة الرى الحديثة حيث توفر المياه و تقلل الفواقد وتحافظ على الرطوبة المتيسرة فى كل وقت للنبات وسهولة الأمتصاص، تم أجراء الدراسة الحقلية فى مزرعة الحسين على طريق القاهرة –الأسكندرية الصحراوى على محصول الذرة الشامية حيث تم حفر الارض وأضافة المحسنات الثلاثة على عمق ٢٠سم ثم وضعت الخراطيم على عمق ١٥سم ثم وضعت تقاوي الذرة الشامية يدويًا ثم وضعت التربة فوقها وتمت تغطيتها مما يزيد الأنتاجية للنبات ونظرًا للتسرب العميق فى التربة الرملية بسبب أنخفاض قدرة احتفاظ التربة الرملية بالماء تم أضافة ثلاثة انواع من محسنات التربة وهى الكمبوست وقش الأرز والبوليمر مما يحسن الخواص الفيزيائية للتربة حيث قوة الأحتفاظ بالرطوبة لاطول فترة ممكنة، إجريت هذة الدراسة للأدارة الجيدة لمحصول الذرة الشامية والذى يعتبرمن اهم المحاصيل الزراعية وتم زراعتة فى الأرض الرملية باستخدام الرى بالتنقيط واستخدام ثلاثة انواع مختلفة من خطوط التنقيط (GR, antiroot GR and T-tape)، لذلك كانت الأهداف الرئيسية للبحث كالتالى: إدارة نظام الرى بالتنقيط لمحصول الذرة، دراسة تأثير إضافة المحسنات على نظام الرى، تقييم الأنواع المختلفة من النقاطات، أجريت دراسة معملية بوزارة الزراعة- معهد بحوث الهندسة الزراعية- معمل الرى الحقلى تم تقييم أداء خطوط النقاطات معمليًا تحت ضغوط (٠,٥، ٠,٧٥، ١، ١,٢٥) بار آخذاً في الأعتبار كل من: تصرف النقاط، إنتظامية التوزيع، معامل اختلاف التصنيع، في حين تم التقييم الحقلي من حيث تقدير القياسات النباتية مثل ارتفاع النبات وطول الورقة وعدد الأوراق والإنتاجية وكفاءة توزيع المياه وكانت النتائج المعملية كالتالى: النقاطات الداخلية العادية (GR): معامل اختلاف التصنيع (١,٤٩) (ممتاز)، إنتظامية توزيع النقاطات (٩٣ %)، (ممتاز) $q = 4.0994\ p^{0.5}$، أما نقاط (T-tape): فكان معامل اختلاف التصنيع (٢,٩٦) (ممتاز)، إنتظامية توزيع النقاطات (٩٤%) (ممتاز) $q = 3.887\ p^{0.5}$، أما النقاط المقاوم للجذور (Anti root): فكان معامل اختلاف التصنيع (٣,١٥) (ممتاز)، إنتظامية توزيع النقاطات (٩٦%) (ممتاز) $q = 3.434\ p^{0.062}$، أما نتائج الجزء الحقلى فكانت كالتالي: أظهرت النتائج ان أعلى إنتاجية كانت للنقاط المقاوم للجذور مع استخدام الكمبوست حيث كانت الإنتاجية ٣٧٦٢ كجم/فدان، وكانت كفاءة الاستخدام المياه ١,٢٧ كجم/م^{٣} حيث كان طول الساق ١,٩م والقطر ٣٧ مم وعدد الأوراق ١٧ ورقة، وكان اقلهما في الإنتاجية النقاط المقاوم للجذور مع محسن التربة البوليمر حيث كانت الإنتاجية ٩٩٠ كجم/فدان، وكانت كفاءة استخدام المياه ٠,٣٥ كجم/م^{٣} وكان طول النبات ١,٥ م وقطر الساق ٣٥ مم وعدد الأوراق ١٤ ورقة، وكان فى المرتبة الوسطى للإنتاجية لخرطوم T-Tapeمع الكمبوست حيث كانت الإنتاجيه٣٥٩٠,٤ كجم/فدان، وكانت كفاءه استخدام المياه ١,٢٢كجم /م^{٣} وكان طول النبات ١,٧٧م وكان قطر الساق ٣٥مم وعدد الأوراق ١٥ ورقة.

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