DETERMINING THE WATER REQUIREMENT OF GROUNDNUT UNDER DIFFERENT IRRIGATION SYSTEMS AND IRRIGATION INTERVALS

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ABSTRACT

Three field experiments were conducted in Al- Rashidiya region, Istiqlal district, north of Baghdad governate, to study the difference the irrigation interval under subsurface drip, sprinkler, and furrow irrigation systems in water requirement and yield of peanut (*Arachis hypogaea* L.) during the summer season 2021.Three field experiments were conducted, each including three irrigation systems, subsurface drip irrigation, sprinkler irrigation, and furrow irrigation. It was implemented as a Factorial experiment within the design of Nested-Factorial Experiments Design. Where the second factor distributed three irrigation intervals on the main plot (2-day, 4 day and 6 day), then the three factors were divided into four replicates in which the levels of organic fertilization under every system (control, 2000 kg ha^{-1} Orgevit fertilizer and 4000 kg ha^{-1} Orgevit fertilizer). The seasonal water consumption of peanut under the subsurface drip irrigation system at the irrigation intervals 2, 4, and 6 days were 362.34, 362.35, and 362.06 mm, respectively. The seasonal water consumption of peanut, calculated under the sprinkler irrigation system at irrigation intervals 2, 4 and 6 days, was 507.02, 507 and 505.63 mm, respectively. The seasonal water consumption of peanut under furrow irrigation at irrigation intervals 2, 4 and 6 on day 583.44, 584.88 and 583.35 mm, respectively. The average total yield of Peanut pods increases by 25% and 33.43% under furrow and subsurface drip irrigation system respectively compared to a sprinkler system.

Keyword: peanut, yield, Orgevit fertilizer, irrigation schedule
***Part of the M.SC. Thesis of St[1] author**

تحديد الاحتياج المائي لفستق الحقل تحت نظم ري وفواصل ارواء مختلفة

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المستخلص

أجريت ثلاث تجارب حقلية ضمن منطقة الراشدية قضاء الاستقلال شمال محافظة بغداد لدراسة اختلاف فاصلة الارواء تحت أنظمة الري بالتنقيط تحت السطحي والرش والمروز في الاحتياج المائي لفستق الحقل *Arachis hypogaea* L. خلال الموسم الصيفي 2021. كل نظام ري نفذ كتجربة عاملية ضمن تصميم التجارب المعششة Nested-Factorial Experiments Design، حيث وزع عامل فواصل الري وبثلاث فواصل للارواء (2 و4 و6 يوم) على القطع الرئيسة Main plot، ثم قسم العامل الرئيسي الى اربع مكررات وزعت فيها مستويات التسميد العضوي (معاملة المقارنة و2000 كغم هكتار$^{-1}$ و4000 كغم هكتار$^{-1}$ سماد الاورجفيت) (القطع الثانوية). وكانت النتائج كالاتي: وصل الاستهلاك المائي الموسمي لفستق الحقل تحت نظام الري بالتنقيط تحت السطحي عند فواصل الارواء 2 و4 و6 يوم 362.34 و362.35 و362.06 مم على الترتيب. بلغ الاستهلاك المائي الموسمي لفستق الحقل والمحسوب تحت نظام ري الرش عند فواصل الارواء 2 و4 و6 يوم بلغ 507.02 و507 و505.63 مم على الترتيب. بلغ الاستهلاك المائي الموسمي لفستق الحقل تحت ري المروز عند فواصل الارواء 2 و4 و6 يوم 583.44 و584.88 و583.35 مم على الترتيب. زيادة متوسط الحاصل الكلي لقرنات فستق الحقل بنسبة 25% و33.43% عند نظام الري بالتنقيط تحت السطحي والمروز على الترتيب قياسا بنظام الري بالرش.

كلمات مفتاحية: فستق الحقل، الحاصل، سماد الاورجفيت، جدولة الارواء

***جزء من رسالة ماجستير للباحث الاول**

Received:7 /1/2022, Accepted:29/3/2022

INTRODUCTION

Water is the determining factor for agricultural production in many regions of the world that suffer from scarcity of water resources, and there is increasing concern about its sources in the future, where its limitations for focusing on the optimal use of water. Water management and its appropriate use is a priority in arid and semi-arid regions or in areas with low rainfall, and good management methods include controlling the amount of water given in each irrigation and the number of irrigations (irrigation scheduling) and according to the ability of the soil to hold water and the need of the plant in its different growth stages to reach the highest productivity (7, 10, 11, 18). Iraqi water resources are managed ineffectively in the field of irrigation systems, and this issue in the short term was not a real problem due to the abundance of water, depending on the Tigris and Euphrates rivers with relatively moderate levels of precipitation (4). The total water withdrawn in Iraq was about 42.8 billion m^3 in 1990, and 90% of it was used for agricultural purposes, 4% for domestic purposes, and 6% for industrial purposes, 85% agricultural purposes (16, 25, 26). The peanut (Arachis *hypogaea* L.,) is the fourth most important source of edible oil and the third most important source of vegetable protein, where the percentage of oil in its seeds sometimes reaches more than 59% of their total weight (12, 19, 29). Despite the economic importance of the peanut crop, the expansion of its cultivation in Iraq was not at the level of its economic importance and it is limited compared to the countries producing this crop. China occupies the first place, followed by India in the second place, and their production constitutes more than 50% of the total production in the world (28, 35). The lack of expansion in its cultivation in Iraq may be due to several problems that limit its productivity, where it needs great care related to the irrigation system used, fertilization operations and crop service. Therefore, this research was proposed to evaluate the possibility of applying subsurface drip irrigation system and sprinkler irrigation system, in addition to following the traditional irrigation method for farms in Iraq (furrow irrigation system) to produce peanut crop. Studies of the water requirement for this crop are almost limited, but rather rare, it is correct to say at the level of Iraq.

MATERIALS AND METHODS

Three field experiments were conducted at Al Rashidiya region, Istiklal District, north of Baghdad Governorate, 33°32′34″N 44°21′07″E, to study the difference irrigation interval under subsurface drip, sprinkler, and furrow irrigation systems during the summer season 2021. The soil was sandy loam texture (sand=660, silt=176, clay=204 gkg^{-1}) Soil samples were taken from the soil at a depth of 0-0.30 m, air dried, and passed through a sieve with an opening diameter of 2 mm to determine some physical and chemical properties according to standard methods (13) (EC=1.83 dSm^{-1}, pH=7.04, O.M.= 5.57 gkg^{-1}, $CaCO_3$ =270 gkg^{-1}), classified as sub-major (Typic Torrifluvent) according to the classification (32).

Experiment treatments and statistical design

1. **Irrigation system**
a) Subsurface drip irrigation
b) Sprinkler irrigation
c) Furrow Irrigation
2. **Irrigation Interval**
a) Irrigation every 2 days
b) Irrigation every 4 days
c) Irrigation every 6 days
3. **Organic fertilization**
a) Control (without adding)
b) 2000 kg ha^{-1} Orgevit fertilizer
c) 4000 kg ha^{-1} Orgevit fertilizer

The experiment was designed as a Factorial experiment within the design of Nested-Factorial Experiments Design. The irrigation intervals were distributed on the main plots (figure 1), then the three factors were divided into four replicates in which the levels of organic fertilization under every system. The operating pressure of 50 kPa system sub surface drip irrigation which gave the highest values of the uniformity coefficient of 95.82%, the application efficiency of irrigation of 94.20%, the distribution uniformity of 93.90%, and the lowest value of the variation ratio amounted to 16.46%,while the approved operating pressure of 175 kPa system sprinkler irrigation was adopted, which gave the highest values of uniformity coefficient of 88.94%, irrigation adequacy of 75%, the application efficiency of irrigation 84.92%, and distribution uniformity of 84.74%.while the approved operating pressure of 200 kPa for sprinkler irrigation system was adopted, which gave the highest values of uniformity coefficient of 81.02%, irrigation adequacy of 81.8%, the application efficiency of irrigation 73.01%. The experiment was conducted on a land area of 2904 m², the land was plowed with moldboard plows, and after that using the rotary cultivator. The area specified for the experiment was divided into four replicates, leaving 5 meters between one experiment and another. Orgevit fertilizer was added to the treatments at a depth of 0.2 m from the soil surface. Peanut seeds were planting standing half-spreading on 31-5-2021, and the distance between one seed and another was 0.25 m at a depth of 0.05 m. The experimental land was fertilized with chemical fertilizers at the rate of 200 kg P_2O_5 ha^{-1} in the form of DAP (P_2O_5 46%) before planting, and nitrogen fertilizer 200 kg ha^{-1} by adding urea N 46% in two times, the first after one week germination and the second after 40 days of planting and potassium fertilizer at an average of 150 kg h^{-1} in the form of potassium sulfate, the peanut pods were harvested on 20-9-2021. According to the content of the available water from the difference between the volumetric moisture content at FC, and the volumetric moisture content at WP according to the following equation:

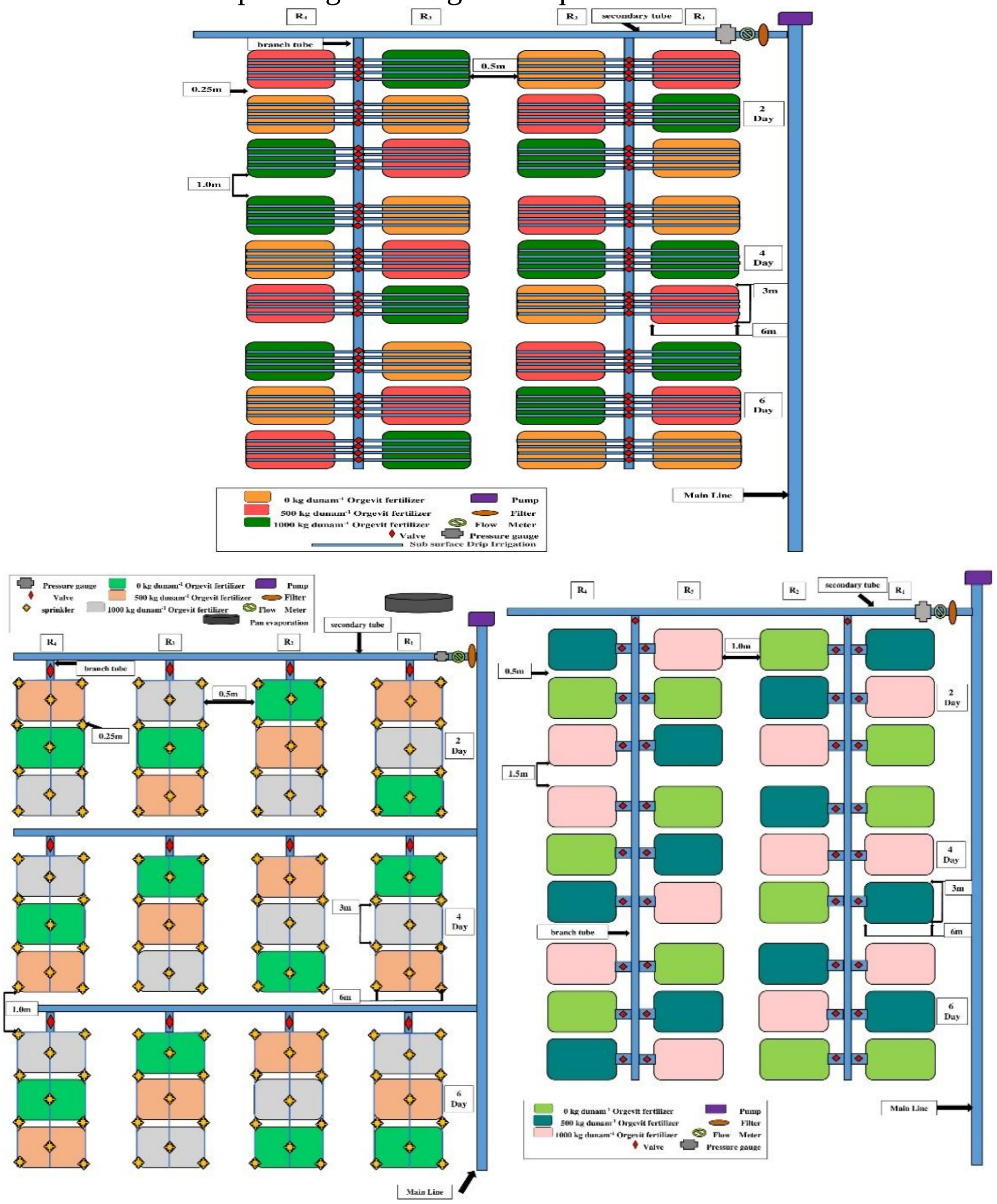

Figure 1. Experiment Field plan, a. subsurface drip irrigation, b. sprinkler irrigation and c. furrow irrigation.

$A_{W} = \theta_{fc} - \theta_{wp}$ (1)

$d = \theta_{fc} - \theta_{w} \times D$ (2)

Where:

Aw = available water content (cm^3 cm^{-3})

θfc = volumetric moisture content at field capacity (cm^3 cm^{-3})

θwp=volumetric moisture content at permanent wilting point (cm^3 cm^{-3})

d = depth of water added (mm)

θw=volumetric moisture before irrigation (cm^3 cm^{-3})

D = soil depth, which is equal to the effective root system depth (cm)

The irrigations for germination were calculated (4 irrigations), the first irrigation at a depth of 0.3 m, and the subsequent three irrigations when 50% of the available water was depleted and completed to the field capacity. The four irrigations were applied according to the method of each irrigation system, dry soil samples taken from the field, a Kenwood Microwave oven, model MW940. The water consumption of the Peanut crop based on the evaporation data from the American evapotranspiration pan, class A. This is to calculate the amount of water that must be added to the field from the water consumption equation (21, 22, 24). To schedule irrigation, depending on the evaporation data from the pan, we follow the following steps (5):

$ETo = K_P \times E_{pan}$ (3)

Where:

ET_0= reference evapotranspiration (mm day^{-1})

Kp = evapotranspiration coefficient of 0.85.

Epan = daily evapotranspiration from pan (mm-day).

$ET_C = ET_O \times K_C$ (4)

Where:

ETc = evapotranspiration of the crop (mm day^{-1}).

ET_O = reference evapotranspiration (mm day^{-1}).

Kc = crop coefficient (0.45, 0.75, 1.05, and 0.70) according to growth stages, germination, vegetative growth, pod formation, filling, and pod maturity, respectively (5).

The crop evapotranspiration was modified for the drip irrigation method by reduction coefficient according to the following equation:

$ET_c = ET_o \times k_c \times Kr$ (5)

The depth of water applied to each irrigation method was calculated according to (22).

$IWT = \frac{NDI}{Ea}$ (6)

Where:

NDI= Net depth irrigation

Ea = Irrigation efficiency

The quantities of irrigation water for each experimental unit were calculated according to the following formula (24).

$Qt = Ad$ (7)

Where:

Q = discharge (m^3 sec^{-1})

t = irrigation time (sec)

A = Area of the experimental unit (m^2)

d = depth of water added (m)

RESULTS AND DISCUSSION

Table 1 shows the effect of irrigation interval on seasonal water consumption of Peanut with subsurface drip irrigation system. It is noted that the seasonal water consumption at the irrigation interval of 2 days was 84.16, 78.85, 51.17 and 148.16 mm for the germination stages, vegetative growth, flowering, and pod maturity, respectively. As for the irrigation interval of 4 days, it was 84.16, 78.83, 62.15, and 137.21 mm for the stages of germination, vegetative growth, flowering, and pod maturity, respectively. While at the 6-day irrigation interval, it was 84.16, 72.60, 60.76, and 144.54 mm for the stages of germination, vegetative growth, flowering, and pod maturity, respectively. It is clear from the results of table 1 that the depth of the irrigation water added for the period does not differ from planting to the completion of the germination stage, the number of which is 17 days, and the number of irrigations equal 4 irrigations, where the first irrigation was up to the field capacity limits with a depth of 0.3 m and depending on the initial moisture content of the soil. As for the second, third and fourth irrigation, it was after consuming 50% of the A.W (to avoid the failure of germination of a large percentage of seeds due to their rotting when the moisture increased). The value of water consumption at the germination stage was 84.16 mm. Which was reflected in the increase in the depth of the added irrigation water, and then the increase in evaporation from the soil surface, and as a result, the increase in water consumption for that stage.

And starting from the date of 6/16/2021 (the start of the vegetative growth stage of Peanut), irrigation intervals were applied, and the depth of the added water was calculated based on the climatic data from the evaporation pan class A, this stage needed 32 days, 16, 8, and 5 irrigations for irrigation intervals 2, 4, and 6 days, respectively. While the values of water consumption began to increase at the stages of flowering and maturity of pods and for all irrigation intervals during the months of July, August and September. The temperatures began to rise, and the rate of evaporation-transpiration and the water requirement for fields increased during these months. The stage of forming and filling the pods took 14 days, with 5, 3, and 2 irrigations, and the water consumption reached 51.17, 62.15, and 60.76 mm for irrigation intervals of 2, 4, and 6 days, respectively. As for the maturity stage of the pods, it took 41 days, with several irrigations 22, 10, and 7, and the water consumption was 148.16, 137.21, and 144.54 mm at irrigation intervals 2, 4, and 6, respectively. The results also indicate in Table 1 the values of daily water consumption for each stage of peanut growth, as the daily water consumption for the germination stage was 4.95 mm, and for the vegetative growth stage it was 2.46, 2.46, and 2.27 mm for irrigation intervals 2, 4, and 6, respectively. The daily water consumption at the stage of flowering was 3.66, 4.44, and 4.34 mm for irrigation intervals 2, 4, and 6, respectively. At the stage of pod maturity, it reached 3.61, 3.35, and 3.53 mm for irrigation intervals 2, 4, and 6, respectively. It is clear from the results that the water consumption values were high during the stages of vegetative growth, flowering, and pod maturity. As the stage of vegetative growth represents a stage of increasing the growth and size of the plant development in order to complete the physiological growth and prepare the plant for the next stage, so the plant's need for water and food consumption increased significantly, which was reflected in the rates of evaporation and transpiration at this stage and the two stages of pod formation and their maturity of 55 days as a result Increasing the depth and spread of the roots, and then increasing their efficiency in absorbing water and increasing the surface area of the leaves .Which increased the water lost from the plant through transpiration, reaching its highest rate, in addition to the high rates of temperatures. The rate of evaporation and transpiration of the Peanut crop increases with the age of the plant, and the influence of climatic factors increases in these months, such as temperature and wind speed. The results of table 1 show the values of the average water consumption per irrigation, as the average consumption per irrigation for the germination stage was 21.04 mm and for the vegetative growth stage it reached 4.93, 9.85 and 14.52 mm for irrigation intervals of 2, 4 and 6 days, respectively. The average water consumption per irrigation for the stage of flowering was 10.23, 20.72, and 30.38 mm for irrigation intervals 2, 4, and 6 days, respectively. Table 2 shows the effect of irrigation interval on the seasonal water consumption of Peanut under sprinkler irrigation system. It is noted that the seasonal water consumption at the irrigation interval of 2 days was 96.10, 124.62, 73.52 and 212.78 mm for the stages of germination, vegetative growth, flowering and maturity of pods, respectively. As for the 4-day irrigation interval, it was 96.10, 124.55, 89.26, and 197.09 for the stages of germination, vegetative growth, flowering, and pod maturity, respectively. While at the 6-day irrigation interval, it was 96.10, 114.70, 87.26, and 207.57 mm for the stages of germination, vegetative growth, flowering, and pod maturity, respectively. The amounts of irrigation water added were 124.62, 124.55, and 114.70 mm in the vegetative growth stage, which 32 days, by 16, 8, and 5 irrigations at irrigation intervals 2, 4, and 6, respectively. The seasonal water consumption in the flowering reached 73.52, 89.26, and 87.26 mm, and they needed 14 days, with a number of irrigations of 5, 3, and 2 irrigations at irrigation intervals 2, 4, and 6, respectively by 41 days, with several 22, 10, and 7 irrigations. It reached 212.78, 197.09, and 207.57 mm at irrigation intervals 2, 4, and 6, respectively. The high consumption values in the maturity stage are attributed to the long period of the stage. We notice that the seasonal water consumption when applying the irrigation treatments increases with the growth stages, the reason for this is due to the increase in the water needs of the plant as a result of increasing the depth and spread of the roots, and then increasing their efficiency water and increasing the surface area of the leaves of the plant, which increased the water lost from the plant through transpiration.

Table 1. Depths of irrigation water (mm) during growth stages and total depth (mm) of seasonal water consumption of Peanut at irrigation intervals under the subsurface drip irrigation system

Total	pods maturity stage	Flowering stage	vegetative growth stage	germination stage	seasonal water consumption(mm)	irrigation interval
104	41	14	32	17	The duration of the growth stage	2 DAYS
47	22	5	16	4	number of irrigations	
362.3	148.16	51.17	78.85	84.16	Seasonal water consumption (mm)	
	3.61	3.66	2.46	4.95	daily water consumption (mm)	
	6.74	10.23	4.93	21.04	Consumption rate per irrigation (mm)	
104	41	14	32	17	The duration of the growth stage	4 DAYS
25	10	3	8	4	number of irrigations	
362.3	137.21	62.15	78.83	84.16	Seasonal water consumption (mm)	
	3.35	4.44	2.46	4.95	daily water consumption (mm)	
	13.72	20.72	9.85	21.04	Consumption rate per irrigation (mm)	
104	41	14	32	17	The duration of the growth stage	6 DAYS
18	7	2	5	4	number of irrigations	
362.0	144.54	60.76	72.60	84.16	Seasonal water consumption (mm)	
	3.53	4.34	2.27	4.95	daily water consumption (mm)	
	20.65	30.38	14.52	21.04	Consumption rate per irrigation (mm)	

Table 2. Depths of irrigation water (mm) during growth stages and total depth (mm) of seasonal water consumption of Peanut at irrigation intervals under sprinkler irrigation system

Total	pods maturity stage	Flowering stage	vegetative growth stage	germination stage	seasonal water consumption(mm)	irrigation interval
104	41	14	32	17	The duration of the growth stage	2 DAYS
47	22	5	16	4	number of irrigations	
507.0	212.78	73.52	124.62	96.10	Seasonal water consumption (mm)	
	5.19	5.25	3.89	5.65	daily water consumption (mm)	
	9.67	14.70	7.79	24.03	Consumption rate per irrigation (mm)	
104	41	14	32	17	The duration of the growth stage	4 DAYS
25	10	3	8	4	number of irrigations	
507.0	197.09	89.26	124.55	96.10	Seasonal water consumption (mm)	
	4.81	6.38	3.89	5.65	daily water consumption (mm)	
	19.71	29.75	15.57	24.03	Consumption rate per irrigation (mm)	
104	41	14	32	17	The duration of the growth stage	6 DAYS
18	7	2	5	4	number of irrigations	
505.6	207.57	87.26	114.70	96.10	Seasonal water consumption (mm)	
	5.06	6.23	3.58	5.65	daily water consumption (mm)	
	29.65	43.63	22.94	24.03	Consumption rate per irrigation (mm)	

The daily water consumption of the sprinkler irrigation system at the irrigation interval 2 days was 5.65, 3.89, 5.25, and 5.19 mm, as for the irrigation interval 4 days, the daily water consumption was 5.65, 3.89, 6.38, and 4.81 mm, where the irrigation interval was 6 days, the daily water consumption was 5.65, 3.58, 6.23, and 5.06 mm for the stages of germination, vegetative growth, flowering, and pod maturity, respectively. The water consumption per irrigation for all irrigation intervals for the germination stage was 24.03 mm. The water consumption per irrigation for the vegetative growth stage was 7.79, 15.57, and 22.94 mm for irrigation intervals of 2, 4, and 6 days, respectively and at the stage of Flower, it reached 14.70, 29.75, and 43.63 mm for the irrigation intervals 2, 4, and 6 days, respectively, and the water consumption per irrigation for the stage of maturity of the pods was 9.67, 19.71, and 29.65 for the irrigation intervals 2, 4, and 6 days, respectively. Table 3 shows the effect of the irrigation interval on the seasonal water consumption of Peanut with the furrow irrigation system. the value of water consumption for the germination stage was 106.5 mm for all irrigation intervals, and it increased to 145.00, 145.01, and 133.55 mm for irrigation intervals 2, 4, and 6, respectively in the vegetative growth stage, and the water consumption values decreased to 84.22, 103.92, and 101.60 mm in flowering stage, while the water consumption values increased to 247.72, 229.45, and 241.70 mm at the maturity stage of irrigation intervals 2, 4, and 6, respectively. The reason for this is due to the duration of the growth of each stage, where the germination stage required 17 days, the vegetative growth stage 32 days, the stage of flowering 14 days, and the stage of maturation of the pods 41 days, as well as the climatic conditions of each stage affecting the seasonal water consumption. We notice an increase in the seasonal water consumption of the plant with the length of the growth period and for all irrigation intervals, and the reason for this is due to the increase in the plant's need for water, as it is a long stage. In addition to the continued high temperature and intensity of solar radiation during the day, which indicates an increase in water losses by an increase in the evaporation process from the soil surface. Hence increasing the water requirements of the crop.

Table 3. Depths of irrigation water (mm) during growth stages and total depth (mm) of seasonal water consumption of Peanut at irrigation intervals under furrow irrigation system

Total	pods maturity stage	Flowering stage	vegetative growth stage	germination stage	seasonal water consumption(mm)	Irrigation intervals
104	41	14	32	17	The duration of the growth stage	2 DAYS
47	22	5	16	4	number of irrigations	
583.4	247.72	84.22	145.00	106.5	Seasonal water consumption (mm)	
	6.04	6.02	4.53	6.27	daily water consumption (mm)	
	11.26	16.84	9.06	26.63	Consumption rate per irrigation (mm)	
104	41	14	32	17	The duration of the growth stage	4 DAYS
25	10	3	8	4	number of irrigations	
584.8	229.45	103.90	145.01	106.5	Seasonal water consumption (mm)	
	5.60	7.42	4.51	6.27	daily water consumption (mm)	
	22.95	34.63	18.13	26.63	Consumption rate per irrigation (mm)	
104	41	14	32	17	The duration of the growth stage	6 DAYS
18	7	2	5	4	number of irrigations	
583.3	241.70	101.60	133.55	106.50	Seasonal water consumption (mm)	
	5.89	7.26	4.17	6.27	daily water consumption (mm)	
	34.52	50.80	26.71	26.63	Consumption rate per irrigation (mm)	

The daily water consumption of the furrow irrigation system for all irrigation intervals for the germination stage was 6.27 mm, while the daily water consumption values for the vegetative growth stage were 4.53, 3.81, and 4.17 mm for the irrigation interval 2, 4, and 6 days, respectively, and for the flowering stage, it reached 6.02, 9.70, and 7.26 mm for the irrigation interval 2, 4, and 6 days, respectively and the stage of maturity of the pods, the daily water consumption was 11.26, 22.94, and 34.53 mm for the 2, 4, and 6 day irrigation interval, respectively. Table 4 shows the effect of irrigation intervals and levels of organic fertilizer on the total yield (pods) of Peanut for each irrigation system. The average total yield under the subsurface drip irrigation system was 7.77, 9.50 and 8.07 Ton ha^{-1} for irrigation intervals of 2, 4 and 6 days, respectively. The 4-day and 6-day irrigation intervals, which did not differ significantly between them, were excelled on the 2-day irrigation interval. The average yield was 5.97, 9.18 and 10.20 Ton ha^{-1} for organic fertilization treatments without addition (control), 2000 kg ha^{-1} and 4000 kg ha^{-1} of Orgevit fertilizer, respectively. The treatment of 4000 kg ha^{-1} of Orgevit fertilizer was significant compared to other treatments. The interaction between the irrigation interval and organic fertilization under the subsurface drip irrigation system, the irrigation interval 4 days gave the highest total yield of pods 11.60 Ton ha^{-1} at the level of 4000 kg ha^{-1} of Orgevit fertilizer, with significant differences with other treatments. This comes consistent with (9, 14, 15, 17, 20). The average total yield under the sprinkler irrigation system was 6.30, 7.13, and 6.87 Ton ha^{-1} for irrigation intervals of 2, 4, and 6 days, respectively. The irrigation interval of 4 and 6 days without significant differences between them. The average total yield was 4.40, 7.33 and 8.57 Ton ha^{-1} for the organic fertilization treatments without addition (control), 2000 kg ha^{-1} and 4000 kg ha^{-1} of Orgevit fertilizer, respectively. The treatment of 4000 kg ha^{-1} of Orgevit fertilizer was significantly on the treatment without addition and treatment of 2000 kg ha^{-1} of Orgevit fertilizer. The interaction between the irrigation interval and organic fertilization under the sprinkler irrigation system, the irrigation interval 4 days and 6 days + 4000 kg ha^{-1} of Orgevit fertilizer was not significant differences between them in the total yield of Peanut pods 8.80 and 8.70 Ton ha^{-1} compared to other treatments. The average total yield under the furrow irrigation system was 8.53, 9.97 and 8.57 Ton ha^{-1} for irrigation intervals of 2, 4 and 6 days, respectively. The average total yield was 6.53, 9.67 and 10.87 Ton ha^{-1} for the organic fertilization treatments without addition (control), 2000 kg ha^{-1} and 4000 kg ha^{-1} of Orgevit fertilizer, respectively. The interaction between the irrigation interval and the organic fertilization under the furrow irrigation system, the irrigation interval of 4 days + 4000 kg ha^{-1} of Orgevit fertilizer was significant in the total yield of Peanut pods 12.10 Ton ha^{-1}. When comparing the three irrigation systems, sub-surface drip, sprinkler, and furrow irrigation system in the total yield of pods using the T-test, it was found that there were significant differences between the irrigation systems, 9.02 and 8.45 Ton ha^{-1} in furrow and subsurface drip irrigation system respectively compared to the sprinkler irrigation system, with an average of 6.76 Ton ha^{-1} (Table 5). Tables 4 and 5 show an increase in the average total yield of Peanut pods by 25% and 33.43% under furrow and subsurface drip irrigation system respectively compared to a sprinkler system. While the percentage increase in the total yield was 53.77% and 70.85% for the organic fertilization treatments of 2000 kg ha^{-1} and 4000 kg ha^{-1} of Orgevit fertilizer, respectively compared to a treatment without addition (control) under the subsurface drip irrigation system, and the sprinkler irrigation system increased the average total yield of pods was 66.59% and 94.77% for the organic fertilization treatments of 2000 kg ha^{-1} and 4000 kg ha^{-1} of Orgevit fertilizer, respectively compared to a treatment without addition (control) , and the increase rate was 48.09% and 66 .46% for the organic fertilization treatments of 2000 kg ha^{-1} and 4000 kg ha^{-1} of Orgevit fertilizer, respectively compared to a treatment without addition (control) under the furrow irrigation. The results show that the lowest yield of Peanut pods was at the irrigation interval of 2 days and under all irrigation systems. The reason may be due to the damage of some Peanut pods because of the shorting of the irrigation interval and then maintaining a high moisture content that is not compatible with preserving the pods from damage and infection with some types of fungi as it appeared in plants grown under irrigation interval of 2 days. The best yield of peanut pods was at the 4-day irrigation interval, while increasing the irrigation interval to 6 days did not lead to a significant decrease in the yield of pods, although the effect was significant in the statistical analysis (1,2,6,8).

Table 4. Effect of irrigation interval and organic fertilization and their interaction on total yield for all irrigation system (Ton ha^{-1})

average	4000 kg ha^{-1} Orgevit fertilizer	2000 kg ha^{-1} Orgevit fertilizer	control	Irrigation interval (day)	Irrigation system
7.77	9.30	8.53	5.50	2	Subsurface drip
9.50	11.60	10.30	6.60	4	
8.07	9.70	8.70	5.80	6	
---	10.20	9.18	5.97	average	
LSD values: Irrigation interval 0.321 Organic fertilization 0.289 Interaction irrigation interval ×Organic fertilization 0.501					
average	4000 kg ha^{-1} Orgevit fertilizer	2000 kg ha^{-1} Orgevit fertilizer	control	Irrigation interval (day)	
6.30	8.20	6.90	3.80	2	Sprinkler irrigation
7.13	8.80	7.70	4.90	4	
6.87	8.70	7.40	4.50	6	
---	8.57	7.33	4.40	average	
LSD values: Irrigation interval 0.346 Organic fertilization 0.342 Interaction irrigation interval ×Organic fertilization 0.599					
average	4000 kg ha^{-1} Orgevit fertilizer	2000 kg ha^{-1} Orgevit fertilizer	control	Irrigation interval (day)	
8.53	10.20	9.10	6.30	2	Furrow irrigation
9.97	12.10	10.60	7.20	4	
8.57	10.30	9.30	6.10	6	
---	10.87	9.67	6.53	average	
LSD values: Irrigation interval 0.188 Organic fertilization 0.187 Interaction irrigation interval ×Organic fertilization 0.325					

Table 5. Comparison of the total yield of Peanut (Ton ha^{-1}) under different irrigation system using the T-test

furrow irrigation	Sprinkler irrigation	Subsurface drip irrigation
9.02	6.76	8.45
	T-Test = 0.1877	

However, this helped not to damage the pods in the plants grown under that interval, but this effect did not appear clearly in the yield of the pods of Peanut at the irrigation interval 2 days under the furrow irrigation system. The reason for this may be because the water runs in the inside of the canals only without the tops, which leads to facilitating the process of draining excess water and increasing soil aeration by providing good draining conditions and then the growth and spread of the root system. As for the role of adding organic fertilization to the treatments of 2000 $kgha^{-1}$ and 4000 kg ha^{-1} of Orgevit fertilizer, were significantly compared to control treatment in plant length, number of branches $plant^{-1}$, root lengths and dry weights, and the total yield of peanut pods. This may be due to the role of organic fertilization in increasing the availability of the main nutrients, especially nitrogen, phosphorus and potassium (the fertilizer content of total nitrogen = 4%, organic nitrogen = 3.6%, total phosphorus = 3%, and total potassium = 2.5%). In addition to the role of organic fertilization in improving the physical properties of the soil, which was reflected in the increase in the growth and distribution of roots in the soil, thus increasing the absorption of water and nutrients (3,23, 27, 31, 33, 34). Also, this increase may be due to the balanced supply of organic as well as mineral nutrients, which led to the ability of the plant to absorb nutrients, which was reflected in increasing plant lengths, number of branches $plant^{-1}$, root lengths and their dry weights, and then increasing the biomass of the plant. Here, the important role of organic fertilization is confirmed once again in improving the physical properties of the soil where it led to an increase water content, and the role of these fertilizers was very clear, especially when taking the statistically significant effect of them individually or with the use of an irrigation interval of 4 and 6 days, as it worked to increase the depth of roots and achieve a good root distribution in the soil. The results also show the role of subsurface drip irrigation systems, the irrigation addition efficiency was 94.20%. The reason may be due to the addition of water directly to the soil surface and the effective root zone and then reducing evaporation from the soil surface by using the subsurface drip irrigation system.

CONCLUSION

The results of the study showed the possibility of using technology required to improve crop water productivity in arid and semi-arid regions using irrigation systems used to reduce water use, such as sprinkler and drip irrigation systems (surface and subsurface). The use of organic fertilizer worked to increase microbiological activity in the soil, which improves soil structure, aeration and water retention capacity, enhances macro-elements and increases the availability of NPK, in soil.

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