Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.5, No.16, 2015

Mathematical Model for Maximizing Irrigation Water Benefits

A.k.Mahmoud[1*], M.E.El-Hagarey[2]

1. Chemical and soil physics department-Desert Research Center (DRC), Cairo, EGYPT
   1 mathaf el Mataria street- Mataria - Cairo- Egypt B.O.P 11753
2. Soil conservation and water resources department-Desert Research Center (DRC), Cairo, EGYPT
   1 mathaf el Mataria street- Mataria - Cairo- Egypt B.O.P 11753

Abstract
Predicting impact of alternative management for enhancing the influence of soil parameters and water management on crop production is concerning in scientific community. This paper emphasis on the soil moisture behaviour at different profiles and their relation with soil temperature and dripper's discharge using a two boxes with diminution (1m X 1m X 1m) for cultivate Fenugreek (*Trigonella foenum-graecum L.,Fam. Fabaceae*) under sandy soil texture with test a two factors. First factor is the timing of irrigation (IRR1) at the morning and (IRR2) at the evening . Second factor is adding compost (C1) (6 ton/fed) and (C2) without compost. Experiment found out that the yield recorded highest production under C1 by 847% comparing with C2 without significant influence for the timing of irrigation. Moreover; using Robust Methods to determent the mathematical relationship with different parameter [soil temperature(C°) for different depths and water quantity (L/day)] to estimate the ratio of soil moisture. Furthermore; using (matrix) Cramer's method to predict any of these parameters by know one parameter.
Keywords: soil temperature, soil moisture, timing of irrigation and mathematic relationship.

Introduction

Agriculture is an essential industry supporting the increasing population on our planet Modern technology has greatly promoted agricultural ductivity by means of genetic improvement, fertilization, pesticide applications and irrigation water management models.

Irrigation water management (IWM) is the act of timing and regulating irrigation water application in a way that will satisfy the water requirement of the crop without wasting water, soil, and plant nutrients and degrading the soil resource. Moreover; the long existing rule of thumb for soils has been that most crops should be irrigated before more than half of the available soil water in the crop root zone has been used. It has also been demonstrated that certain crops respond with higher yields and product quality by maintaining a higher available soil-water content. Policies of water resource management and inexpensive energy have encouraged many irrigators to adopt irrigation practices consistent with an abundant and inexpensive water supply. Typically, these practices were designed to avoid moisture stress and strive for maximum yield.

Moisture and water distribution under drip emitters varies both spatially and temporally (Rolston et al., 1991). Furthermore, soil moisture depletion under drip irrigation has been demonstrated to a depth of 120 cm (Stevens and Harvey, 1996).

On the other hand Irrigation during the summer months increased evaporative cooling and improved soil-heat transfer (Wierenga et al. l97l). After an irrigation event (or rain), there is a significant reduction in maximum soil temperature at shallow soil depths (Singh and Sandhu 1979). However, irrigation increases soil temperature at greater depths, thus, providing a more favourable environment for biological activity (Leonard et al. l97l). so influence in crops or plant productivity.

For instance, Fenugreek (Trigonella foenum-graecum L.,Fam. Fabaceae) is one of the oldest medicinal plants and spice. Fenugreek is believed to be native to the Mediterranean region (Petropoulos, 2002), Applications of fenugreek were documented in ancient Egypt. In modern Egypt, fenugreek is still used as a supplement in wheat and maize flour for bread-making (Ionescu and Roman, 2013).

Yield of fenugreek seed showed on different dates differed in both seasons, sowing in the first two weeks of April resulted in considerably higher yield compared to sowing at the end of April and during May, (Radojka and Jevdjovic, 2007).

Finally; using mathematical models for the simulation of soil water movement in the unsaturated zone is a precise approach to rational irrigation and the key to irrigation water saving. (H. Georgoussis et al., 2007); Most of the mathematical models are simple water balance applications in contrast to the detailed mathematical ones that solve the partial differential equation This partial differential equation describes the movement of water through unsaturated porous media, subject to appropriate boundary and initial conditions, while it accounts for the water uptake from the plant roots. The solution of this equation provides the depth distribution of soil water in a cultivated soil at one point in time.

The objectives of this study were to 1) determine the soil moisture and soil temperature behaviour under drip irrigation system to irrigate a Fenugreek plant. 2) Obtain a mathematical model describes this relation

which; contribution for maximizing irrigation water management.

Material and methods

The experiment was carried out in the cairo in north Egypt (latitude 30°07'40.42" N; longitude 31°20'53.33" E) in 2014 and 2015. This is a semi-arid area with a Mediterranean climate of hot, dry summers and wet winters. The mean annual air temperature is 21.4 °C, with the highest (34.6 °C) in July. Annual Penman-Montheith reference evapotranspiration amounts to 1869 mm, the highest of 234 mm occurring in July.

Furthermore; [fig(1)].using a two boxes with diminution (1m X 1m X 1m) for cultivate Fenugreek (*Trigonella foenum-graecum L.*,Fam. Fabaceae) on April under sandy soil texture , none saline, and none calcareous. Silt and clay content are quite low there for both field capacity and available water are very low 6.2 % and 5.1 %. Those boxes equipped with drip irrigation system (4L/h).

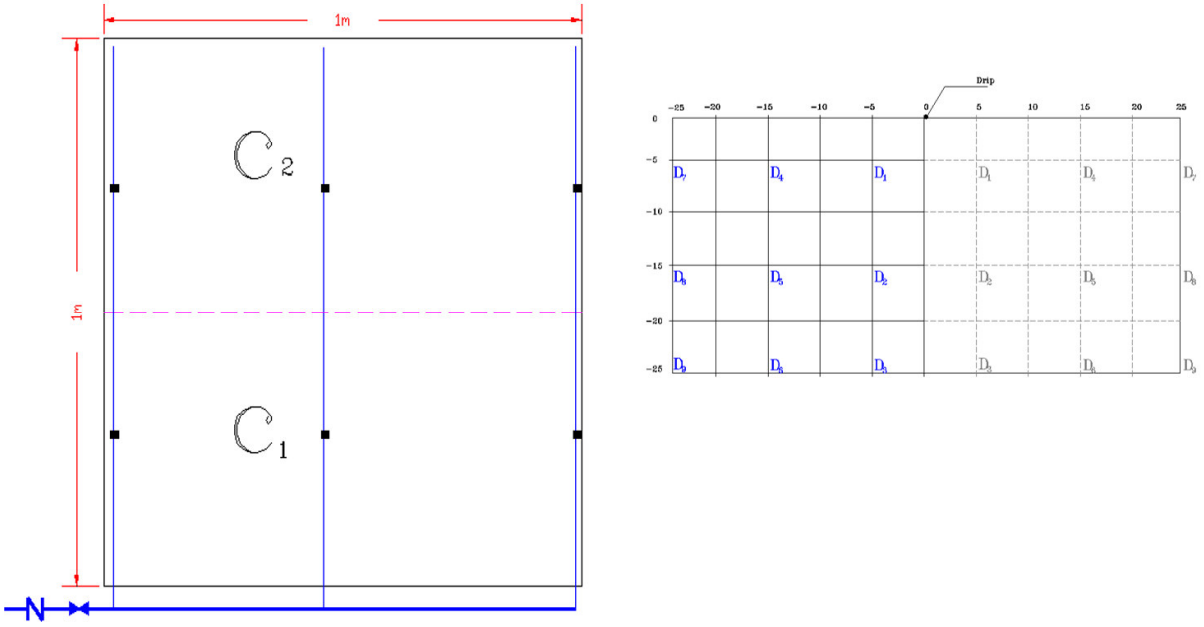

Figure 1. Layout of distribution factors and measuring points

After that; dividing the box into two section first for applying compost (C1) (6 ton/fed) and the other (C2) without compost then start irrigation treatments (IR1) for irrigating first box at the morning and (IR2) for irrigating second box at the evening as a perpendicular on the compost factor.

The total water applied for Fenugreek is (3281.15 m^3/fed) which distributed throw growing season to (99.75mm, 217.6mm, 354.37mm and 109.5mm) from April to July respectively.

Analyses of soil and some physical and chemical analyzed according to Martin, (1993). The soil of the experimental site is sandy texture, none saline, and none calcareous. Silt and clay content are quite low there for both field capacity and available water are very low 5.6 % and 4.5 %.

The data were analyzed using the three way ANOVA split plot procedure with Duncan's HSD test at $p<0.05$ using the NCSS10.0.05 System software.

1. Measurements and calculations

In addition; using (TDR300) Soil moisture meter to measure soil water content and soil temperature for horizontal and vertical axis for left and right sides from dripper point for instance $D_n(X_n,Y_n)$ [D_1(5,-5)-D_2(5,-15)-D_3(5,-25)-D_4(15,-5)-D_5(15,-15)-D_6(15,-25)-D_7(25,-5)-D_8(25,-15)-D_9(25,-25)] as shown in fig (1) .

Mathematic model using "Robust Methods" Portnoy S. and He, X.(2000) Provides an alternative to least squares regression that works with less restrictive assumptions. Specifically, it provides much better regression coefficient estimates when outliers are present in the data. Outliers violate the assumption of normally distributed residuals in least squares regression. They tend to distort the least squares coefficients by having more influence than they deserve. Typically, you would expect that the weight attached to each observation would be about 1/N in a dataset with N observations. However, outlying observations may receive a weight of 10, 20, or even 50 %. This leads to serious distortions in the estimated coefficients. Robust method is an iterative procedure that seeks to identify outliers and minimize their impact on the coefficient estimates

Several families of robust estimators have been developed. This estimator minimizes the sum of a function p (0) of the residuals. That is, these estimators are defined as the β's that minimize.

$$\min_{\beta} \sum_{j=1}^{N} \rho(y_{j-}x'_{j}\beta) = \min_{\beta} \sum_{j=1}^{N} \rho(e_j)$$

M in M-estimators stands for maximum likelihood since the function $\rho(\cdot)$ is related to the likelihood function for a suitable choice of the distribution of the residuals. In fact, when the residuals follow the normal distribution, setting results in the usual method of least squares $p(u)= 0.5U^2$ Unfortunately, M-estimators are not necessarily scale invariant. That is, these estimators may be influenced by the scale of the residuals. A scale-invariant estimator is found by solving .He, X. and Portnoy, S.(1992)

$$\min_{\beta} \sum_{j=1}^{N} \rho \frac{(y_{j-}x'_{j}\beta)}{s} = \min_{\beta} \sum_{j=1}^{N} \rho(\frac{e_j}{s})$$

Where **S** is a robust estimate of scale. The estimate of **S** is

$$S = \frac{median\ |e_j - median(e_j)|}{0.6745}$$

This estimate of S yields an approximately unbiased estimator of the standard deviation of the residuals when N is large and the error distribution is normal. The function

$$\sum_{j=1}^{N} \rho\left(\frac{(y_{j-}x'_{j}\beta)}{s}\right)$$

Is minimized by setting the first partial derivatives of ρ(·) with respect to each to zero which forms a set of p + 1 nonlinear equations βi

$$\sum_{j=1}^{N} X_{ij}\omega\left(\frac{(y_{j-}x'_{j}\beta)}{s}\right) = 0; \quad i = 0,1, \dots\dots\dots, p$$

Where $\omega(u) = p'(u)$ is the influence function

1.1 Cramer's method.

Cramer's rule is an explicit formula for the solution of a system of linear equations with as many equations as unknowns, valid whenever the system has a unique solution. Zhiming Gong,*et al* (2002)**;** It expresses the solution in terms of the determinants of the square coefficient matrix and of matrices obtained from it by replacing one column by the vector of right hand sides of the equations

General case:

$$X_i = \frac{\det(A_i)}{\det(A)} \qquad i = 1, \dots\dots\dots\dots\dots, n$$

And about the determinant of a matrix for :

$$A_{ij} = \begin{pmatrix} a_{1,1} \dots\dots a_{1,j-1} & a_{1,j+1} \dots\dots\dots\dots a_{1,n} \\ a_{i-1,1} \dots\dots a_{i-1,j-1} & a_{i-1,j+1} \dots\dots\dots\dots a_{i-1,n} \\ a_{i+1,1} \dots\dots a_{i+1,j-1} & a_{i+1,j+1} \dots\dots\dots\dots a_{i+1,n} \\ a_{n,1} \dots\dots a_{n,j-1} & a_{n,j+1} \dots\dots\dots\dots a_{n,n} \end{pmatrix}$$

The determination can be calculated with this formula.

$$\det(A) = \sum_{j=1}^{N} a_{i,j}(-1)^{i+1}\det(A_{i,j})$$

Result Discussion

1. Yield production

As shown at fig (2) data indicated that there is a significant effect of yield production under (C1) which recorded 847% comparing with (C2). on the other hand there is no any significant influence in yield production whenever applied (IR1) or (IR2) both of them achieved 790kg/fed as an average.

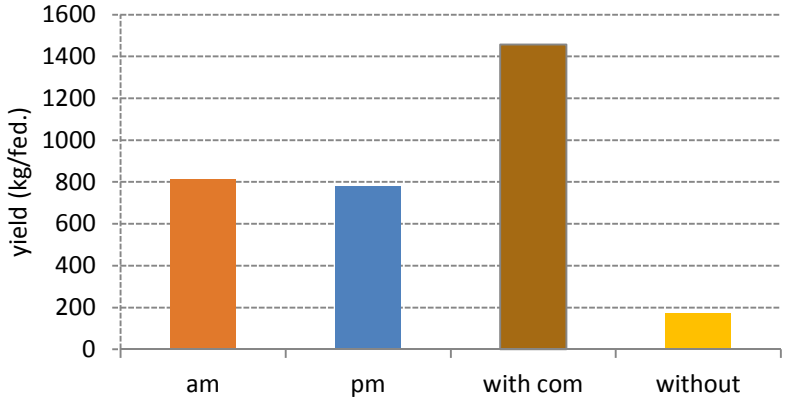

Figure 2. Influence of treatments on yield production.

2. Soil temperature distribution.

As shown it table (1) the data present that there are a significant effect for (IR1) and (IR2) on soil temperature on various depths whatever near or far from dripper at May and June however at first month for seedling (April) the significant influence recorded at (Td_1 & Td_2 and Td_3) and there is no any significant disparate for data at (Td_4,Td_5,Td_7,Td_8) this may related to that applied low amount of water at the first stage thus the contribution of their influence appeared at the nearest distance to dripper comparing with other distance which placed far from dripper. On the other hand, at (Td_6 and Td_9) data reflect a significant influence for (IR1 and IR2). May this action appeared inasmuch as they placed at the end of section thus the influence of water may appear on temperature's value comparing with Td_9.consequaently.

In addition, as shown in fig (3). The distribution soil temperature (DST) has a different behaviour related to IRR1 and IRR2 also C1 and C2. For instances; DST under C1 at April has high record 26C°for short distance at the IRR1treatment; furthermore, under IRR2 the same value recorded for long distance below the dripper. On the other hand, DST under C2 has patches values below the dripper whatever applying IRR1 or IRR2 treatments.

Moreover, on May the DST recorded almost a similar values among IRR1 and IRR2 treatments but between C1 and C2 treatments values has a different behaviour where under C1 the high value 30C° recorded for short distance no more than 7cm below the dripper but under C2 the same value has recorded no more than 11cm below the dripper whatever the time of irrigation.

Furthermore; on June the DST has different behaviour related the influence of treatments. For instance; after applied IRR1 under the two treatments C1 and C2 the observation of values recorded high soil Temperature 32 C° at 12 cm behind the dripper but

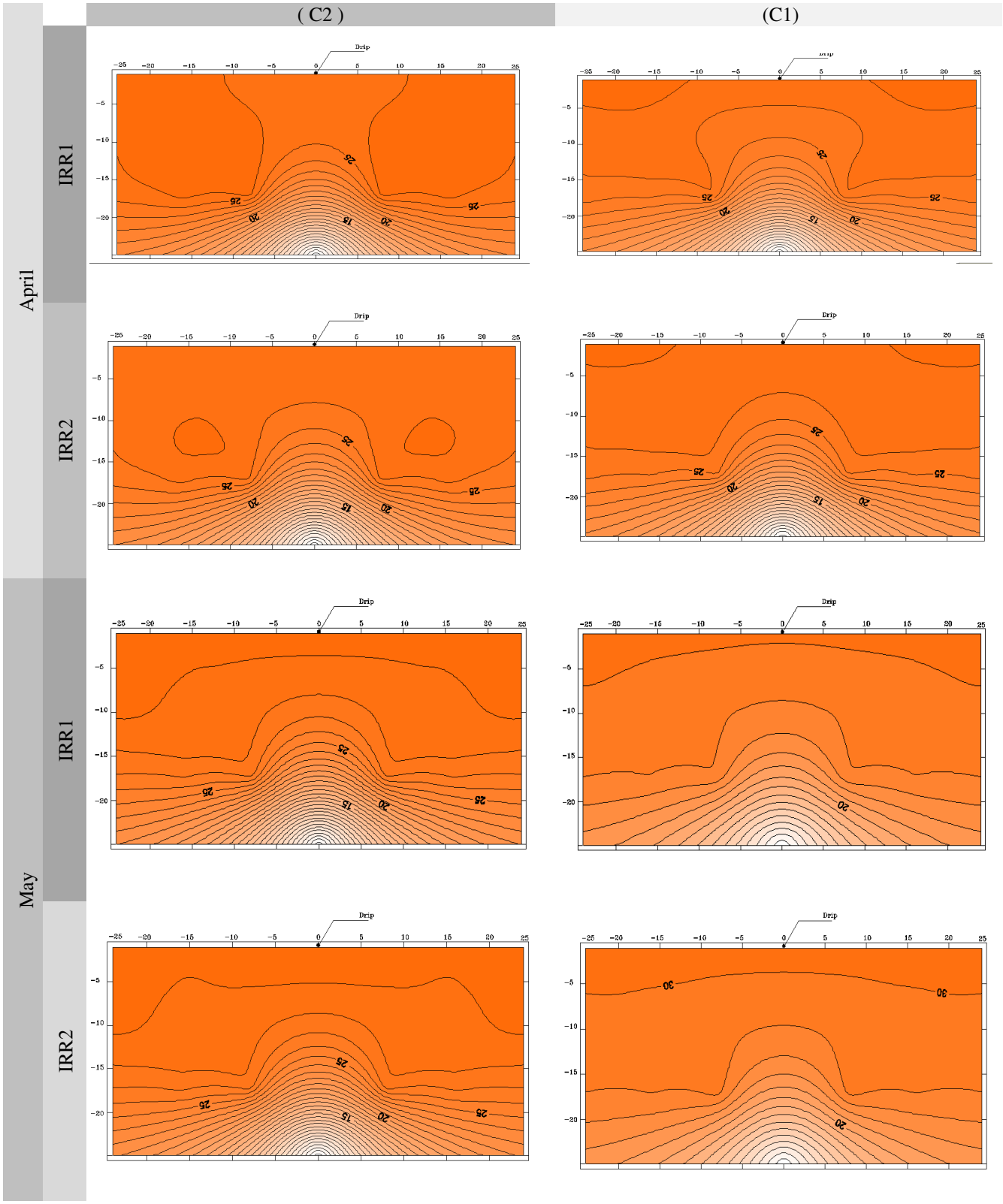

Figure 3. Influence of treatments on distribution of soil temperature.

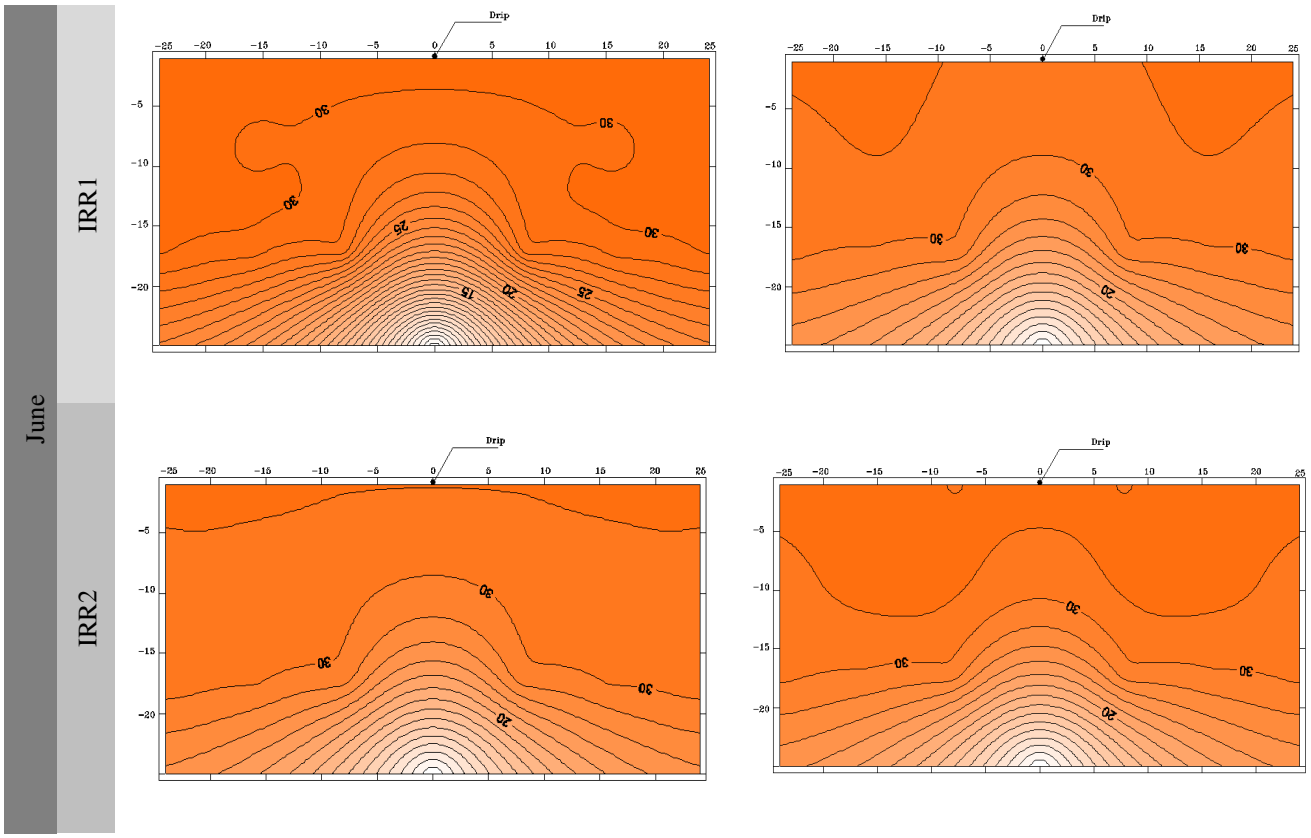

Figure 3. Continue. Influence of treatments on distribution of soil temperature.

Under C2 this value did not recorded. on the other hand; after applied the IRR2 the DST has recorded the high value 32 C° under both treatments C1 and C2 but under C1 this value observed for short distance 5 cm below the dripper compare with C2 which observed the same value for long distance 13cm below the dripper.

3. Soil moisture distribution. (SMD)

As shown it table (2) the data present that there are a significant influence for (IR1) and (IR2) on soil moisture on various depths whatever near or far from dripper at April and May however at the end of season (June) the significant influence recorded at all depths under both treatments however at (Md_2 and Md_6) there is no any significant effect under treatment IRR1 and IRR2.may this data observed related to that the value for air temperature at these months was very high thus effect on evaporation from soil surface so data recorded with significant influence. in addition; at the last period of plant the the total water applied was low amount of water comparing with deferent stages of plant thus there is not significant influence for some depths (Md_2 and Md_6).

As shown in fig (4). The soil Moisture distribution (SMD) has a different behaviour related to IRR1 and IRR2 also C1 and C2. For instances; SMD under C1 at April has a homogenous for vertical and horizontal axis comparing with SMD under C1where the water cover the long distance from dripper comparing with C2. in addition; the IRR2 recorded the high performance water distribution under C1 and C2. however; the best performance for applied IRR2 with C1. may this happened because that the irrigation action done at noon with adding some compost on soil which helping to retention the water at different depths and wide distances from dripper.

	April				May				June			
	am	**pm**	**without**	**with com**	**am**	**pm**	**without**	**with com**	**am**	**pm**	**without**	**with com**
Td1	26.1a	25.8b	26.3a	25.6b	29.05b	29.3a	27.9b	30.45a	29.21a	29.35a	28.95a	29.61a
LSD0.05	0.138		0.215		0.0801		0.215		0.622		0.727	
Td2	25.8b	26.3a	26.2a	25.9b	29.5b	29.7a	29.35b	29.85a	30.25b	31.55a	30.1b	31.7a
LSD0.05	0.8		1.49		0.179		0.124		0.0801		0.447	
Td3	26.11b	26.7a	26.2b	26.6a	31b	31.4a	30.7b	31.7a	31.05b	32.05a	31.25b	31.85a
LSD0.05	0.185		0.189		0.08		0.124		0.212		0.124	
Td4	25.85a	25.85a	26.4a	25.3a	29.2b	29.55a	29.15b	29.6a	29.65b	30.15a	30a	29.8a
LSD0.05	0.768		1.432		0.196		0.248		0.16		0.248	
Td5	26.5a	26.6a	26.7a	26.4b	30.15a	31.05b	30b	31.2a	30.9b	31.9a	30.55b	32.25a
LSD0.05	0.16		0.124		0.138		0.328		0.113		0.124	
Td6	27a	26.35b	25.95b	27.4a	31.25b	31.65a	30.2b	31.1a	31.4b	32.45a	31.3b	32.55a
LSD0.05	0.113		0.124		0.113		0.328		0.0801		0.124	
Td7	25.5a	25.4a	25.5a	25.4a	29.8b	30.1a	29.75b	30.15a	30.35b	30.95a	30.75a	30.55a
LSD0.05	0.113		0.328		0.138		0.328		0.179		0.215	
Td8	26.35a	26.15a	26.4a	26.1a	30.5b	30.85a	30.25b	31.1a	30.75b	31.55a	30.5a	30.31a
LSD0.05	0.764		1.308		0.113		0.248		0.226		0.215	
Td9	27.1a	26.9b	26.6b	27.4a	31.25b	31.6a	30.8b	32.05a	31.35b	32.35a	31.35b	32.35a
LSD0.05	0.277		0.124		0.179		0.124		0.113		0.215	

Table 1. Effect of treatments factors on soil temperature distribution.

	April				May				June			
	am	**pm**	**without**	**with com**	**am**	**pm**	**without**	**with com**	**am**	**pm**	**without**	**with com**
Md1	13.05b	14.25a	12.95b	14.35a	13.6b	14.6a	13.4b	14.7a	12.8b	13a	11.65b	14.15a
LSD0.05	0.844		1.103		0.196		0.215		0.179		0.372	
Md2	13.16b	14a	12.75b	14.416a	13.5b	13.8a	12.95b	14.35a	13.1a	13.1a	11.9b	14.3a
LSD0.05	0.046		0.189		0.138		0.215		0.08		0.372	
Md3	12.816b	13.9a	14.16a	12.55b	12.85b	14.2a	12.55b	14.5a	12.3b	12.8a	11.85b	13.95a
LSD0.05	0.092		0.312		0.179		0.124		0.16		0.43	
Md4	11.61a	12.3a	9.55b	14.36a	11.05b	11.75a	8.9b	13.9a	11.05b	11.5a	8.25b	14.3a
LSD0.05	0.774		1.316		0.16		0.215		0.179		0.215	
Md5	11.25b	11.9a	9.15b	14a	10.75b	11.55a	8.6b	13.7a	10b	10.3a	13.15a	7.15b
LSD0.05	0.138		0.124		0.0801		0.372		0.16		0.248	
Md6	10.95b	11.63a	8.93b	13.65a	10.45b	10.65a	7.9b	13.2a	9.7a	9.7a	6.6b	12.8a
LSD0.05	0.217		0.071		0.179		0.124		0.113		0.328	
Md7	10.65b	11.85a	8.8b	13.7a	10.1b	11.7a	8.5b	13.3a	10.65a	10.4b	7.5b	13.55a
LSD0.05	0.896		1.1178		0.212		0.124		0.08		0.447	
Md8	10.316b	11.8a	8.55b	13.56a	9.85b	11.6a	8.2b	13.1a	10.05b	10.3a	6.85b	13.5a
LSD0.05	0.046		0.189		0.226		0.328		0.179		0.215	
Md9	10.2b	11.3a	8.15b	13.35a	9.85b	11.033a	7.53b	13.35a	10.28a	9.5b	6.53b	13.25a
LSD0.05	0.179		0.124		0.244		0.143		0.146		0.436	

Table 2. Effect of treatments factors on soil moisture distribution.

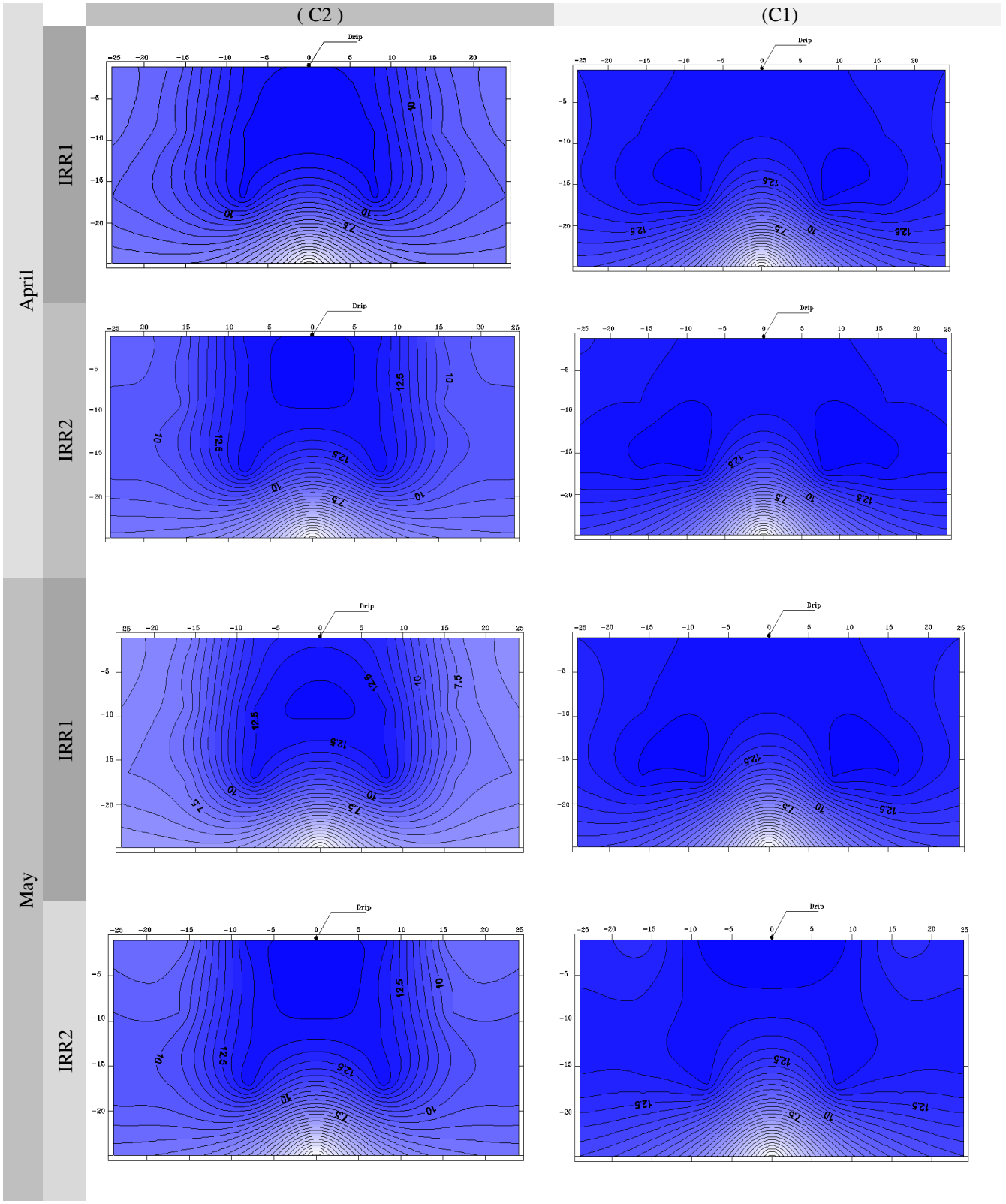

Figure 4. Influence of treatments on distribution of soil moisture.

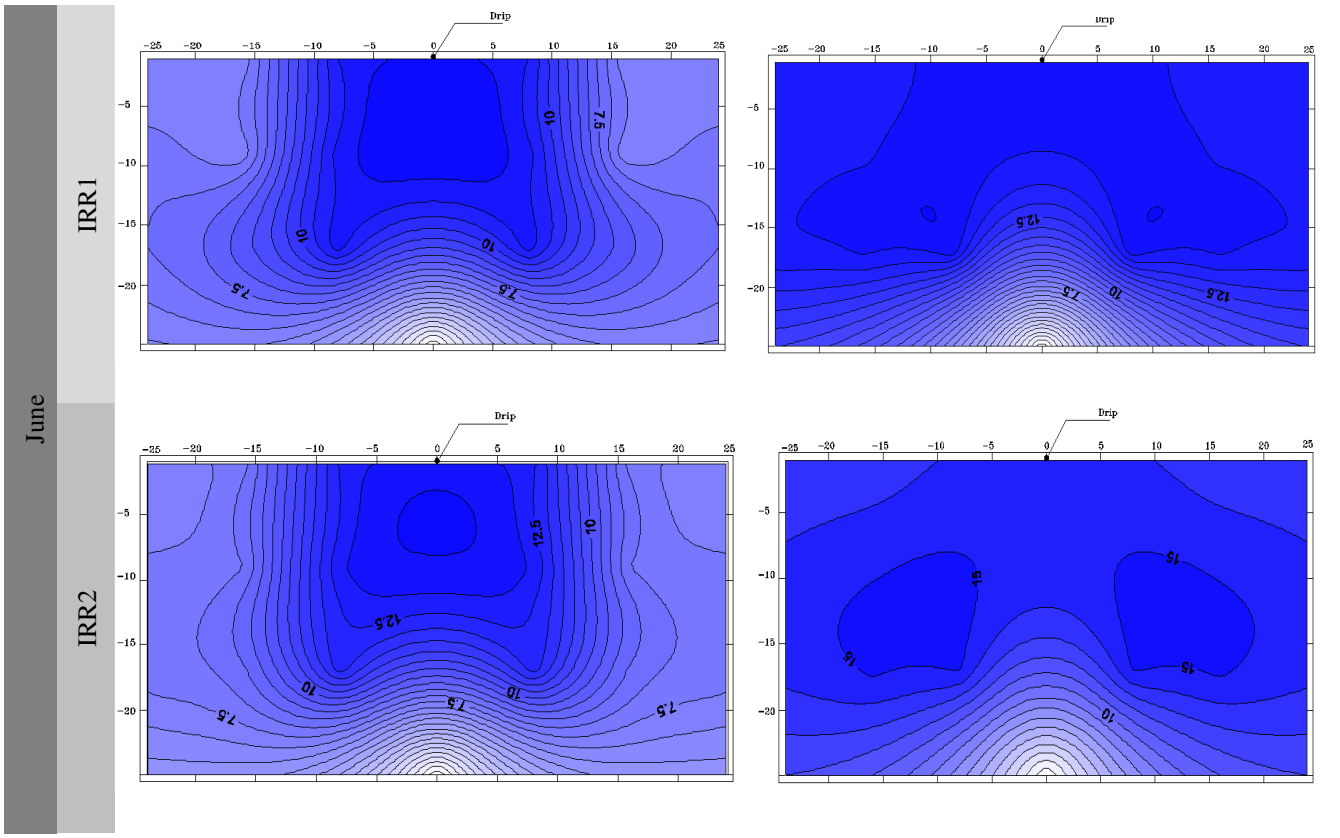

Figure 4. Continue. Influence of treatments on distribution of soil moisture

On the other hand; at May the value of SMD has a different behaviour related to increasing air temperature value specially with treatments IRR1 and C2 where SMD acquired the short distance from dripper under C1 comparing with observation data at April for the same treatment. Moreover; under IRR2 the data acquired the same behaviour by short distance comparing with the treatment on April. But the best identity of the SMD observed under IRR2 and C1 too.

Likewise; on June the SWD acquired the same behaviour on May under different treatments and the best homogenous distribution also acquired with IRR2 and C1. This help to explain that the data of yield production acquired highest value under C1 comparing with C2 may that SWD performance is significant homogenise which helped to make a good environment for growth crops.

Finally; Mathematic relation using Robust and Cramer's methods to explain the behaviour for influence water quantity and soil temperature to estimate soil moisture for specific depth under C1 is:-

$$M\begin{pmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \\ d_5 \\ d_6 \\ d_7 \\ d_8 \\ d_9 \end{pmatrix} = \begin{pmatrix} 29.858 \\ 20.13 \\ 31.236 \\ 27.23 \\ 24.897 \\ 19.652 \\ 34.52 \\ 29.074 \\ 31.73 \end{pmatrix} + td_1 \begin{pmatrix} 0.113 \\ -0.184 \\ -0.220 \\ 0.015 \\ 0.005 \\ 0.287 \\ -0.04 \\ -0.156 \\ 0.054 \end{pmatrix} - td_2 \begin{pmatrix} 1.205 \\ 0.645 \\ 2.058 \\ 0.595 \\ 0.870 \\ -0.078 \\ 1.292 \\ 1.152 \\ 1.418 \end{pmatrix} + td_3 \begin{pmatrix} 0.623 \\ 0.003 \\ 0.498 \\ 0.565 \\ 0.607 \\ 0.853 \\ 0.85 \\ 0.855 \\ 1.347 \end{pmatrix} + td_4 \begin{pmatrix} 1.496 \\ 1.002 \\ 2.603 \\ 0.504 \\ 0.606 \\ -0.331 \\ 2.606 \\ 2.660 \\ 1.306 \end{pmatrix} - td_5 \begin{pmatrix} 0.250 \\ 0.323 \\ -0.447 \\ 0.877 \\ 0.273 \\ 0.845 \\ -0.218 \\ -0.364 \\ 0.305 \end{pmatrix}$$

$$- td_6 \begin{pmatrix} 2.275 \\ 0.498 \\ 3.5 \\ 0.903 \\ 1.574 \\ 0.188 \\ 3.760 \\ 3.021 \\ 2.346 \end{pmatrix} - td_7 \begin{pmatrix} 3.088 \\ 0.833 \\ 3.674 \\ 0.817 \\ 1.646 \\ 0.084 \\ 3.533 \\ 2.897 \\ 3.076 \end{pmatrix} + td_8 \begin{pmatrix} 4.024 \\ 1.437 \\ 4.125 \\ 1.751 \\ 1.941 \\ 0.155 \\ 3.67 \\ 2.692 \\ 3.287 \end{pmatrix} + td_9 \begin{pmatrix} -0.317 \\ -0.276 \\ 0.78 \\ -0.348 \\ 0.603 \\ 0.091 \\ 0.204 \\ -0.123 \\ 0.093 \end{pmatrix} + Q \begin{pmatrix} 2.212 \\ 0.856 \\ 2.442 \\ 1.585 \\ 1.153 \\ 0.362 \\ 2.525 \\ 1.9 \\ 2.368 \end{pmatrix}$$

On the other hand; under C_2 the equation is

$$M\begin{pmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \\ d_5 \\ d_6 \\ d_7 \\ d_8 \\ d_9 \end{pmatrix} = -\begin{pmatrix} 36.005 \\ 28.605 \\ 66.305 \\ 99.974 \\ 73.445 \\ 38.334 \\ 102.512 \\ 108.054 \\ 83.031 \end{pmatrix} + td_1\begin{pmatrix} 0.445 \\ 0.276 \\ 1.715 \\ 2.473 \\ 1.763 \\ 1.423 \\ 2.627 \\ 2.879 \\ 2.668 \end{pmatrix} - td_2\begin{pmatrix} 0.273 \\ -0.065 \\ 0.0746 \\ 0.434 \\ 0.208 \\ 0.091 \\ 0.09 \\ 0.388 \\ 0.246 \end{pmatrix} + td_3\begin{pmatrix} 0.669 \\ 0.677 \\ 0.472 \\ -0.229 \\ 0.0236 \\ -0.086 \\ -0.199 \\ 0.101 \\ 0.222 \end{pmatrix} + td_4\begin{pmatrix} 2.554 \\ 2.377 \\ 3.179 \\ 4.108 \\ 3.128 \\ 1.006 \\ 4.103 \\ 3.821 \\ 3.014 \end{pmatrix} + td_5\begin{pmatrix} 1.205 \\ 1.069 \\ 1.090 \\ 3.838 \\ 2.084 \\ 1.126 \\ 1.676 \\ 2.757 \\ 0.526 \end{pmatrix} -$$

$$td_6\begin{pmatrix} 0.419 \\ 0.336 \\ 1.203 \\ 0.376 \\ 0.793 \\ 0.982 \\ 1.744 \\ 1.445 \\ 1.788 \end{pmatrix} + td_7\begin{pmatrix} 0.218 \\ 1.129 \\ 2.408 \\ 1.880 \\ 1.241 \\ 1.419 \\ 4.098 \\ 2.850 \\ 2.988 \end{pmatrix} - td_8\begin{pmatrix} 1.608 \\ 2.426 \\ 2.957 \\ 4.69 \\ 2.956 \\ 0.942 \\ 4.568 \\ 3.601 \\ 2.621 \end{pmatrix} - td_9\begin{pmatrix} 0.657 \\ 0.999 \\ 1.171 \\ 1.956 \\ 0.721 \\ 0.714 \\ 0.991 \\ 1.896 \\ 0.701 \end{pmatrix} - Q\begin{pmatrix} 1.983 \\ 1.680 \\ 2.834 \\ 3.159 \\ 2.953 \\ 2.294 \\ 4.124 \\ 4.133 \\ 3.611 \end{pmatrix}$$

Where:-

Md_n = Ratio of soil moisture for specific depth (%).

Td_n = soil temperature for specific depth (C°).

Q = the amount of water from dripper (Litter).

Conclusion

It could be concluded from these obtained results that the time of irrigation has not the effective influence on yield and crop production. Nevertheless; adding compost with (6 ton/fed) effect on both yield by 847% and ratio of soil moisture. Moreover; the mathematic model helping to determine the relation between soil temperature under different depths with water discharge from dripper and the ratio of soil moisture which trace on ideal water management under such conditions.

Reference

H. Georgoussis, c. Babajimopoulos, a. Panoras, g.Arampatzis, v. Hatzigiannakis, d. Papamichail.(2007). Regional Scale Irrigation Scheduling using a Mathematical Model and GIS. Water Resources Management: New Approaches and Technologies, European Water Resources Association, Chania, Crete - Greece, (14-16th June, 2007, 299-306.

He, X. and Portnoy, S.(1992) "Reweighted LS Estimators Converge at the same Rate as the Initial Estimator," *Annals of Statistics* Vol., 20, No.4, 2161–2167

Ionesuc, A. M. and Gh. V. Roman, (2013). Research on biology, productivity and yield quality of Trigonella foenum-graecum L. species (Fenugreek) in the Central Part of the South Romanian Plain. Scientific Papers Series A. Agronomy, Vol., LVI, 395-397.

Leonard, R. E., Leaf, A. L., Berglund, J. V. and Craul, P. l. (1971). Annual soil moisture temperature patterns as influenced 7y irrigation. Soil Sci., ll,220-227.

Martin. R.Carter.(1993).Soil Sampling and Methods of analysis.Lewis Publication, chapter (3).

Petropoulos, G. A., (2002). Fenugreek- The genus Trigonella, Taylor & Francis Inc Publishing House, London, chapter (1).

Portnoy S. and He, X.(2000). "A Robust Journey in the New Millennium," Journal of the American Statistical Association Vol., 95, No.452, 1331–1335

Radojka, M. and R. Jevdjovic, (2007). Sowing date-the factor of yield and quality of fenugreek seed (*Trigonella foenum-graecum L.*). journal of Agricultural Sciences, vol., 52 (1),1-8

Rolston, D.E., J.W. Biggar, and H.I. Nighingale.(1991). Temporal persistence of spatial soil water patterns under trickle irrigation. Irr. Sci.,12,181–186.

Singh, B. and Sandhu, B. S.(1979). Effect of irrigation, mulch and crop canopy on soil temperature in forage maize. J.Indian Soc. Soil Sci., 27, 225-235.

Stevens, R.M. and G. Harvey. (1996). Soil water depletion rates under large grapevines. Aust. J.Grape Wine Res., 2,155–162.

Wierenga, P. J., Hagan, R. M. and Gregory, E. J.(1971) . Effects of irrigation water temperature on soil temperature. Agron. J., 63, 33-36.

Zhiming Gong, M. Aldeen and L. Elsner (2002). "A note on a generalized Cramer's rule". Linear Algebra and its Applications , 340, 253–254

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
http://www.iiste.org

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: http://www.iiste.org/journals/ All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: http://www.iiste.org/book/

Academic conference: http://www.iiste.org/conference/upcoming-conferences-call-for-paper/

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar