# Effect of the degree of soil smoothing, the distance between the emitters and the Positional alternation of irrigation levels on some physical properties of the soil and the growth and productivity of corn plants

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## Abstract
The field experiment was conducted on corn (*Zea mays* L.) crop during the spring season of 2020. The soil was fine clay mixed, calcareous, hyperthermic typic torrifluvent. To study the effect of different soil smoothing degrees and Positional alternation of irrigation levels on some physical properties of soil, growth and productivity of the crop. The surface drip irrigation system was used after a calibration and field evaluation of the system at an operating pressure of 150 cm and a design discharge of 8 (L.ha$^{-1}$).The experiment included 9 treatments: PS (smoothing the soil tillage three times) and PC (smoothing the soil tillage once) representing the degree of smoothing of the soil and (0 - 100) %, (33 - 100) %, (66 - 100) %, (100) -100%) to represent the treatments of the Positional alternation of the irrigation level and (25, 30, 35) cm to represent the treatments of the distance between the emitters. The above-mentioned experimental treatments were randomly distributed according to a complete randomized block design (R.C.B.D) with three replications. Bulk density, Mean Weight Diameter, plant height, leaf area and cob weight were measured. The results showed that the PC soil smoothing treatment recorded the highest Mean Weight Diameter of 0.293 mm and the highest average leaf area amounted to 1023.56 cm$^2$.While the treatment of Positional alternation of the irrigation level 100-100% achieved the lowest Bluk density of 1.314 mcg. m$^{-3}$ and the highest total porosity of the soil at 48.43%, as well as the highest average weight of the cob at 11.08 (ton.ha$^{-1}$) While the treatment of the distance between the emitters 25 cm gave the highest average plant height of about 165.38 cm, according to the order.

**Keywords:** soil smoothing, emitters, Positional alternation, physical properties, soil, corn plants
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rapid wetness leads to differences in the expansion of soil aggregates and the occurrence of air retention within the air pores and an increase in the pressure placed on them, and thus causes air explosions and the destruction of soil aggregates, and this in turn leads to the deterioration of the building.A study was conducted by Jassem et al. (2016) on the effect of surface and subsurface drip irrigation method on some physical properties, using three drip emitters of 2.5, 3 and 3.5 L. hour$^{-1}$ on sandy loam soil in the fields of the College of Agriculture, University of Baghdad.They noticed that the lowest values of the bulk density were recorded in the subsurface drip irrigation system and emitters 2.5 L. hour$^{-1}$ and it was 1.31 mcg. m$^{-}$

## Introduction
Drip irrigation is defined as the process of adding water to the soil slowly and at close intervals in order to maintain the moisture content in the soil close to the field capacity. This is done through the emitters that are connected in selected places on the field pipes to obtain good growth and high productivity (Ibrahim, 2017).The use of low drains improves some of the physical properties of the soil compared to the high drains. The reason is due to the fact that the slow and unsaturated movement of water at low drains leads to slow hydration, which reduces the phenomenon of destruction and deterioration of soil structure (Barbush and Thiab, 2015). It has been emphasized (Hulugalle et al. 2002).The

hand-driven machine equipped with double disc harrows. The second section of the sector was smoothed three times with the same machine. Then the drip irrigation system was installed .Where the experiment included the use of the site alternation method and the irrigation time (chronological alternation) and a double drip irrigation system was used for two field tubes (fixed) in which the emitters alternate depending on the distance between the emitters used in the experiment as one of the experiment parameters as one of the experiment parameters. The order of shifts was as follows:

1- Treatment (100% -0% of the evaporation value) +20% L.R. It is applied in an experimental unit that uses two field tubes, where the emitters fixed on the first field tube give 100% of the evaporation value + 20% washing requirements, while the second tube adjacent to it gives 0% of the evaporation value and this is done in the first irrigation. As for the second irrigation system, the irrigation system is reversed, meaning that the first pipe discharges 0% water, and the second pipe is 100% of the value of evaporation. In the third irrigation, the method of the first irrigation is applied, and in the fourth irrigation, the method of the second irrigation is applied, and so on.

2- Treatment (100% - 33% of the evaporation value) +20% L.R. It is applied in an experimental unit that uses two field tubes, where the emitters fixed on the first field tube give 100% of the evaporation value + 20% washing requirements, while the second tube adjacent to it gives 33% of the evaporation value + 20% washing requirements. The irrigation system is reversed, meaning that the first tube drains 33% of the water, and the second tube is 100% of the evaporation value + 20% washing requirements, and in the third irrigation the first irrigation method is applied, and in the fourth irrigation the second irrigation method is applied, and so on.

3- Treatment (100%-66% of the evaporation value) +20% L.R. It is applied in an experimental unit that uses two field tubes. The emitters fixed on the first field tube give 100% of the

$^{3}$,Whereas, the highest values in the surface drip irrigation and drainage system reached 3.5 liters.h1, which are 1.41 mcg. $m^{-3}$. Improving the method of water management under the strategy of lack of irrigation requires accurate knowledge of the sensitivity of the crop in general and according to the stages of growth in particular and to study the effect of deficient irrigation on some growth parameters and yield of corn under surface drip irrigation system in a soil with a silty clay loam texture.

**Materials and methods**

The field experiment was conducted in the Karmat Ali area in the fields of the College of Agriculture - University of Basra in soils classified to a level under the great group as hyperthermic typic torrifluvent according to the modern American classification system USDA during the spring season of 2020.To study the effect of the number of soil smoothing and Positional alternation in irrigation levels and dot spacing on some physical soil properties, growth and production of corn crop. The experiment included three factors: the smoothing factor, which is divided into

1 - Smoothing once (PC). 2- Three times smoothing (PS) and the distance between the emitters factor: (25, 30, 35) cm and the factor of alternating irrigation levels:

Selected parameters of the following irrigation levels were used: -1-100 of the evaporation value (Epan A 100%) + 20%LR 66 -2% of the evaporation value (Epan A 100%) + 20% LR 33 - 3% of the value evaporation (Epan A%100)+20%LR. 00 -4% of the evaporation value (Epan A%100)+00%LR.The treatments were conducted with a factorial experiment according to a randomized complete block design (R.C.B.D) with three replications. After tillage the experiment land, the soil was leveled using the leveling machine, and then the field was divided into three replicate , and the distance between one replicate and another was 3 meters. Each sector was divided into two equal parts (two main plots), where the first section of the sector was smoothed once using a semi-mechanical of the evaporation value + 20% washing requirements. The second one repeats the same method and continues in this manner throughout the cultivation period.The quantities of irrigation water were determined based on the evaporation value measured directly from the American evaporation basin (Evap.pan class-A), which was installed at the study site, where it was based on taking the evaporation rate for every three days and then returning it to the soil as the volume of irrigation water in each irrigation It occurs during the next three days, during which water is added depending on the crop's need for irrigation, and an additional 20% water quantity is added as a washing requirement.

evaporation value + 20% washing requirements, while the second tube adjacent to it gives 66% of the evaporation value + 20% washing requirements. This is done in the first irrigation .As for the second irrigation, the irrigation system is reversed, meaning that the first pipe drains 66% of water, and the second tube is 100% of the evaporation value + 20% washing requirements .In the third irrigation, the method of the first is applied, and in the fourth, the second method is applied, and so on.

4- Treatment (100%-100% of the evaporation value) +20% L.R. It is applied in an experimental unit that uses two field tubes, where the emitters fixed on the first field tube give 100% of the evaporation value + 20% washing requirements, while the second tube adjacent to it gives 100%

**Results and discussion**

**1 - Mean Weight Diameter (MWD)**

Figure (1) shows that there are significant differences, as the one-time soil smoothing treatment (PC) recorded the highest values of 0.293 mm.While the smoothing treatment of three times (PS) gave the lowest values of 0.273 mm at the end of the season .The values of MWD in soil PC compared to soil PS. This is due to the improvement in the physical properties of the soil due to the reduced number of times of agricultural machines that leads to the destruction of large soil masses and the crushing and smashing of soil aggregates, thus increasing the soil moisture conservation averages(PC) during the wetting and drying cycles, which was positively reflected in the increase in MWD values. This is consistent with the results of (Adesodum et al., 2007), as it was found that the MWD values decrease from 0.9 mm in one-time smoothed soils to 0.6 mm in three-times smoothed soils. As for the effect of the distance between the emitters on the MWD values, it is cob from (Fig. 2) that there are significant differences between all the treatments. The treatment of 25 cm recorded the highest values of 0.292 mm, followed by the treatment of 30 cm that gave 0.283 mm, while the treatment of 35 cm recorded the lowest values of 0.274 mm at the end of the season. The reason for the high MWD is due to the convergence of the distances between the emitters due to the nature of the water movement and thus the speed of the convergence of the hydration fronts compared to the far distances and the accompanying displacement of salts from the soil trough, and this is reflected in the improvement of soil properties and in turn raises the values of MWD (Aboamera et al., 2008).It is evident from the results in Figure (3) that there is a highly significant effect of the Positional alternation factor of irrigation levels, which was 50%, 66%, 83%, 100% for alternating treatments as added irrigation water and an overall average of two successive irrigations for the same emitter in the values of the Mean Weight Diameter(mm). The results showed the treatment (100-100) were excelled and gave the highest values of 0.324 mm, while the treatment (0-100) recorded the lowest values of 0.243 mm.This is due to the increase in the added moisture content, which reduces the electrical conductivity values of the soil and thus reduces its negative effects in destroying the soil structure, enhancing the stability of the soil aggregates (Al-Hadi and Odeh, 2014).

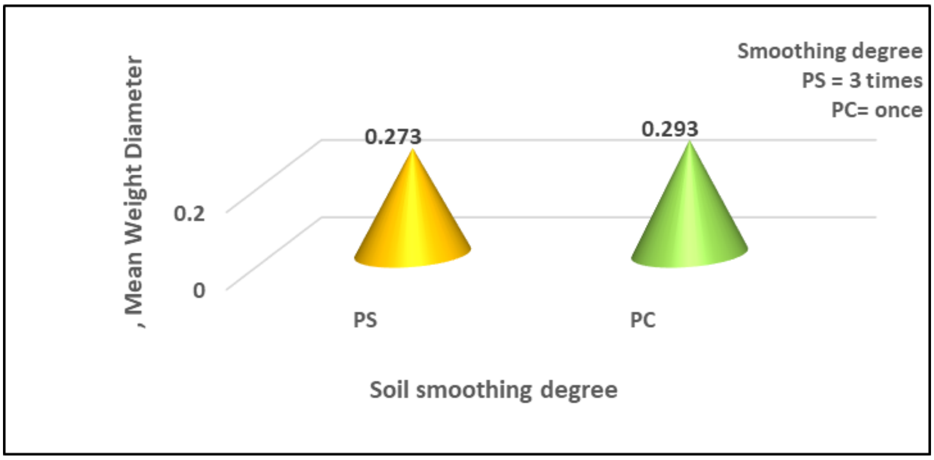


**Figure (1) Effect of soil smoothing degrees on the Mean Weight Diameter values (mm).**

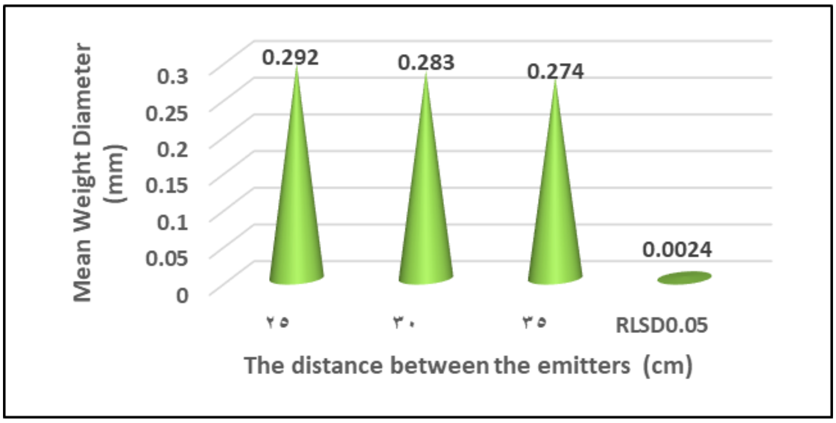


**Figure (2) The effect of the distance between the emitters on the values of the Mean Weight Diameter (mm)**

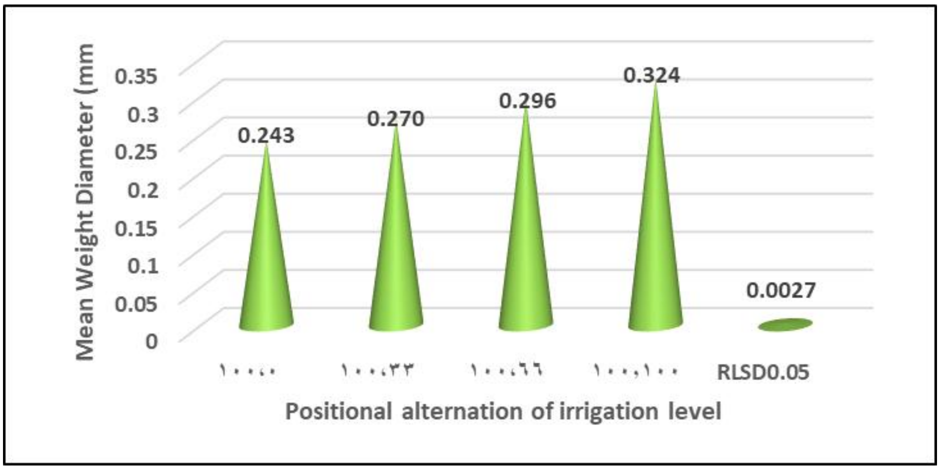


**Figure (3) Effect of Positional alternation values of the Mean Weight Diameter (mm(**

**2 – Bulk density ( ρb )**

Figure (4) shows that there is a significant effect of the degree of soil smoothing factor on the bulk density values (ρb). The treatment of soil with (one time smoothing) (PC) was significantly excelled in reducing the values of ρb compared to soil treatment with (three times smoothing) (PS), where the percentages of decrease were 1.53% for treatment (PC) compared with treatment (PS) at the end season.The reason may be due to the fact that the repetition of smoothing leads to the smashing of the soil blocks to small sizes and their stability in the interspaces of the entire soil, and thus the deterioration of their structure, and this in turn leads to an increase in their Bluk density and peeling of their surface. As well as the pressure resulting from agricultural Machines and Equipment and its repeated passage in the field, which led to soil compaction and reduced porosity (Jassim, 2006).Figure (5) shows that there is a highly significant effect of the distance between emitters treatment on the values of bulk density (Pb). When comparing between the treatments, there were significant differences between all the treatments, where the 25 cm treatment recorded the lowest values of Pb at 1.343 mcg.m-3, while it was Pb values were 1.368, 1.356, and Mg.m-3 for treatments 35 and 30 cm at the end of the season, respectively.The reason for this is due to the improvement of soil construction as a result of reducing the distance between the emitters and the phenomenon of convergence and the rapid interaction of the moisturizing follicles, and thus the nature of the moisture distribution and reducing the salt concentration by pushing the salts out of the root area. Reducing its negative impact on the repulsion and dispersal of soil particles, which leads to clogging of large pores and turning them into smaller pores, and this in turn reduces the bulk density (Tayel et al., 2009).As for the effect of the Positional alternation factor in the level of irrigation, it is cob from Figure (6), there are significant differences between all treatments, where the treatment (100-100)% recorded the lowest values for the bulk density of 1.314 mcg. $m^{-3}$, while the treatment (0-100%) gave the highest values for the bulk density, which was 1.404 mcg. $m^{-3}$The decrease in the soil ρb is due to the role of the added moisture level when treated (100-100%) in maintaining the soil structure and its contribution to keeping the soil moist, which causes the soil particles to diverge as a result of the expansion of the stratified water covers, which leads to a decrease in the bulk density of the soil. On the contrary, the decrease in the moisture content when treated (0-100%) caused cracks in the soil surface, which resulted in the deterioration and consequently the dispersal of the soil aggregates due to the subsequent wetting processes and the movement of fine soil particles between the porous spaces, which increases with increasing electrical conductivity (Dianqing et al. 2004).

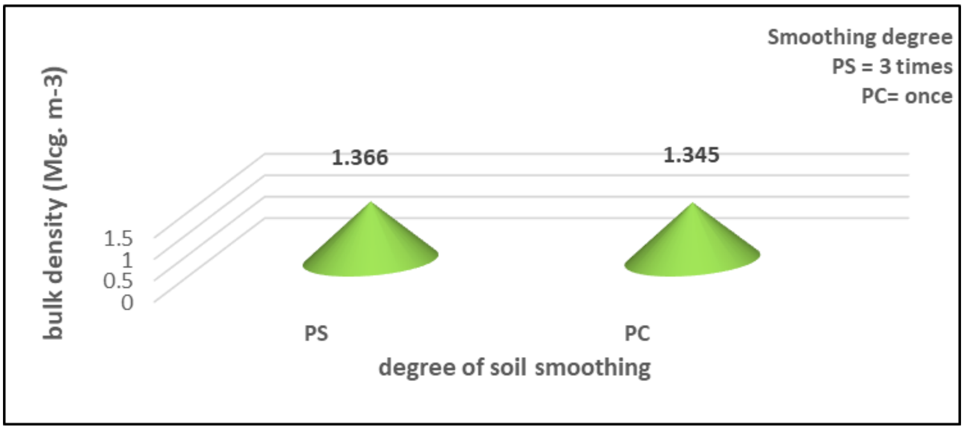


**Figure (4) Effect of the degree of soil smoothing on the values of bulk density (Mcg. $m^{-3}$)**

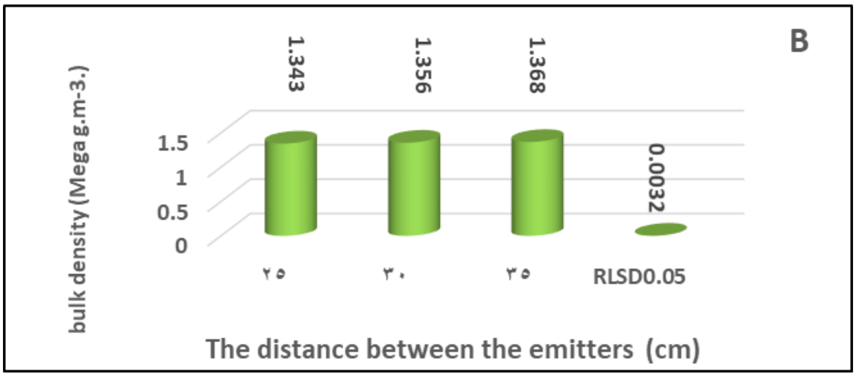


**Figure (5) Effect of the distance between the emitters (cm) on the values of the bulk density (Mcg g. $m^{-3}$)**

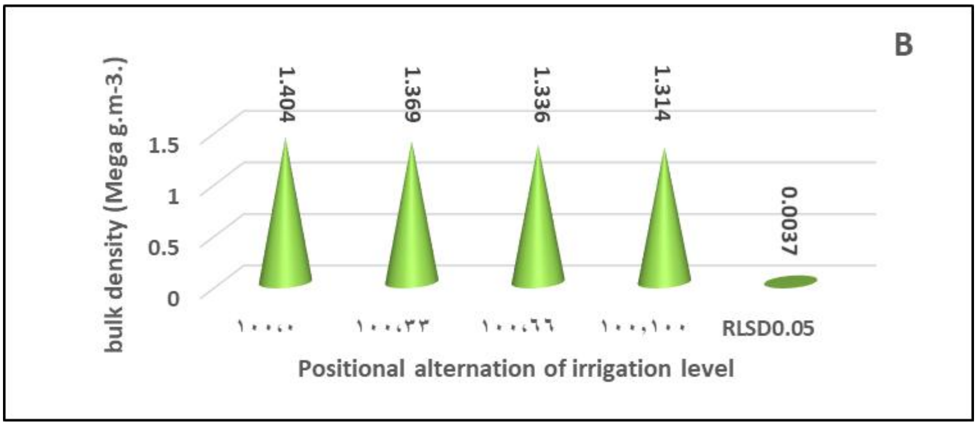


**Figure (6) Effect of Positional alternation on bulk density values (Mcg. $m^{-3}$)**

**3- Plant height**

It is cob from the results of the analysis that there is a significant effect of the degree of soil smoothing factor on plant height values at the end of the season. It is noticed from Figure (7) that the degree of smoothing PC was significantly excelled in increasing the height of corn plant by 15.78% compared with smoothing soil PS. From the destruction of the soil aggregates and the crushing of its end, as well as the repeated smoothing, which caused an increase in the bulk density of the soil and a decrease in the soil's stock of water as a result of moisture depletion by evaporation under the conditions of smoothing soil PS because the water in the upward capillary movement travels a shorter distance and with regular capillary pores (Fig.) compared to soils with smoothing PC in which the capillary pores are zigzag and with a longer distance due to the presence of lumps and large soil aggregates, which negatively affects the physical properties of the soil and thus leads to a decrease in plant height (Dheyab, 2019).The results show in Figure (8), there is a significant effect of the distance factor between the emitters in the plant height values at the end of the season. When comparing these treatments, significant differences emerged between all treatments, where the 25 cm treatment recorded the highest values of 165.38 cm, while the values were 160.17 and 156.50 cm for the two treatments 30 and 35 cm, respectively. With a decrease of 3.15%, 5.36% compared to the treatment of 25 cm. This may be due to the fact that by the convergence of the distance between the emitters , this provided optimum moisture for plant growth, leading to a reduction in the effort to absorb water and nutrients, and thus increasing the rates of photosynthesis and growth processes, increasing the division and elongation of cells, which reflected positively on the height of the plant. In addition, the continued preservation of soil moisture through the convergence of the distance between the emitters contributed to reducing the salinity of the soil and increasing the stability of its aggregates, which increased the provision of appropriate conditions of moisture and aeration to increase the growth and spread of the root system and thus increase the absorption of nutrients and water, which stimulated the cells to divide and elongate the internodes This is reflected in the height of the plant (Cakir 2004).

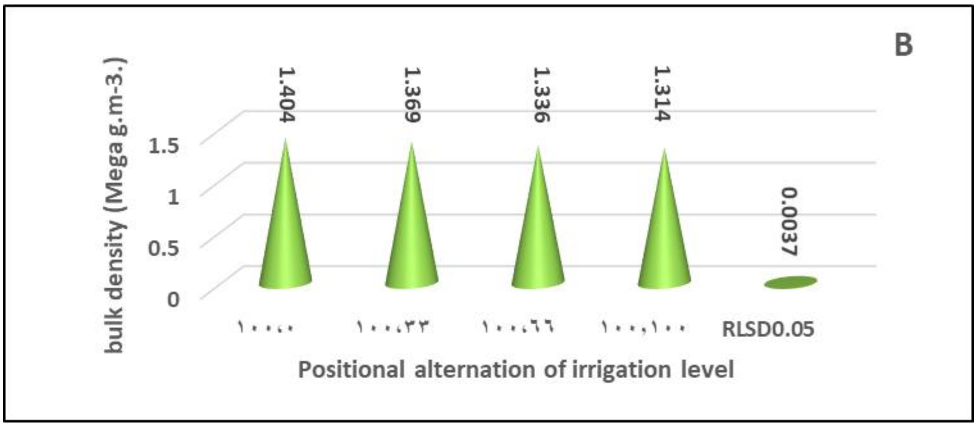

**Figure (6) Effect of Positional alternation on bulk density values (Mcg. $m^{-3}$)**

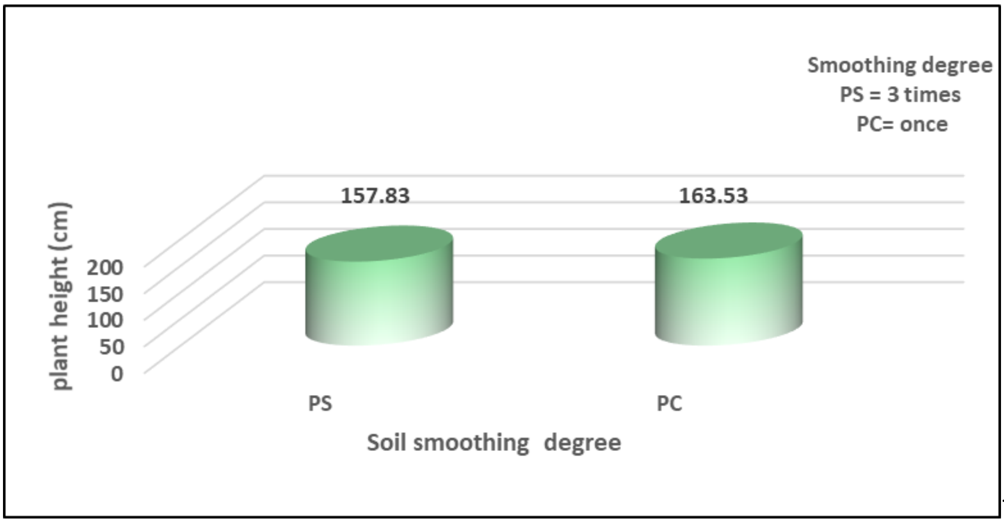


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**Figure (7) shows the effect of soil smoothing degrees on plant height values (cm) at the end of the season.**

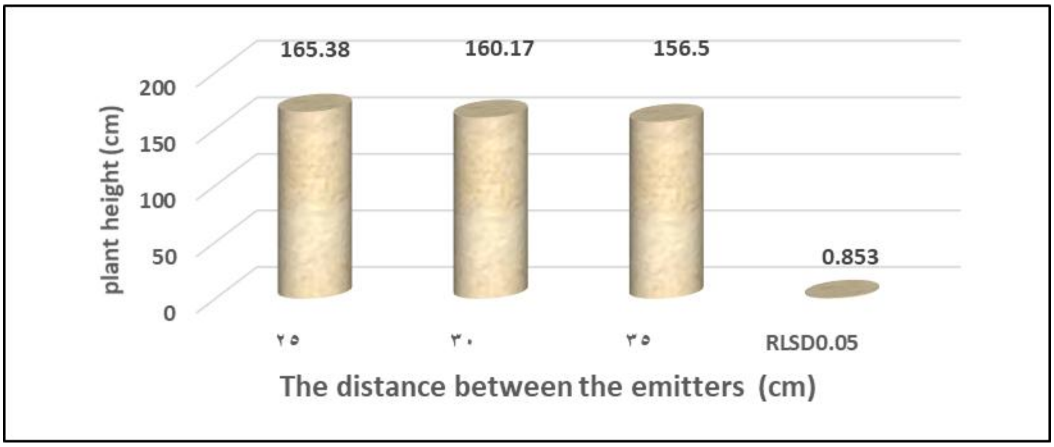


**Figure (8) shows the effect of the distance between the emitters (cm) on plant height values (cm) at the end of the season.**

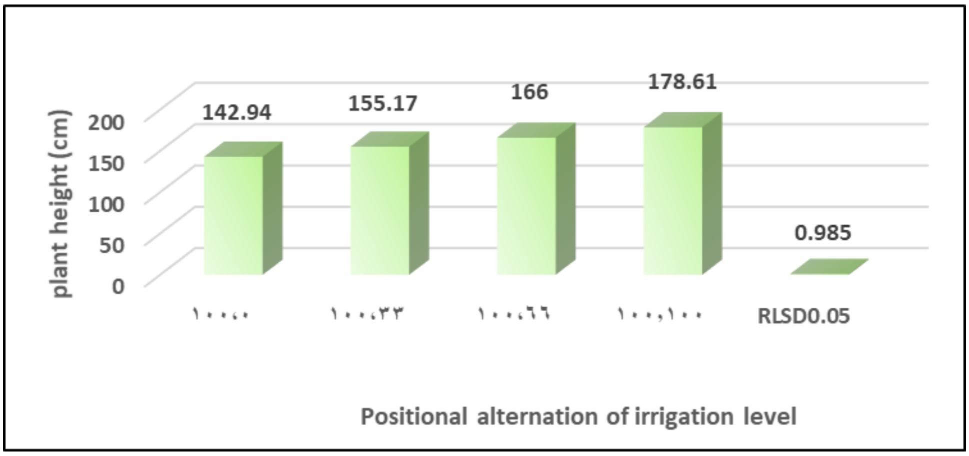


**Figure (9) shows the effect of Positional alternation of irrigation level on plant height (cm) values at the end of the season**

**4 - Leaf Area index (A L)**

The results show in Figure (10), there is a significant effect of the degree of soil smoothing factor on the leaf area values (AL) at the end of the season. The one-time smoothing treatment PC significantly excelled on the three-time PS treatment with an increase average of 4.02%. The reason for this may be due to its low Bluk density, which was positively reflected in the increase in the total porosity of the soil, which contributed to creating a good bed for germination and growth compared to softening the soil PS, which works to break up and reduce the diameter of the soil masses, which in turn works to fill the large pores with smaller soil particles, leading to an increase in its Bluk density and consequently the lack of soil aeration and the deterioration of its other physical properties (Al-Mohammadi, 2013).It is cob from the results of the analysis that there is a highly significant effect of the factor of the distance between the emitters in the values of leaf area (AL) at the end of the season. When comparing between the treatments, it was found that there were significant differences between all the treatments (Fig. 11), as the highest values in the treatment were 25 cm by 1007.96 cm $^2$, while the two treatments 30 and 35 cm recorded the values of 1003.88 and 999.42 cm $^2$, respectively, with an increase of 0.4% and 0.85 % compared to the treatment 35 cm.This is due to the increase in the moisture content at the root zone with close distances between the emitters , which works to raise the efficiency of washing salts from the soil pot away from the area and spread of the roots and thus reducing its osmotic effect, which leads to a reduction in the amount of water entering the plant as a result of affecting the growth and division of cells and then leaf area , As well as the improvement of soil construction by increasing its moisture, which contributed to creating the appropriate conditions for the growth and spread of roots and increasing its absorption of nutrients and water, which was positively reflected on the values of (A L) (Arbat et al., 2009).It is evident from the results in Figure (12) that there is a significant effect of the alternation factor of irrigation levels, which is added by 100%, 83%, 66% and 50% to two irrigations at the same point as a general average in the values of leaf area (AL). It appcobs that the differences between the treatments were significant, where the highest values were recorded in the treatment 100-100% and it was 1020.89 cm$^2$, while the treatment 0-100% gave the lowest values of 986.33 cm2.While the leaf area values were 998.06, 1009.72 cm$^2$ at irrigation levels 33-100% and 66-100%, respectively. It is cob from the results that there is an increase in AL values with an increase in the irrigation level in the alternation treatments and the percentage increase was by 1.18%, 2.37%, 3.50% for the treatments (33-100%), (66-100%) and (100-100%) compared to treatment 0 - 100%.The reason for the decrease in the values of A L compared to the treatment of alternation in full irrigation is due to the decrease in the ready moisture available in the soil at the alternation average in the low irrigation levels, which negatively affected the values of A L and consequently on its growth at high moisture stresses, causing great stress in the flowering and maturation stages.Moisture is also of great importance in increasing cell division and thus increasing the leaf area (Al-Muaini, 2007).

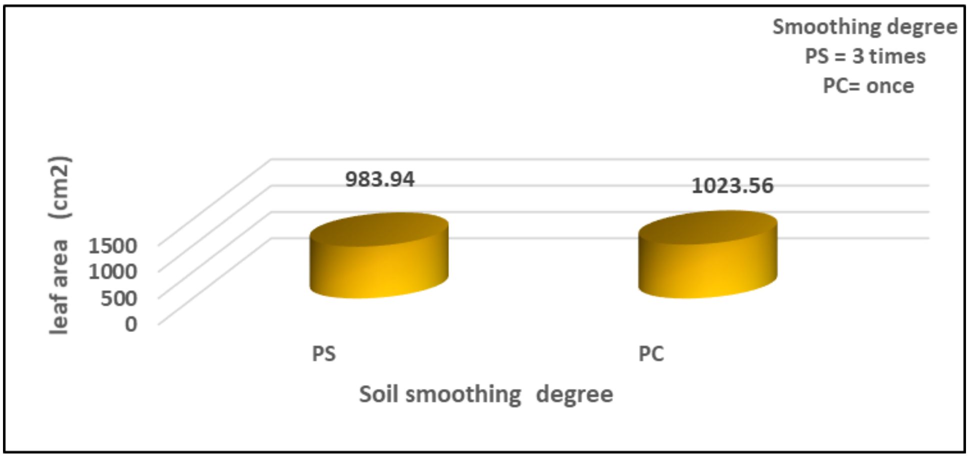


**Figure (10) shows the effect of soil softening degrees on the values of leaf area (cm2) at the end of the season.**

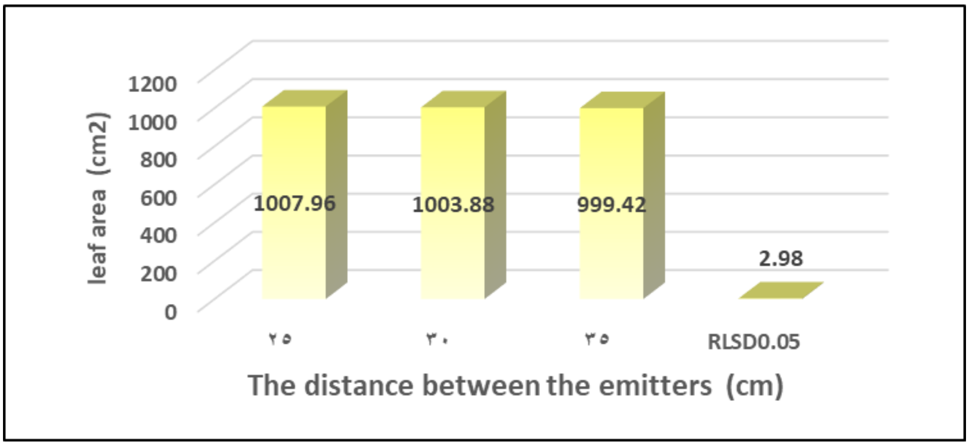


**Figure (11) shows the effect of the distance between the emitters (cm) on the values of the leaf area (cm2) at the end of the season.**

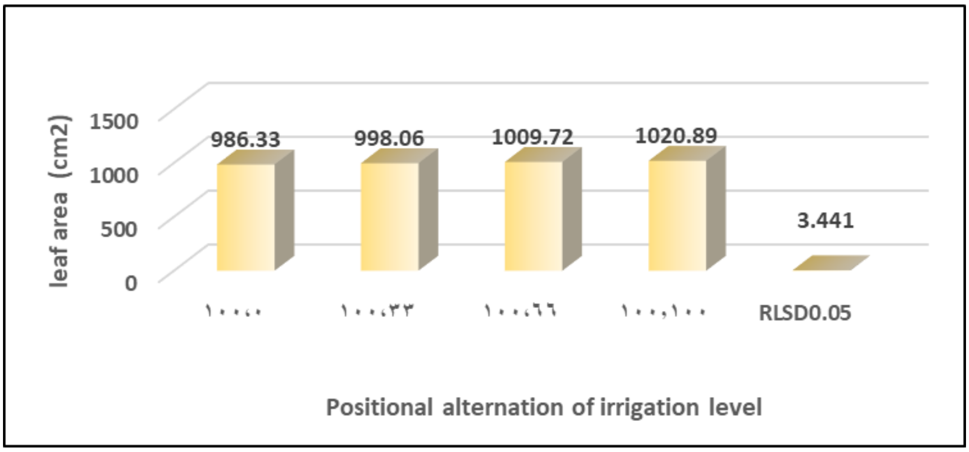


**Figure (12) shows the effect of Positional alternation of irrigation level on the values of leaf area (cm$^2$) at the end of the season**

statistical analysis show that there is a significant effect of the factor of the distance between the emitters (cm) on the weight of the whole cob , and when comparing the treatments, it became cob that there are significant differences between all the treatments (Fig. 14), where the treatment of the distance between the emitters was 25 cm, and the highest values were recorded by 10.21 (ton.ha$^{-1}$) followed by treatment 30 cm and gave 9.94 (ton.ha$^{-1}$), while the lowest values were at treatment 35 cm with a average of 9.59 (ton.ha$^{-1}$), and reduction rates of 2.71% and 6.46% for treatments 30, 35 cm compared to the treatment of 25 cm. The reason for the increase in the weight of the eaves when the distances between the emitter converge is due to the nature of the water distribution under the drip irrigation system .As the homogeneity of the distribution and spread of water in the soil trough

**5- The cob weight**

There is a highly significant effect of the treatment of the degree of smoothing on the total whole cob weight at the end of the season. When comparing the two smoothing treatments, there were significant differences (Fig. 13), where the one-time smoothing treatment PC was significantly excelled in increasing the values by 5.94% compared with the three-time smoothing PS.It was noted that the frequency of PS softening led to a decrease in the yield of corn , and the reason may be due to the deterioration that took place in the physical properties of the soil, in particular the increase in bulk density, lack of total porosity and a decrease in saturated water conductivity and weighted diameter values, which negatively affected the growth traits of the soil. The plant and its production (Jassem and Al-Qazzaz, 2006).The results of the

the highest values at 11.08 (ton.ha$^{-1}$) while it was recorded Treatment (0 - 100) % had the lowest values of 8.79 (ton. ha$^{-1}$). It cobs from the results that there is an increase in the values of the weight of the cob with an increase in the level of irrigation in the alternation treatments, and the percentages of increase were 8.98%, 16.15%, 26.05% for the treatments 100-33%, 100-66% and 100-100% compared to the treatment (0-100). ) %, respectively .The reason for the excelled of the alternation 100-100% in increasing the weight of the cob is due to the role of the added moisture content in reducing the effect of soil salinity, increasing infiltration rate , the Mean Weight Diameter and the decrease in the bulk density, which in turn is reflected positively in increasing the homogeneity of the distribution of irrigation water in the soil Profile and thus provides an increase in the available water for uptake by the plant, leading to an increase in the spread of roots and an increase in the growth of the vegetative part, and then an increase in the weight of the stalks (Bharati V et al., 2007).

increases at a distance of 25 cm as a result of the rapid convergence of the wetness fronts, which leads to the washing and displacement of salts at the limits of the wetting front and thus improving the soil characteristics such as increasing the Mean Weight Diameter , soil porosity and moisture content, and all this provides the ideal environment for the crop to perform its vital activities in a manner satisfactory and thus increase the efficiency of photosynthesis and the transfer of water and nutrients from the source to the sites of the formation of the cob, which in turn works to increase the productivity of the crop.As well as increasing the size and area of the wet soil section, which positively affected the increase in vegetative growth, as well as the increase in the spread of the root system, and then the increase in the weight of the cob in the plant (Hao Feng et al., 2018).It became cob from the results of the analysis that there is a highly significant effect of the alternation treatments of the irrigation level, and when comparing all the treatments there were significant discrepancies (Fig. 15), where the treatment (100 - 100) gave

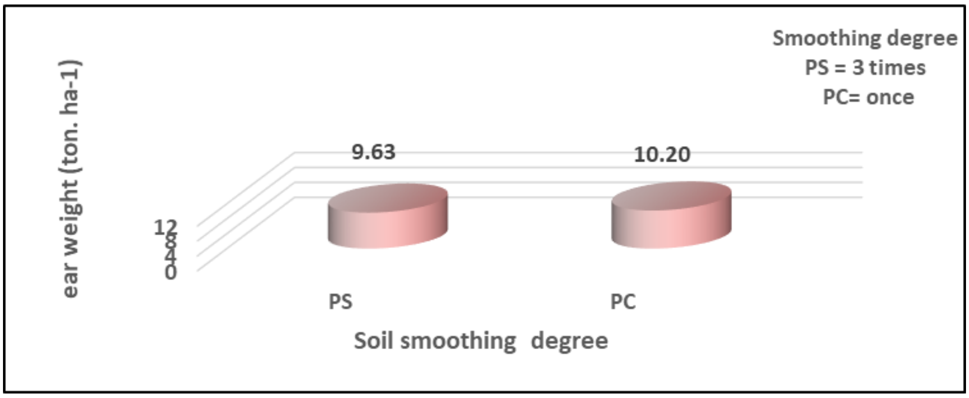


**Figure (13) shows the effect of the degree of soil smoothing on the weight values of cob (ton. ha$^{-1}$) at the end of the season.**

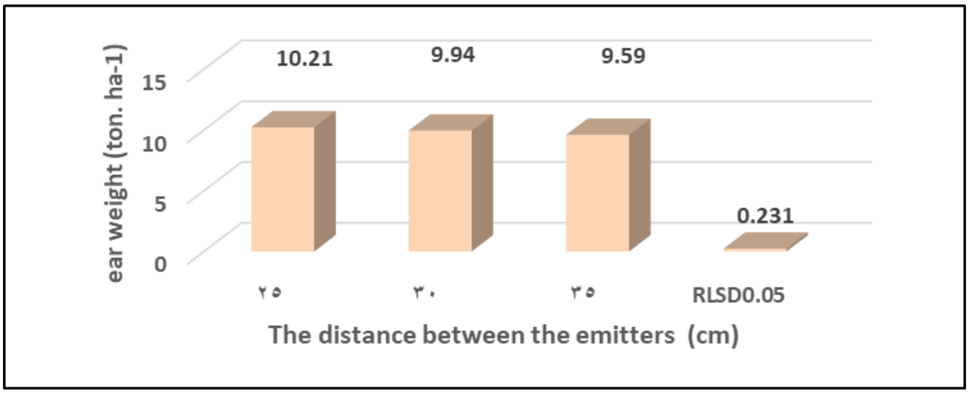


**Figure (14) shows the effect of the distance between the emitters (cm) on the values of the weight of cob (tons. ha$^{-1}$) at the end of the season.**

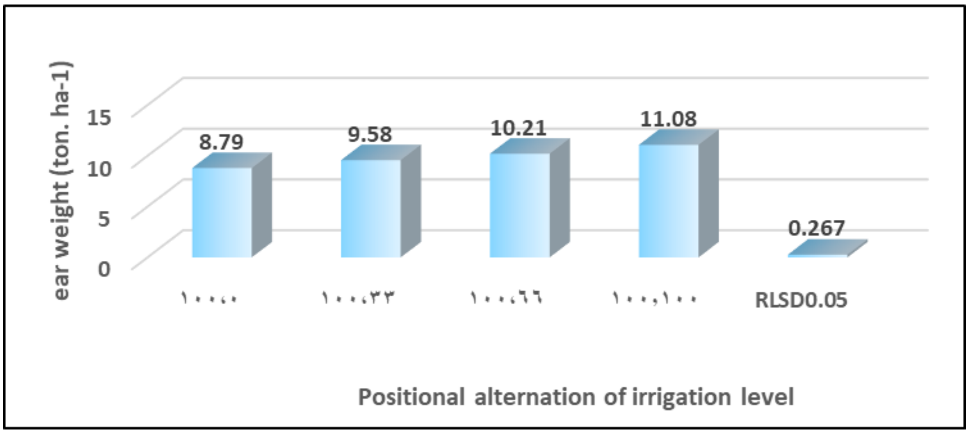


**Figure (15) shows the effect of the Positional alternation of irrigation levels on the cob weight values (ton. ha-1) at the end of the season.**

methods in clay soil and maize plant growth. Basra Journal of Agricultural Sciences. Volume 27 (1): 82-92.

Jassem, Abdel-Razzaq Abdel-Latif, Kamal Mohsen Al-Qazzaz and Mowaffaq Saeed Naoum (2006). Effect of some irrigation systems, primary tillage equipment, and frequency of softening on some physical properties of soil and maize production. Of Ag.Eng.,22Nov.,2006. The 14th. Annual Conference of the Misr Society

Al-Mohammadi, Shukr Mahmoud and Ahmed Madlul Al-Kubaisi (2013). The effect of drip drainage and the length of the side line on some evaluation parameters of the drip irrigation system. Anbar Journal of Agricultural Sciences. Volume 11 (1): 123-137.

Al-Muaini, Iyad Hussein and Rafid Saleh Nihaya. 2007. Effect of irrigation frequency and plant distribution on the growth and yield of maize Zea

References

Ibrahim, Farid Al-Qasim Muhammad Ali (2017). Evaluation of the drip irrigation system inside the greenhouse for the production of cucumber crop. Khartoum: Sudan University of Science and Technology, College of Agricultural Studies.

Barbush, Mowaffaq Salem and Ali acidi Diab. 2015 . Effect of irrigation level and alternating drip irrigation or irrigation cycle on the stability of soil assemblies in clay soil. Kufa Journal of Agricultural Sciences. Volume 7 number 4.

Jassim, Abdul Razzaq Abdul Latif and Salam Fawaz Saadoun. 2016 . Effect of some soil preparation systems on the appcobance of plowing and some technical indicators of the machine unit. Iraqi Journal of Agricultural Sciences. 47 (5): 1196-1201.

7- Al-Hadi, Sabah Shafi and Yahya Ajeeb Odeh (2014). Effect of adding soil conditioners on population stability using drip and drip irrigation

Productivity under Subsurface Drip Irrigation (SDI) . Applied Engineering in Agriculture 26(3).

**Hao Feng, Lifeng Zhou , Jianqiang He , Zhijuan Qi , Miles Dyck , Yufeng Zou . 2018** . Effects of lateral spacing for drip irrigation and mulching on the distributions of soil water and nitrate, maize yield, and water use efficiency. Agricultural Water Management . Volume 199, February 2018, Pages 190-200 .

**Bharati V. , Nandan Ravi, Kumar Vinod, Pandey I. B.( 2007)** . Effect of irrigation levels on yield, water-use efficiency and economics of winter maize (Zea mays)-based interc- ropping systems. Indian Journal of Agronomy Ycob : 2007, Volume : 52, Issue : 1First page : ( 27) Last page : ( 30) Print ISSN : 0537-197X.

maize L. . Anbar Journal of Agricultural Sciences. 5(2): 85-100.

**Hulugalle , N.r.; J.J.Friend and R. Kelly. 2002**. Some physical and chemical properties of hardsetting Alfisols can be affected by trickle irrigation. Irrigation Science , 21 (3) : 103-113.



**Adesodum, J. K., E. F. Adeyemi, and C. O. Oyegoke. 2007**. Distribution of nutrient elements within water stable aggregates of two tropical agro-ecological soils under different land use soil tillage Res. 92; 190-197.

**Aboamera, M.A. ; A.H.Gomaa and Abed-El wahab.H.M. (2008).**Spacing and depth effects of subsurface drippers on greenhouse hot peppers. Irrigation and drainage Misr.J. Ag.Eng.25(1):102-120.

**Tayel, M. Y; A. A. El Gendy and Abd El-Hady. M. .2009**. Effect of Irrigation Systems On: I- Some Soil Physical Characteristics. Journal of Applied Sciences Rescobch, 5(5): 573-578, 2009 .

**Dianqing WU & Lin LI Wei Jun PAN, Shu Zhao PANG, Tao HUANG, Hui Yun GUO, ( 2004 )** . Characterization of Function of Three Domains in Dishevelled-1: DEP Domain is Responsible for Membrane Translocation of Dishevelled-1 . Cell Rescobch volume 14, pages324–330 (2004).

**Dheyab , Ali Hamdhi . ( 2019 ) .** Movement of water and salt accumulation in soil as effected by emulsified and un-emulsified crude oil . International Journal of Plant Rescobch . Vol. 20 No.1 .

12- **Cakir, R. (2004)**. Effect of water stress at different development stages on vegetative and reproductive growth of corn. Field crops Rescobc. Vol. 89 (1): 1-16.

**Bouazzama, B., D. Xanthoulis, A. Bouazia, P. Ruelle and Jean-Claude Mailhol, 2012**.Effect of water stress on growth, water consumption and yield of silage maize under flood irrigation in a semi-arid climate of Tadla (Morocco). Biotechnol.Agron. Soc. Environ., 16 (4): 468- 477.

**Arbat, Gerard P. Freddie R. Lamm, Abdrabbo A. Abou Kheira.2009** . Effect of Emitter Spacing on Soil Water Redistribution, Corn Yield and Water