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EVALUATION THE PERFORMANCEOF BIOLOGICAL TREATMENT IN THE SCARCITY OF IRRIGATION WATER CONDITIONS ON MAIZE (*ZEA MAYS* L.)

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ABSTRACT

The current study focuses on the use of biological treatment, with the goal of finding ways to cope with water scarcity and understanding the physiological adaptations of corn plants to drought**.** A field study was conducted from March 2014 to June 2014 to investigate the influence of different concentrations of Salicylic acid (0, 50, 100, 200, 300 ppm) to reduced the effect of water deficit on vegetative growth and grain yield of sweet corn (*Zea maize* L.) under different irrigation levels (25%, 50%, and 75%). Specifically, a clear increase was noted in the leaf area index, root length (cm) and number of Cob perplant. The corn was sprayed with Salicylic acid (0, 50, 100, 200, 300 ppm) under water deficit conditions. Corn plants positively responded to the spraying of Salicylic acid. The corn plants were most tolerant of drought when sprayed with 300 ppm Salicylic acid. The use of Salicylic acid is an innovative and promising way to reduce the impact of drought on the plant growth and production.

KEYWORDS: Biological Treatment, Water Deficitconditions, Salicylic Acid, Maize.

INTRODUCTION

The scarcity of water in arid and semi-arid areas makes irrigation in a timely manner necessary to maintain crop productivity, especially as the yield decreases much as the soil becomes more dry, adding irrigation water in quantities and distributing it uniformly in the field ensures optimal and efficient use of water for optimal production [1]. The availability of such crops, which can use water efficiently and maintain a good value makes them useful in semi-dry and dry areas [2]. The control of plant density in the productivity of the crop through the efficiency of its opposition to the sun required by photosynthesis and competing with other growth requirements makes the number of plants in the Unit area of the necessary practices. Explain [3] that both the quantity and distribution of water significantly affect the grain yield. The shortage of soil water during the period of growth of sun flower, soybean and maize crop leads to a decrease of 90%, 09% and 20% respectively.

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The lack of water determines the length of the leg and the breadth of the paper, and the lack of water reduces the process of carbon representation, and increase breathing [4]. The effect of plant height was significantly increased by increasing the water stress, where the height of the plant decreased from 0.08 cm to 00 cm when giving 022% and 02% of the field capacity, and this corresponds to what happened. Water decreased the yield of grain and its components when using three levels of irrigation and the reduction rate was 59% compared to the treatment of full irrigation [5].Salicylic acid is a crystalline powder that is melted at a temperature of 107-109 ° C, which is the average solubility in water and very soluble in organic solvents [6]. It is characterized by its rapid transition in plant parts from treated areas to other regions (37, 38 and 39) It has a role in the efficiency and transfer of ions and is involved in stimulating certain changes in leaf regulation and the installation of green plastids, participates in endogenous signaling events and enters into defense against the causative (30) [7]. It has a role in stimulating the resistance by stimulating the production of proteins (26 and 42). PR-protein with associated diseases.

MATERIALS AND METHODS

EXPLANATION OF STUDY

The study was divided into several stages for the purpose of studying the effect of water deficit, and Salicylic acid in more detail and find out the effect of these factors combined to increase the productivity and resistance of maize (Zea mays L.) under water deficit conditions.

This study was conducted at the Agro Technology Research Station, University Malaysia Perlis Padang Besar, Perlis, Malaysia. Soil samples were taken from the field before planting it was crushed and then passed from the sieve diameter of the openings to estimation some of the chemical and physical parameters of the soil study.

The methods used as follows:

1. Soil texture: estimated by the pipette method as set out in [8] explained in [9].
2. Bulk density: estimated in a core sampler method [8] explained in [10].

The soil sample was taken by a vicious cylinder (moist soil) from three different places of experiment field. The soil was chosen randomly. The diameter and height of the cylinder, was measured the sample and then weighed the samples in a sensitive balance and values of these weights was recorded, and then the samples was placed in an oven with temperature of 105 ° c for 8 hours.

Bulk Density (BD) =$[M \div D] \times L$ Equation (3.1)

BD = bulk density of the soil (g / cm 3).

M = dry sample weight (grams).

D = cylinder diameter (cm).

L = Length of the cylinder (cm).

3. Electrical conductivity EC: measured in the extract of saturated dough by using a conductivity bridge by way of [11] explained in [12].
4. Soil moisture: estimated the percentage of the soil moisture at tensile 33 kpa (field capacity) and 1500 kpa (The wilting point) by using a pressure membrane apparatus pressure plate by the method reported by [8] explain in [13].

The percentage of soil moisture is measured on a dry weight basis to calculate the percentage of soil moisture taken a sample of moist soil from 3 different places, at least on the experiment field these places are selected randomly, weighed samples in a sensitive balance and recorded the values of these weights samples be placed in an oven with temperature of $105^{\circ C}$ for 8 hours, and use the following formula to calculate the moisture content of the soil:

MC= $W1 - W2$ Equation (3.2)

MC = moisture content of the soil depending on the dry weight (%).

W_1 = weight of moist sample (grams).

W_2 = weight of dry sample (grams).

5. Determination of soil reaction (pH): the measurement in leaky saturated soil dough by using pH-meter according to method cited by [11], [14].
6. Determine of matter: The organic matter was determined by weighing one gram of air-dried soil sample in an Erlenmeyer flask of 500 ml capacity. 10 ml of 1N potassium dichromate solution was added at the rate of 10 ml per sample and 20 ml of sulfuric acid (concentrated) was added by means of a pipette. The sample was mixed by shaking and left for 30 minutes. Distilled water at the rate of 150 ml and 0.5 N ferrous sulfate solution at the rate of 25 ml was added to the sample and the excess was titrated using 0.1 N solution of potassium permanganate to pink end point (Moodie *et al*., 1959).
7. Available nitrogen in the soil :ready nitrogen in the soil is estimated by using a micro-Kjeldahl device according to the method of [11].
8. Phosphorus determine: estimated according to the method (Olson) as stated [11].
9. Potassium: extraction by using an ammonium acetate solution (1n) was estimated by optical flame device flame photometer as stated in [8]. All results were recorded in Table 3.1.

Table 1.The chemical and physical properties of the soil before planting

Measurement	Value
Electrical conductivityds.m^{-1}	4.89
The degree of soil interaction	7.35
Nutrients:	
Total nitrogen (N) %	1.12
Available Phosphors (P) (mg.kg^{-1} soil)	32
Potassium (K) (mg.kg^{-1} soil)	96.1
Organic Metter (OM) %	0.18
Apparent density megagram/m^3	1.22
Volumetric distribution of separate soil)G. kg $^{1-}$soil(	
Sand	70.32%
Clay	10.74%
Silt	18.94%
Conception	Sandy Loam
Percentage soil moisture when pulling 33 KPa	18.4
Percentage soil moisture when you lift 1500 kPa	6.6

DETERMINE THE FIELD CAPACITY OF THE SOIL

The field capacity of the soil used in the experiment, by taking a small can (known weight) perforated from the base and put a wet filter paper in the base of the can and weighed out, after that we put the (100) grams of the soil and then flooded the base of the can in container contains a water and left the soil until saturated by water, and it came out of the container and leave it until the last drop of water then weighed again [15], the method of calculation as follows:

The moisture content of the soil =.. $$\frac{\text{Weight of dry soil}}{\text{Weight of saturated soil} - \text{weight of dry soil}} \quad (3.3)$$

The percentage of the water in 100 grams of the soil = Field capacity (3.4)

PREPARATION OF SALICYLIC ACID

It was sprayed salicylic acid (0, 50, 100, 200 and 300ppm) was prepared as follows:

salicylic acid at the rate of one gram was taken and dissolved in some drops of ethanol 95% (ethyl alcohol) when the dissolve it with 1 liter of distilled water (1000 ml) gives a solution concentration 1000 mg. liter [16]. Prepared the concentration of 50 mg. liter by taking 50 ml of the original solution (concentration of 1000 mg. Liter) It was completed to size 1000 ml of distilled water, to prepare the concentration of 100 mg. Liter then taking 100 ml of the original solution and has been completed to 1000 ml, and repeated the same method with the other concentrations by using the mitigation equation [17]:

C_1 =the concentration of stockpiling.

V_1 = Original size for solution (stockpiling).

C_2 = Required concentration.

V2 =the required size.

(C1V1 = C2V2) Equation (3.6)

These concentrations were sprayed once on leaves at the stage of (4-6) leaves. Tween (80) at the concentration of (0.025) % was added to the foliar solution as surfactant agent. Spraying processes were carried out during the morning (6 am) until the solutions were run off all plants by using a manual sprayer.

LEAF AREAINDEX (LAI)

The leaf area index was considered the important productivity indicators, which gives a clear visualization about the efficiency of solar rays interception and advantage in the photosynthesis for the plant. Table 1 indicates the effect of water deficit on the leaf area index, LAI is defined as the ratio of total upper leaf surface of vegetation divided by the surface area of the land on which the vegetation grows.

The results described in Table 2 showed the significant influence of the interactions between the levels of irrigation and sprayed Salicylic acid on plants. Statistical data analysis detection superiority the interactions (25% of field capacity and 300ppm Salicylic acid) in the highest rate of leaf area index reached (3.27) with a significant difference from the other interactions, while the lowest rate for leaf area index it has been in interactions (75% of field capacity and 0ppm Salicylic acid) reached to (1.66), this was followed by the interactions (75% of field capacity and 50 ppm Salicylic acid) with leaf area index reached (2.08) with a significant decrease from the other treatments that have been sprayed with Salicylic acid, while it is given the significant increase when compared with that treatments have not been sprayed with Salicylic acid(control). The deficit can be defined at the whole plant level as environmental conditions that limit the rate of the dry-matter biomass of at least one component of the vegetation below its genetic potential. The reduction in growth can sometimes cause a decrease in demand of photosynthetic assimilates, which leads to a loss of photosynthetic activity and a disruption of the photosynthesis apparatus due to water deficit.

Table 2.Effect of the Field Capacity levels and sprayed Salicylic acid on the leaf area index

Field Capacity levels	Salicylic acid concentration (ppm)					Average
	0	50	100	200	300	
25%	2.02	2.38	2.64	2.88	3.27	2.638
50%	1.9	2.33	2.56	2.77	3.04	2.52
75%	1.66	2.08	2.29	2.74	2.82	2.318
Average	1.86	2.26	2.49	2.79	3.04	
LSD	Field Capacity levels= 0.157					
-0.05	Salicylic acid concentration =0.150					
	Interaction Field Capacity levels					
	Salicylic acid = 0.222					

ROOT LENGTH (CM)

The deeper roots an important characteristic which directly affect the productivity of maize. Table 3 indicates the effect of water deficit and Salicylic acid on the root length (cm).

Study results showed the interaction between different Field Capacity levels and concentrations of Salicylic acid explained that the superiority of the interactions (75% of field capacity and 300 ppm Salicylic acid) in the highest rate of root length (cm) reached (87.23cm) with a significant difference from the other interactions, while the lowest rate for root length (cm) it has been in interactions (25% of field capacity and 0ppm Salicylic acid) reached to (53.00cm), followed by the interactions (25% of field capacity and 50 ppm Salicylic acid) with root length (cm) rate (60.23cm) with a significant decrease from the other treatments that have been sprayed with Salicylic acid, while it is given a significant decrease when compared with that treatments have not been sprayed with Salicylic acid (control). Under no irrigated conditions, roots may deplete the shallowest horizons of soil, water and may then grow only at the lower, more moist depths. However, water deficit could lead to marked changes in the growth, morphology and physiology of roots that will, in turn, change water and ion uptake and as a result, the whole plant is then affected when its root is growing in unfavorable medium with a high water deficit. These findings are consistent with [18] which indicated That water deficit in one of the growth stages has increased in root's depth for maize with the lack of size and weight, to search for moisture it was needed for growth. Also, [19] confirmed that the Salicylic acid has effectively contributed an increase in the root depth with increasing the plant's ability to withdraw water and nutrients from the soil.

Table 3.Effect of Field Capacity levels and sprayed Salicylic acid on the root depth (cm)

Field Capacity levels	Salicylic acidconcentration (ppm)					Average
	0	50	100	200	300	
25%	53	60.23	63.45	70.65	79.33	65.33
50%	57.12	59.87	69.67	76.44	84.44	69.5
75%	61.78	65.55	79.33	79.34	87.23	74.64
Average	57.3	61.88	70.81	75.47667	83.66	
LSD	Field Capacity levels= 1.477					
-0.05	Salicylic acidconcentration = 2.113					
	Interaction Field Capacity levels					
	Salicylic acid = 3.303					

COB LENGTH (CM)

Table 3 indicates the effect of water deficit on the cob length.

Study results showed the interaction between different Field Capacity levels and concentrations of Salicylic acid explained that the superiority of the interactions (25% of field capacity and 300 ppm Salicylic acid) in the highest rate of cob length reached (26.76cm) with a significant difference from the other interactions, while the lowest rate for cob length(cm) it has been in interactions (75% of field capacity and 0ppm Salicylic acid) reached to (10.33cm), this was followed by the interactions 75% of field capacity and 50ppm Salicylic acid with cob length rate (15.42cm) with a significant decrease from the other treatments that have been sprayed by Salicylic acid, while it is given a significant increased when compared with that treatments has not been sprayed by Salicylic acid (control).That an increase in the other features causes a decrease of ear length in consequence of drought deficit, by reason of decrease in the photosynthesis and total biomass accumulation of the plant and Salicylic acid action is necessary for normal growth and development, seedlings lacking the capacity to synthesis or perceive Salicylic acid will undergo limited development, including even the transition to flowering under certain light conditions.

These results are in line with [20] who pointed out that the growth regulators has helped to increase the growth and development of cob it has had a good effect on increased plant's resistance to water deficit for maize.

Table 4.Effect of Field Capacity levels and sprayed Salicylic acid on cob length (cm)

Field Capacity levels	**Salicylic acid concentration (ppm)**					**Average**
	0	**50**	**100**	**200**	**300**	
25%	14.12	19.33	22.54	24.67	26.76	41.48
50%	12.4	17.65	19.33	22.12	23.34	18.96
75%	10.33	15.42	17.88	20.41	21	17.008
Average	12.28	17.46	53.25	22.4	23.7	
LSD	Field Capacity levels=0.633					
-0.05	Salicylic acid concentration =0.448					
	Interaction Field Capacity levels					
	Salicylic acid = 1.415					

CONCLUSION

The results of the interaction between Salicylic acidand water deficit showed the clear influence of water deficit by reducing all parameters of growth and yield of corn, while spraying Salicylic acidhas helped to increase the plant's resistance to water deficit.

It was observed that, where Salicylic acidhad an effective role of increasing cell division and elongation of the corn plants. The previous researchers also have proved that the lack of water in the plant lead to reduction the rate of Salicylic acid, thus gave an adverse effect on the plant. However, the plant needs water even Salicylic acid which playedan effective role in the plant.

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