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EFFECT OF DRIP IRRIGATION , ORGANIC MANURE AND MULCHING ON GROWTH AND YIELD OF POTATO (*Solanum tuberosum* L.)

A Dissertation Submitted by

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Abstract

This study was conducted in one of Al-maameer Private field ,about 50 km west of Baghdad at east longitude 43° 88´ 80" and north in latitude 33°27´ 42" during autumn 2010 . The soil texture was silt loam and classified to the sub-great group,Typic Torrifluvent.The purpose of this study was to know the effect of drip irrigation ,organic fertilization and coverage on wetness and salt distributions , some soil physical properties and the growth and yield of potato (*Solanum tuberosum* L). Split- split with R.C.B.D design was applied with three replications. Deficient drip irrigation occupied the main treatments which included three levels of the deficient irrigation,Full drip irrigation , 75% of E_{pan} and 50% of E_{pan} . The secondary sections included the use of organic fertilizers Contain an equall mixture of, sheep, cows and poultry percent 1:1:1 both of type with three replication, without adding organic fertilizers, adding half of the organic fertilizer 5 tons.ha^{-1} and adding all organic fertilizer 10 tons.ha^{-1}.The sub secondary treatments included soil coverage by plant residues Peatmoss+sawdust and without coverage. Plant residues were added as 30 ton.ha^{-1} mixture percent 1:1 %.Potato tubers (*Solanum tuberosum* L.) cv , Desiree class B (which is locally produced of the previous fall season ,stored in alocal coolant under 4°C and taken out 2 weeks before planting date)were used in this study. The tubers were planted at 14th of Sept.2010 by

making aslot into furrow ,10-18 cm depth and the distance between the slots was 25 cm, each one experimental unit contained 16 plants .Evaluation for drip irrigation system was conducted before the planting through measuring the homogeneity coefficient and the range of drippers flow by giving different operational pressures,50,100,150 kpa .Wetness and salt distributions were studied vertically and horizontally from the source of dripping in three stages of crop growth ,vegetative growth (40-45 days at the beginning of planting), tubers initiation stage (45-60 days),and tubers enlargement stage (60-100 days) of planting .Surfer program was used for drawing counter lines . At the end of the experiment ,the soil characteristics of study treatments were measured ,which included: saturated water conductivity ,bulk density ,mean weight diameter ,resistance of soil penetration ,some properties of growth and production , water consumption ,crop response coefficient (Ky) and water use efficiency for potato crop.

The important results were summarized as follow :

1- 150 kpa operational pressure verified higher homogeneity coefficient which was 98.6%,while the variation ratio in drippers flow wasn't upper than 10% and the higher range in drippers flow was 0.526 $L.hr^{-1}$

2- There was a decrease in water content , whenever went far of the drippers in both direction , horizontal and vertical, the greater was at the level 50% E_{pan}. The water content in comparison treatment , at10-10 cm ,was 16.5%, 13.3% and 11.4% by adding Full irrigation ,75% and 50%from E_{pan}

respectively at the beginning of growth season, while the water content ,in adding organic fertilizers and coverage with plants residues at 10-10 depth ,was 29.5% ,23.8% and 19.8% by adding Full drip irrigation ,75% and 50% from E_{pan} respectively at the end of growth season. The horizontal and vertical movement of wetness front increased with the organic fertilizers plant residues coverage. .

3- Soil salinity increased whenever went far , horizontally and vertically of the dripping source ,salts moved far away of drippers at the wetness front with increasing of added irrigation water. Higher salinity was found at the horizontal and vertical wetness front limits and distributed increasingly and coordinately with the depth in coverage treatment .Lesser salinity was recorded in the treatment of adding water at Full drip irrigation by adding organic fertilizers as 10 tons.ha^{-1} with the plant residues coverage at the end of the growth season . The electrical conductivity of the comparison treatment ,in the layer10-10 cm was 3.75,4.15 and 5.1 dsm.m^{-1} by adding Full drip irrigation ,75% and 50% from E_{pan} respectively at the beginning of growth season ; While the electrical conductivity ,in the treatment of adding organic fertilizers with coverage by plant residues ,was 1.95,2.45 and 2.65 dsm.m^{-1} in the layer 10-10 cm by adding Full drip irrigation ,75% and 50% from E_{pan} respectively at the end of growth season

4- The results showed that the increase of deficient drip irrigation levels verified significant difference in the hydraulic conductivity value ,which was 7.7cm.hr^{-1} by adding Full drip irrigation from E_{pan} comparing with the 75% and 50% levels which were 8.1and 8.4 cm.hr^{-1} the increase ratios were 9% and 5.3% respectively ,adding organic fertilizers ,as well, at the level 10 tons.ha^{-1}verified

higher value in hydraulic conductivity range which was 9.9 $cm.hr^{-1}$ beside 8.1 and 6.3 $cm.hr^{-1}$ by adding 5$tons.ha^{-1}$ and without adding organic fertilizers respectively.

The results showed that plant residues coverage peatmoss+sawdust gave a higher value to the range of hydraulic conductivity which was 8.3 $cm.hr^{-1}$ with significant increase was 12.8% comparing with no coverage by plant residues ,which the hydraulic conductivity of it was 7.6 $cm.hr^{-1}$.

5- The results showed that the increase of deficient drip irrigation levels didn't verify any significant difference in a value of the bulk density which was 1.24 $Mgm.m^{-3}$ by adding Full drip irrigation comparing with other levels 75% and 50% which were 1.24 and 1.23 $Mgm.m^{-3}$,the increase ratios were 0% and 0.8% respectively. Also ,adding organic fertilizers as 10 $ton.ha^{-1}$ verified a higher value in the range of bulk density which was 1.14 $Mgm.m^{-3}$ beside 1.25 and 1.33 $Mgm.m^{-3}$ by adding 5 $ton.ha^{-1}$ and without adding organic fertilizers respectively. Results showed too that the coverage by plant residues peatmoss +sawdust gave a lesser value to the range of bulk density which was 1.21 $Mgm.m^{-3}$ with significant increase was 6% comparing with no coverage by plant residues which the bulk density range of it was 1.27 $Mgm.m^{-3}$.

6- The results showed that the increase of deficient drip irrigation levels reduced the mean weight diameter which was 0.8 mm by adding Full drip irrigation comparing with other levels,75% and 50% from E_{pan} ,which were 0.9 and 1.0 mm with increasing ratio was 25% and 13.4% respectively. Adding organic fertilizers as 10 $ton.ha^{-1}$ verified a higher value of the mean weight diameter range

which was 1.4 mm beside 0.7 and 0.6 mm by adding 5 ton.ha^{-1} and without adding organic fertilizers respectively. Results, also showed that the coverage by plant residues peatmoss +sawdust gave the higher value which was 1.0 mm with significant increase was 26.1% comparing with no coverage by plant residues which the mean weight diameter of it was 0.8mm.

7- The results showed that the increase of deficient drip irrigation levels reduced the value of soil penetration resistance which was 1.02 kg.m^{-2} by adding Full drip irrigation which was significantly superior comparing with other levels,75% and 50% from E_{pan} ,which were 1.20 and 1.32 kg.m^{-2} with an increasing ratio,29.8% and 9.7% respectively. Adding an organic fertilizers as 10 ton.ha^{-1} verified a lesser value of the soil penetration resistance which was 0.98 kg.m^{-2} beside 1.19 and 1.38 kg.m^{-2} by adding 5 ton.ha^{-1} and without adding organic fertilizers respectively. Results, also showed that the coverage by plant residues peatmoss +sawdust gave the soil penetration resistance a lesser value ,was 1.10 kg.m^{-2} with significant increase, was 14.6% comparing with no coverage by plant residues ,which the soil penetration resistance of it , was 1.26 kg.m^{-2} .

8- Coverage by plant residues, organic fertilizers and irrigation with Full drip irrigation level, significantly affected on the mean of plant length, vegetative dry weight, foliar area and numbers of major stems , increased from 63.5cm ,1694.8 kg.ha^{-1},6480.3 cm^2 and 3.2 stem.plant^{-1}to 68.8 cm , 1801.2 kg.ha^{-1},6930.2 cm^2 and 3.6 stem.plant^{-1} by coverage with plant residues , from 55.8 cm , 1585.8 kg.ha^{-1}, 5700.5cm^2

and 3.0 stem.plant^{-1}to 73.9 cm, 1905.8 kg.ha^{-1}, 7487.3cm^2 and 4.03 stem.plant^{-1} by adding organic fertilizers as 10 tons.ha^{-1}and from 53.2 cm, 1540.7 kg.ha^{-1} ,5420.3cm^2 and 2.9 stem.plant^{-1} to 72.1 cm , 1855.7 kg.ha^{-1} , 7191.1cm^2 and 3.7 stem.plant^{-1} by adding organic fertilizers as 10 tons.ha^{-1}.

9- Significantly, the yield of potato increased by coverage with plant residues ,adding the organic fertilizers and the irrigation with Full drip irrigation .The yield increased from 34.2 to 36.5 tons.ha^{-1} with plant residue coverage , the increasing ratios were 6.7% as irrigation with Full drip irrigation level ,5.1% as irrigation with 75% E_{pan} and 4.8% as irrigation with 50% E_{pan} . Adding the organic fertilizers as 10 ton.ha^{-1} increased the total yield of potato with increasing ratios were 27.13% as irrigation with Full drip irrigation level,37.38% as irrigation with 75% E_{pan} and 30.39% as irrigation with 50% E_{pan}. The higher value of the potato yield was deduced at the irrigation with Full drip irrigation, adding the organic fertilizers as 10 tons.ha^{-1} and coverage with plant residues was 45.4 tons.ha^{-1} with increasing value ,32.48% than irrigation with Full drip irrigation without adding organic fertilizer and without coverage by plant residues.

10-The treatment of irrigation with 50% E_{pan} level, gave best water use efficiency for potato which was 24.42 kg.m^{-3}

beside 18.77 and 15.79 kg.m^{-3} at adding water with Full drip irrigation and 75% E_{pan} levels and at adding organic fertilizers as10 tons.ha^{-1} with coverage , beside 22.99,18.18 and 15.16 kg.m^{-3}by adding Full drip irrigation,75% and 50% E_{pan} respectively and adding organic fertilizers as 10 tons.ha^{-1} without coverage.

11- The water consumption of potato was 466.5 mm.season^{-1} as irrigation with Full drip irrigation level, 349.9 mm.season^{-1} with 75% E_{pan} and 233.3 mm.season^{-1} with 50% E_{pan} for fall crop in the middle of Iraq.