Design of Drip Irrigation System in a Study Area

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ABSTRACT

The finest irrigation technique in use today, among all irrigation techniques, is drip irrigation, thanks to its excellent and high consistency. This technique uses a pipe network to carry water to the field, then emitters to change it into energy for the plant. Despite the benefits of drip irrigation, there are several issues with the conventional network, including how the distribution of discharges, silt, and soil type affects the system. The location and rate of water supply in the root zone must be coordinated with crop needs in order for a drip irrigation system to fulfill its objectives .

The goal of the study is to is to design a drip irrigation system as a means of availing water for irrigation using crop data, consumptive use and soil data.
Fieldwork methodology and theoretical approach are the two methodologies that the study uses. In field work, soil analysis is done to look at the physical and chemical characteristics of the soil that have an impact on its quality and its appropriateness for growing plants. A study of soil testing was carried out in an engineering laboratory to monitor the functioning of this system.

Regarding the theoretical strategy a well-known piece of software called CROPWAT was used to calculate the crop water requirements and irrigation requirements based on soil, climate, and crop data. In estimation of the consumptive use, flow velocity, discharge, running time, distance between two drips, wetted soil width, wetted soil depth, frequency of irrigation for clay and sand soil.

Keywords: drip irrigation, soil type, CROPWAT, discharge, wetted depth, wetted width, running time, frequency of irrigation.

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Introduction

The shortage of water is one of the main constraints in the Tigris River, which recharges Kut Province in Iraq. Rising population and industry will place a twofold stress on scarce water supplies, negatively harming agriculture. to satisfy these expanding needs, agriculture will have a less stable supply of irrigation water.

Using present water resources more efficiently and effectively is one possibility for future water requirements. Trickle irrigation systems are often permanent and need little labor. Deep percolation losses are reduced due to the low rate of water application. Because of the reduced water consumption and lower operating pressure needs, the systems often have lower energy requirements than sprinkler systems (James, 1993). Mass et al. (1982)

discovered significant bums on tomatoes and potatoes, particularly on older leaves when employing spray watering with low quality (saline) water.

The adoption of a drip irrigation system can fully eliminate the problem of leaf damage caused by sprinkler watering. According to Meiri et al. (1982), the threshold salinity was somewhat lower with sprinklers, but the rate of yield reduction was larger (8% per dSm-1) than with trickle irrigation (4% per dSm-1). Another benefit of trickling irrigation is the pattern of salt dispersion underneath the emitters and the continual preservation of high matric potentials. Bernstein and Francois (1973) discovered a 59% yield difference for bell pepper between trickle and sprinkler irrigation when irrigation water salinity was 4.4 dSm-1, but no difference when excellent water was utilized.

Drip irrigation systems give the optimum overall soil water potential conditions for low quality irrigation water. It prevents leaf harm while also providing optimal soil water conditions (Shalhevet, 1984). However, there are various issues with drip irrigation. The most serious issue is particle and biological material obstruction of emitters, which can result in poor application uniformity (James, 1993). This problem can be solved by flushing the system after each farming season. When only a section of the root zone is moist and saline solutions are used without suitable control, salt buildup might result.In drought situations, drip irrigation systems have the ability to save irrigation water while maintaining or even boosting productivity.

Now that the necessary technology, expertise, and services are available, the country will be able to implement drip irrigation on a wide scale in the future. Drip irrigation systems have a significant initial investment but are labor, water, and fertilizer efficient, with minimal expenditure in land leveling (WRRI, 2001). Although drip irrigation systems have advanced to the point that farmers are embracing them, their effectiveness in the field has to be evaluated and standardized. Furthermore, drip irrigation systems should be distributed uniformly across the field, which may be accomplished by correct irrigation scheduling. Water application accuracy avoids over- or under-irrigation. Overwatering wastes both water and energy. The goal of irrigation scheduling is to calculate the precise amount of water to apply to the field as well as the precise timing. Furthermore, uniform water distribution across the field is critical for reaping the greatest benefits from irrigation schedule. Given the foregoing, the study was undertaken to assess the effectiveness of the indigenous drip irrigation system in the Iraq's Kut Province.

Objective:

The objective of this research work is to Design a drip irrigation system as a means of availing water for irrigation with discharge, running time, distance between two drips, wetted soil width, wetted soil depth, frequency of irrigation for clay and sand soil.

Materials and Methods

Location of the Study Area

The research area is situated in Kut Province's Al-Kut Palms station, 180 kilometers south of Baghdad, between longitude 43°42 and latitude 31°15, on the Kut-Baghdad road from the north side, and it has a total area of 323760 m^2.

Field investigations

The quality of a soil and it's suitability for plant growth can be determined by physical and chemical factors that can be learned by soil analysis. Using an auger and core sampler, soil samples were taken from 10 sites at depths ranging from 0 to 30 cm. For the purpose of analyzing the physical and chemical characteristics, the augured samples were air dried and powdered to pass through a 2 mm sieve. The engineering Andrea laboratory in Kut Province evaluated the study area's soil.

- **Physical soil testing**

Physical soil testing involves investigating the gravel, sands, and amendments used in green construction to ascertain a variety of characteristics, including soil texture, moisture content, bulk density, particle density, porosity, and hydraulic conductivity. Table 1 shows the results of physical characteristics.

Table 1 : Results of the study area's Physical analyses.

Sample	Soil (%)	Classification		Type	Moisture content (%)	Bulk density gm/cm³	Particle density (gm/cm³)	Porosity (%)	Saturated hydraulic conductivity Ks (cm/min)
	Clay	Loam	Sand						
S1	43	43	13	Silty clay	7.11	1.60	2.58	36.82	0.0005
S2	44	39	18	Clay	3.17	1.68	2.56	39.37	0.002
S3	46	16	48	Sandy clay	2.58	1.48	2.55	40.39	0.0002
S4	50	35	24	Clay	5.14	1.64	2.53	35.59	0.002
S5	44	41	25	Clay	3.21	1.54	2.60	40.76	0.0015
S6	52	39	23	Clay	2.26	1.66	2.54	33.07	0.003
S7	45	33	25	Clay	3.31	1.61	2.70	37.77	0.002
S8	50	22	42	Sandy	6.68	1.58	2.57	35.40	0.001
S9	51	39	28	Clay	3.16	1.56	2.64	40.90	0.001
S10	49	18	36	Clay	10.29	1.67	2.54	33.46	0.001

Sample	EC Ds/m	C.E.C. mol/kg	Na mmol/l	HCO_3 mmol/l	Ca mmol/l	Mg mmol/l	Cl mmol/l	pH	SAR
S1	5.41	4.28	9.5	2.2	58.4	30.8	27.6	7.42	2.01
S2	4.88	4.28	12	1.4	49.6	24	24.8	7.48	2.80
S3	4.76	2.67	13.6	2	48.8	25.2	22.6	7.40	2.46
S4	5.81	3.74	10.5	2	58.4	36.8	29.9	7.36	2.27
S5	4.78	4.81	9.8	2.4	50.8	25.2	23.1	7.51	2.25
S6	4.60	4.28	10	1.8	49.6	18.4	21.7	7.38	2.91
S7	5.10	5.35	15	2.2	50.4	21.6	23.4	7.47	3.53
S8	4.79	4.81	11.9	1.2	50.4	21.6	23.1	7.75	2.80
S9	5.11	5.35	13.1	2.2	52.4	23.6	23.4	7.18	3.08
S10	4.72	4.28	9.2	2	54	22	19.5	7.26	2.11

- **Chemical soil testing**

The most used technique for determining the nutrient content (and requirements) of soil is chemical analysis. If two requirements are met, an accurate assessment of nutrient requirements can be made: first, which the soil sample is accurately representative of the field to be studied; and, second, that the chemical testing method has been sufficiently calibrated to the crops and soils in the region (Manachini et al. 2009). Ten samples were collected from the research region for chemical tests, and the findings are shown in table 2.

Table 2 : Results of the study area's chemical analyses.

Item	Crop Name	Root Zone (d)(cm)	Crop factor (k)
1	Cabbage	50	1.05
2	Rice, Potato, Small vegetables	60	1.1
3	Green Beans	70	1.05
4	Groundnut Rabi , Pasture, Sweet peppers, Tobacco	80	1.06
5	Artichoke, Dry Beans, Banana	90	1.12
6	Maize, Pulses, Soybean, Sugar beet, Sweet Melon, Tomato	100	1.07
7	Barley	110	1.15
8	Alfalfa, Small Grain, Millet, Spring Wheat	120	1.04
9	San Flower	130	1.15
10	Citrus, Cotton, Sorghum (Grain)	140	0.92
11	Table Grapes, Wine Grapes, Winter WheatSugarcane (Raton)	150	1.09

12	Mango, Date Plans	200	1.2

CROPWAT software

CROPWAT is a decision-support tool created by the Land and Water Development Division of the Food and Agriculture Organization (FAO [6]). It is a computer program for calculating crop water requirements and irrigation requirements based on soil, climate, and crop data, as well as for the development of irrigation schedules for various management conditions and the calculation of scheme water supply for various crop patterns.

According to the kind of plant, root zone depths range from (50-200) m for the 12 crops of plants that are recommended for the research area. as shown in table 3.

Table 3: Values of root zone depth and crop factor for deferent crops.

Consumptive Use Determination

The percentage permanent wilting point (P.W.P.) of the two types of soil tested (clay and sand) each with a distinct proportion of silty, is the most often used metric and is calculated as follows (Basak, 1999):

P.W.P = F.C / f (1)

Where:

F.C = field capacity.

f = factor varying from 2 to 2.4 based on the soil's silt concentration (with 2 denoting low silt content and 2.4 denoting high silt content).

The available moisture content (A.M.C.), however, is equivalent to

A.M.C = F.C – P.W.P (2)

The depth of water stored in root zone (Dw) (cm), is expressed as:

Dw = (Ɣ * d / w) * R.A.M.C * P (3)

Where:

Ɣ = bulk density (F/L^3).

d = root zone depth (L).

w = Specific weight of water 1 gm/cm3 .

P = Percentage of wetted area.

R.A.M.C. stands for readily available moisture content, which is usually taken to be 75% of A.M.C.

In the research region, the field capacity was determined to be 7.5% for sand soil and 36% for clay soil, as indicated in Table 3. The two kinds of soil (clay and sand) that were taken into consideration for this investigation were determined to have bulk densities of 1.45 gm/cm^3 and 1.55 gm/cm^3, respectively.

The depth of water stored in the root zone (Dw) was discovered to be larger in clay soil than sand soil because clay is more porous and can store water for a longer period of time by a smaller surface area. The amount of water required to remove the silt from each kind of soil and pay it outside the plant root zone increases as the silt rate rises. The root zone depth of the recommended crops for both sand and clay soils is correlated with stored water (Dw). The Blaney-Criddle formula (Blaney and Criddle, 1962) can be used to calculate the consumptive irrigation use as:

Cu = 0.45 K * P (t + 17.8) (4)

Where Cu is the monthly consumptive use (cm) ,table 5. K is the crop factor of plant, P mean daily percentage of annual daytime hours and t is the mean daily temperature (°C), see table 4.

Table 4: Results of the factor [0.45 p (t + 17.8)] and monthly consumptive use of Kut Province.

Month	Mean Temp (°c)	p %	0.45 p (t+17.8)
1	11.5	0.0615	0.8108775
2	13.45	0.0691	0.97171875
3	17.35	0.0709	1.12146075
4	22.7	0.0764	1.39239
5	28.95	0.0886	1.8639225
6	32.95	0.1105	2.52354375
7	34.95	0.1093	2.59450875

8	34.85	0.1053	2.49482025
9	31.65	0.0966	2.1495915
10	26.2	0.0822	1.62756
11	19	0.0654	1.083024
12	13	0.0642	0.889812

Drip irrigation system parameters

System discharge (Q)

The daily dripper discharge is measured by the amount of water that wets a certain area of soil, and clay soil has a larger value than sand because of its capacity to store water. The dripper discharge values for sandy and clayey soils are shown in Table 5.

The area served by the current drip irrigation system is 323760 m^2. Figure (1) (Al_Kut Palms station, [2]) shows that this area, which is split into eight strips each measuring (40470) m^2 (100 * 250), comprises a drip irrigation system made up of a pump, filter, main pipe measuring 1.5 inches in diameter, lateral pipe measuring 1 inches in diameter, and dripper pipe measuring 16 mm in diameter. The Tigris River recharges the system into a basin with a size of (10 * 10 * 2.5) m.

The system's distribution of discharge values may be thought of as the following:

$$Q_L = Q_d * N_d \quad (5)$$

$$Q_m = Q_L * N_L \quad (6)$$

$$Q_h = Q_m * N_m \quad (7)$$

Where: Q_d the dripper discharge, (V/T), Q_L the lateral pipe discharge, (V/T), Q_m the main pipe discharge, (V/T). Q_h the head discharge, (V/T), N_d number of drippers, (20 drippers), N_L number of lateral pipe, (4 pipes) and Nm number of main pipe, (2 pipes). From the equation of continuity, the flow velocity of the pipe is:

$$V = \frac{4\, Q_{L,m,h}}{\pi\, d^2} \quad (8)$$

Where: V is the flow velocity of the pipe, (L/T), d is the diameter of the pipe (L).

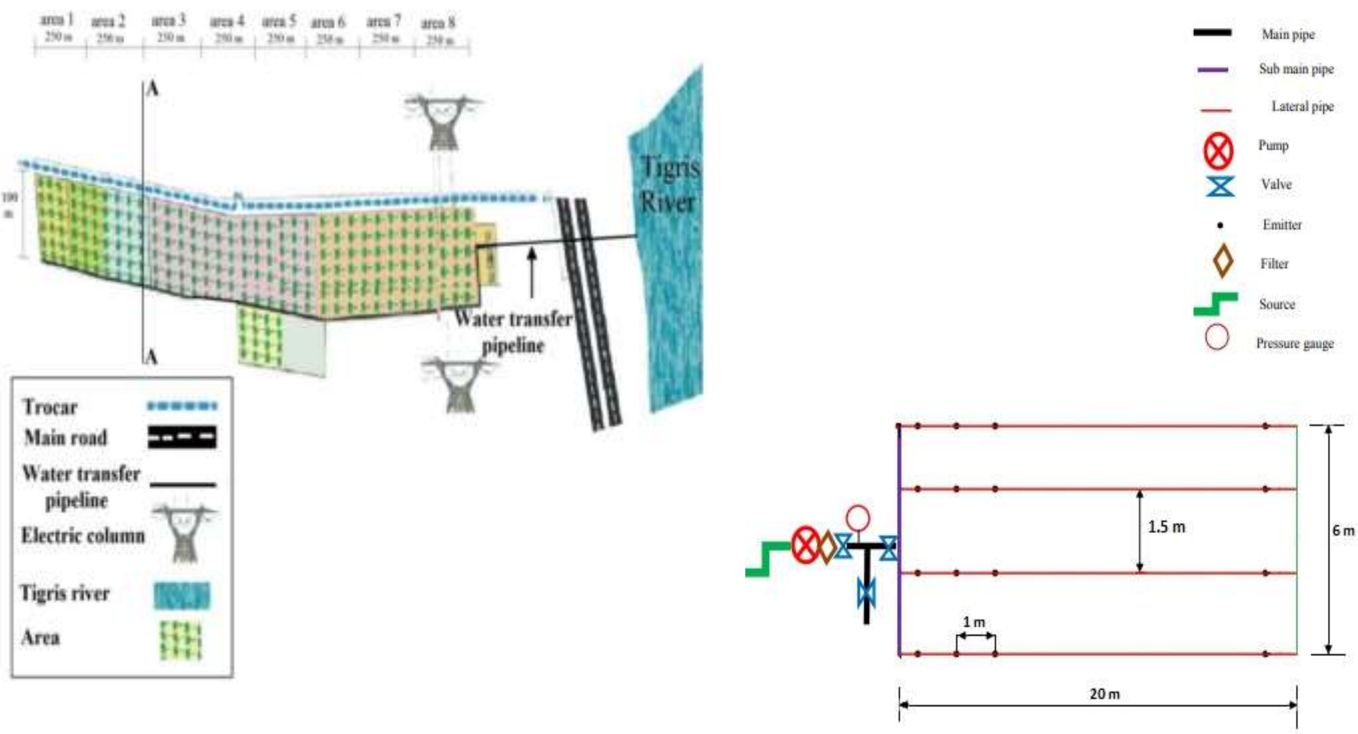

Figure 1: Outline of the drip irrigation system in Kut Province (Al_Kut Palms station,[2]).

Table 5: Estimated of consumptive use, flow velocity, discharge, running time, distance between two drips, wetted soil width, wetted soil depth, frequency of irrigation for clay and sand soil.

Soil	f	d (cm)	K	Q_d (l/h)	P%	Dw (cm)	Q_L (m3/h)	V_L (m/h)	Q_m (m3/h)	V_m (m/h)	Q_h (m3/h)	V_h (m/h)	Distance between two drips (l) (m)	running time (t) (day)	W (m)	D (m)	Cu (cm/day)	Fw (day)
caly	2	50	1.05	2.271	0.611	5.978	0.045	225.985	0.182	358.685	0.363	318.831	1.034	2.194	1.243	1.678	2.724	2.195
caly	2	60	1.1	2.725	0.629	7.388	0.054	271.182	0.218	430.421	0.436	382.597	1.091	2.259	1.342	1.807	2.854	2.589
caly	2	70	1.05	3.179	0.647	8.868	0.064	316.379	0.254	502.158	0.509	446.363	1.147	2.325	1.431	1.920	2.724	3.255
caly	2	80	1.06	3.633	0.665	10.419	0.073	361.576	0.291	573.895	0.581	510.129	1.204	2.39	1.512	2.022	2.75	3.788
caly	2	90	1.12	4.087	0.683	12.041	0.082	406.773	0.327	645.632	0.654	573.895	1.261	2.455	1.585	2.114	2.906	4.144
caly	2	100	1.07	4.541	0.702	13.735	0.091	451.971	0.363	717.369	0.727	637.661	1.318	2.52	1.653	2.198	2.776	4.948
caly	2	110	1.15	4.996	0.72	15.5	0.1	497.168	0.4	789.106	0.799	701.428	1.374	2.586	1.717	2.276	2.984	5.195
caly	2	120	1.04	5.45	0.738	17.335	0.109	542.365	0.436	860.843	0.872	765.194	1.431	2.651	1.776	2.349	2.698	6.425
caly	2	130	1.15	5.904	0.756	19.242	0.118	587.562	0.472	932.58	0.945	828.96	1.488	2.716	1.833	2.416	2.984	6.449
caly	2	140	0.92	6.358	0.774	21.22	0.127	632.759	0.509	1004.317	1.017	892.726	1.545	2.781	1.886	2.480	2.387	8.89
caly	2	150	1.09	6.812	0.792	23.269	0.136	677.956	0.545	1076.054	1.09	956.492	1.602	2.847	1.937	2.540	2.828	8.228
caly	2	200	1.2	9.083	0.883	34.582	0.182	903.941	0.727	1434.738	1.453	1275.323	1.885	3.173	2.161	2.800	3.113	11.107
caly	2.4	50	1.05	2.649	0.626	7.148	0.053	263.649	0.212	418.465	0.424	371.969	1.081	2.248	1.327	1.787	2.724	2.624
caly	2.4	60	1.1	3.179	0.647	8.868	0.064	316.379	0.254	502.158	0.509	446.363	1.147	2.325	1.431	1.920	2.854	3.107
caly	2.4	70	1.05	3.709	0.668	10.684	0.074	369.109	0.297	585.851	0.593	520.757	1.214	2.401	1.524	2.038	2.724	3.922
caly	2.4	80	1.06	4.239	0.69	12.598	0.085	421.839	0.339	669.544	0.678	595.151	1.280	2.477	1.608	2.143	2.75	4.581
caly	2.4	90	1.12	4.768	0.711	14.608	0.095	474.569	0.381	753.238	0.763	669.544	1.346	2.553	1.686	2.238	2.906	5.027
caly	2.4	100	1.07	5.298	0.732	16.715	0.106	527.299	0.424	836.931	0.848	743.938	1.412	2.629	1.757	2.325	2.776	6.021
caly	2.4	110	1.15	5.828	0.753	18.919	0.117	580.029	0.466	920.624	0.933	818.332	1.479	2.705	1.823	2.405	2.984	6.341
caly	2.4	120	1.04	6.358	0.774	21.22	0.127	632.759	0.509	1004.317	1.017	892.726	1.545	2.781	1.886	2.480	2.698	7.864
caly	2.4	130	1.15	6.888	0.796	23.618	0.138	685.489	0.551	1088.01	1.102	967.12	1.611	2.857	1.945	2.550	2.984	7.916
caly	2.4	140	0.92	7.418	0.817	26.112	0.148	738.219	0.593	1171.70	1.187	1041.51	1.677	2.934	2.001	2.616	2.387	10.94

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caly	2.4	150	1.09	7.947	0.838	28.703	0.159	790.948	0.636	1255.396	1.272	1115.907	1.743	3.01	2.054	2.677	2.828	10.15
caly	2.4	200	1.2	10.597	0.944	43.111	0.212	1054.598	0.848	1673.861	1.695	1487.877	2.075	3.39	2.290	2.945	3.113	13.847
sand	2	50	1.05	0.545	0.542	1.181	0.011	54.232	0.044	86.077	0.087	76.513	0.818	1.806	0.430	0.309	2.724	1.3
sand	2	60	1.1	0.654	0.546	1.429	0.013	65.078	0.052	103.292	0.105	91.815	0.832	1.821	0.469	0.337	2.854	1.502
sand	2	70	1.05	0.763	0.551	1.68	0.015	75.925	0.061	120.508	0.122	107.118	0.845	1.835	0.504	0.362	2.724	1.85
sand	2	80	1.06	0.872	0.555	1.935	0.017	86.771	0.07	137.723	0.14	122.421	0.859	1.85	0.537	0.385	2.75	2.111
sand	2	90	1.12	0.981	0.559	2.194	0.02	97.617	0.078	154.939	0.157	137.723	0.873	1.864	0.567	0.406	2.906	2.265
sand	2	100	1.07	1.09	0.564	2.457	0.022	108.464	0.087	172.154	0.174	153.026	0.886	1.879	0.595	0.425	2.776	2.655
sand	2	110	1.15	1.199	0.568	2.724	0.024	119.31	0.096	189.369	0.192	168.328	0.900	1.893	0.621	0.444	2.984	2.738
sand	2	120	1.04	1.308	0.572	2.994	0.026	130.156	0.105	206.585	0.209	183.631	0.913	1.908	0.646	0.461	2.698	3.329
sand	2	130	1.15	1.417	0.577	3.268	0.028	141.003	0.113	223.8	0.227	198.934	0.927	1.922	0.670	0.478	2.984	3.286
sand	2	140	0.92	1.526	0.581	3.546	0.031	151.849	0.122	241.016	0.244	214.236	0.941	1.937	0.692	0.493	2.387	4.457
sand	2	150	1.09	1.635	0.585	3.828	0.033	162.696	0.131	258.231	0.262	229.539	0.954	1.951	0.714	0.508	2.828	4.061
sand	2	200	1.2	2.18	0.607	5.294	0.044	216.927	0.174	344.308	0.349	306.052	1.022	2.024	0.809	0.574	3.113	5.101
sand	2.4	50	1.05	0.636	0.545	1.387	0.013	63.271	0.051	100.423	0.102	89.265	0.829	1.818	0.463	0.332	2.724	1.527
sand	2.4	60	1.1	0.763	0.551	1.68	0.015	75.925	0.061	120.508	0.122	107.118	0.845	1.835	0.504	0.362	2.854	1.766
sand	2.4	70	1.05	0.89	0.556	1.978	0.018	88.579	0.071	140.592	0.142	124.971	0.861	1.852	0.542	0.388	2.724	2.178
sand	2.4	80	1.06	1.017	0.561	2.281	0.02	101.233	0.081	160.677	0.163	142.824	0.877	1.869	0.576	0.412	2.75	2.489
sand	2.4	90	1.12	1.144	0.566	2.59	0.023	113.887	0.092	180.762	0.183	160.677	0.893	1.886	0.608	0.435	2.906	2.674

sand	2.4	100	1.07	1.271	0.571	2.903	0.025	126.541	0.102	200.846	0.203	178.53	0.909	1.903	0.638	0.456	2.776	3.138
sand	2.4	110	1.15	1.399	0.576	3.222	0.028	139.195	0.112	220.931	0.224	196.383	0.925	1.92	0.666	0.475	2.984	3.24
sand	2.4	120	1.04	1.526	0.581	3.546	0.031	151.849	0.122	241.016	0.244	214.236	0.941	1.937	0.692	0.493	2.698	3.943
sand	2.4	130	1.15	1.653	0.586	3.875	0.033	164.503	0.132	261.1	0.264	232.089	0.957	1.954	0.717	0.511	2.984	3.896
sand	2.4	140	0.92	1.78	0.591	4.21	0.036	177.157	0.142	281.185	0.285	249.942	0.973	1.971	0.741	0.527	2.387	5.291
sand	2.4	150	1.09	1.907	0.596	4.549	0.038	189.812	0.153	301.27	0.305	267.795	0.988	1.988	0.764	0.543	2.828	4.826
sand	2.4	200	1.2	2.543	0.622	6.324	0.051	253.082	0.203	401.693	0.407	357.06	1.068	2.072	0.864	0.611	3.113	6.094

Wetted width (W)

The wetted soil width at the root zone of plants can be determined as: (Phull and Babar, 2012):

$W= 3.245 [q_w^{0.5} * d^{0.065} * t^{0.435} / k_s^{0.065}]$ (9)

Where: W is wetted soil width, (m), qw water application rate or discharge rate per unit distance between two subsequent drips, (m^2/s), ks saturated hydraulic conductivity of the soil, (m/s), d Depth of root zone, (0.2 m) and t running time of the drip (day), can be determined as:

$t = A * Dw / Q_d$ (10)

Where : A is the area served by each drip (m^2).

Wetted depth (D)

The wetted soil depth must be applied to an irrigation system after the soil water level reaches the prescribed depletion level. The wetted soil depth at the root zone of plants can be calculated as: (Phull and Babar, 2012):

$D= 3.572 [qw^{0.5} * d^{0.177} * t^{0.323} / ks^{0.177}]$ (11)

Where: D is wetted soil depth below porous pipe, measured in meters.

Frequency of irrigation (Fw)

It refers to the amount of days that between two irrigated periods void of rain. The moisture usage ratio varies depending on the type of crop and the environment, and it increases as the crop becomes bigger. According to (Basak, 1999) the frequency of irrigation (Fw) is as follows:

$Fw = Dw / Cu$ (12)

Where: Fw is frequency of irrigation (day), D_w the depth of water stored in root zone (cm). The frequency of irrigation is highest level in clay and silty soil.

Summary of the irrigation system parameters are listed in table (5) for both soils.

Results and Discussion

The distance between emitters and emitter flow rates must be adjusted to the soil's wetting qualities and the running time and frequency of irrigation to be provided to the crop for drip irrigation systems to supply improved water.

The irrigation system parameters summarized as:

1. The dripper discharge Q_d for clay soil with low silty (f=2) and high silty (f=2.4), are found to vary between (2.27 - 9.08) l/h and (2.65 - 10.6) l/h, respectively. For sand soil, the values of Q_d are found to range between (0.54 - 2.18) l/h with low salinity (f=2) and (0.64 - 2.54) l/h with high salinity (f=2.4).
2. Running time of the drip (t) value in clay soil with low silty (f=2) for range between (2.194 - 3.173) days and (2.248 - 3.39) days in clay soil with high silty (f=2.4), while (1.806 – 2.024) days for sand soil with low silty (f=2) and (1.818– 2.072) days with high silty (f=2.4).
3. The wetted soil width (W) values were found to be at range between (1.243 - 2.161) m for the clay soil with low silty (f=2) and (1.327 - 2.290) m with high silty (f=2.4), while in the sand soil it is found to range between (0.430 – 0.809) m with (f=2) and (0.463 – 0.864) m with (f=2.4).
4. The wetted soil depth (D) values were found to be at range between (1.678– 2.8) m for the clay soil with low silty (f=2) and (1.787– 2.945) m with high silty (f=2.4), while in the sand soil it is found to range between (0.309- 0.574) m with (f=2) and (0.332- 0.611) m with (f=2.4).
5. The frequency of irrigation (Fw) values of plants taken for range between (2.195– 11.107) days for clay soil with low silty (f=2) and (2.624 – 13.847) days with high silty (f=2.4), while (1.3– 5.101) days for sand soil with low silty (f=2) and (1.527– 6.094) days with high silty (f=2.4).

The information on soil often employed in drip system designs are broad soil texture ranges (such as sand and clay). Varied soil types have varied wetting patterns.

Can be summarized as:

1. Clay soil: Its particles are tightly packed, leaving little room for air or water to pass through. Water is absorbed extremely slowly, and if it is administered too rapidly, runoff may result. Clay soil can hold water quite well and can stay wet for several days in this condition, when water tends to travel outward away from the drip emitter.
2. Sandy soil: It is highly soft and has lots of space for air or water. Water evaporates relatively rapidly, and runoff rarely happens. When the earth is damp, water usually seeps down through it. Sandy soil can dry up extremely rapidly since it cannot retain water effectively.

Conclusions:

From the information collected during this study, and from the analysis of results, the following conclusions are drawn:

1. It is important to assess the drip irrigation system's compatibility based on the elevation of the physical and water-holding characteristics of the soil before selecting it.
2. The kind of soil affects how quickly the drip irrigation system filters water. The amount of water that a particular soil needs may be localized with the help of this irrigation system. Because clay soil can store more water than sandy soil, it requires less frequent soaking.
3. The capacity, drip line spacing, and emitter spacing of drip irrigation systems are determined by the crop and soil types. The drip system's capacity must be sufficient to meet the crop's peak water needs.
4. Based on soil, climate, and crop data, CROPWAT is an easier computer tool to use to do typical estimates for crop water requirements and irrigation requirements.
5. In order to clay soil is less porous than sand soil; it is able to store water for a longer period of time by a smaller surface area, resulting in a higher designed drip irrigation discharge in clay soil. For each kind of soil, a rise in the silt rate results in a greater need for irrigation water.
6. To prevent pipeline water hammer issues, flow velocity should be kept low when irrigation system pipe diameter increases.
7. The wetted soil width varies with soil type and emitter discharge; it is larger for high silty clay soils than for low silt and less for sandy soils.
8. The wetted soil depth for clay soil is higher than sand soil as it ability to save the water for long time, with high silt.
9. The frequency of irrigation is higher in high silty clay soil than sandy soil, the latter paid of water more quickly, so the irrigation needs convergent periods.

Recommendations

Regular system cleansing reduces emitter obstruction and increases emission discharge from obstructed emitters.in addition to investigating the effect of organic fertilizers on soil salinity in drip irrigation system

The soil's infiltration rate is difficult to assess; it fluctuates during watering and may vary throughout the season. As a result, it is recommended that when building a drip irrigation system, the right dripper discharge, operating time, and watering frequency be selected at the design stage.

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