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Moisture Distribution in High Ground Water Table Sandy Soils under Mini-Sprinkler Irrigation System.

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The research was run in a - 73 cm ground water table sandy soil at Siwa Oasis . A.R. E. . Soil surface is undulated . A nozzle operating pressure of 0.69 bar (10 psi) , yielded the mini-sprinkler (Mikroregner) a precipitation rate of 7.56 - , 1.52 -, 0.80 - and 0.00 mm / h at zones surrounding the mini -sprinkler, 1 (0 -120 -), 2 (120 - 230 -) , 3 (230 - 300) and 4 (300 - 370 cm). After one hour and 45 minutes with the given precipitation rates resulted a change of soil moisture content of 3.31 -, 0.67 - 0.04 - and 0.00 vol. % in the 0 -40 cm soil layer for the above mentioned zones, respectively. Ignoring the two abnormal measurement values of 29 - at the mini-sprinkler and 19 mm /h at 50 cm left-hand of the mini-sprikler resulted in a change of soil moisture content of 2.54 vol. % in the 0 - 40 cm soil layer in the 1 (0 -120 cm) zone. Nevertheless, an application of 3.4 mm, on the average , through 1 hour and 45 minutes across a 144 square meters area irrigated by four mini-sprinklers , 6 meters apart , caused an wetting increase of 2.34 - , 2.33 - and 2.40 vol. % at the 0 -40 cm soil layer related to the moisture content before irrigation of the three zones , 1 (0 - 120 -) , 2 (120 - 230 -) and 3 + 4 (230 - 370 cm) , respectively . Such discrepancy might be attributed to variable depth of ground water in the three zones with different contribution through upward capillary flow from the ground water table .

A mini-sprinkler with better application uniformity at low nozzle operating pressure would be preferable . It is advisable to use such mini-sprinkler irrigation only as supplemental irrigation for orchards in Siwa Oasis to control water logging problems , save good quality irrigation water and reduce irrigation costs . The saved good quality water would be applied for wider land reclamation projects .

Key words: zones surrounding the mini-sprinkler, precipitation rate , upward capillary flow , supplemental irrigation .

There are water logging problems in Siwa Oasis. Surface irrigation systems require soil surface leveling. Such leveling has high costs and often destroys top soil.

With surface irrigation, drainage networks are required to get red of the ground -, leakage - and drainage water. However, there are no drainage outlets. Such factors necessitate use of pressurized irrigation systems, such as mini-sprinkler, to control wetting depth and make use of upward capillary flow.

Materials and Methods

The experiment was conducted in Alkaf ground water control project in Siwa Oasis, Egypt. The soil characteristics are given in Table (1) according to Black *et.al.* (1965) and Rowell (1994). The soil moisture content was determined before and after an irrigation of 3.4 mm average depth through four mini-sprinklers during 105 minutes. The mini-sprinklers are 6 m apart and serve 144 m^2 (Fig. 1). Such mini-sprinklers are 1 5, 1 4, 2 5 and 2 4. Soil moisture was determined across three profiles and each was replicated two times. Such profiles are profile 1 ; perpendicular to the irrigation lines, profile 2 ; along the irrigation lines and profile 3 ; axial of the four mini-sprinklers. The soil moisture sampling continued about 2 hours before irrigation and about 2 hours after irrigation. The soil surface elevation at the mini-sprinkler 1 5 was considered as reference level. $N^{7\,cm}$ means that the soil surface at that location is 7 cm higher than that at 1 5 and $V^{-4\,cm}$ is 4 cm lower. Ground water table was measured at several locations of the studied area and written as ($^{\bullet}$). The mini-sprinkler water distribution pattern was measured (Fig. 2). Table (2) reveals soil moisture content before and after the irrigation. Soil moisture equipotential lines were drawn (Fig. 3). Soil moisture distribution in the 0 - 40 cm layer in relation to the ground water table is illustrated in Fig. (4).

Results and Discussion

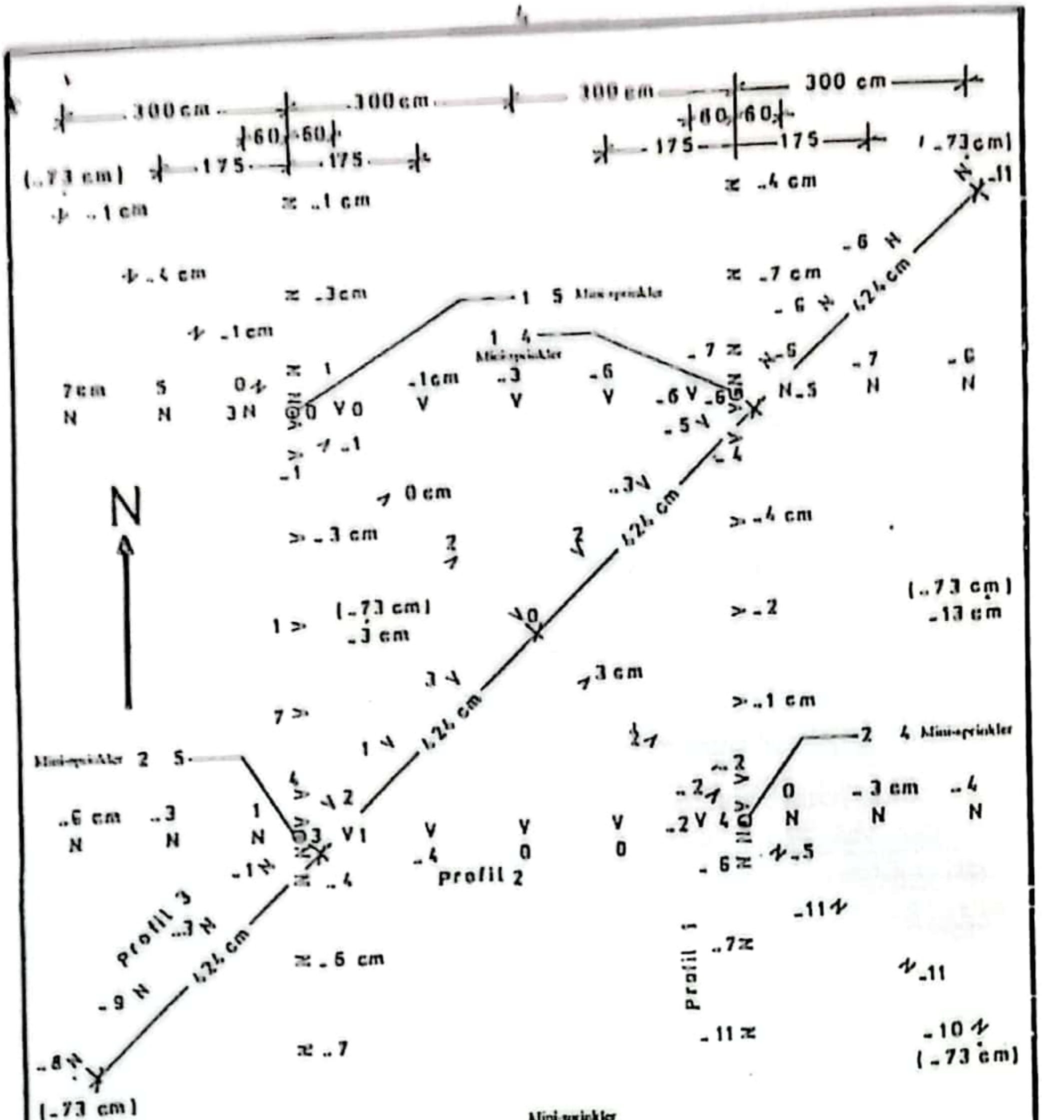
It is concluded from Table (1) that 0 - 80 cm soil layer has 10 -, 25 -, 50 - and 63 % Available Water (A. W.) of 4.7 -, 9.4 -, 17.1 - and 21.1 vol. %, respectively. Fig. (3), before irrigation, discloses that the soil moisture Equipotential Lines (E. L.) through the bottom layer (A) slowly decreased with elevation. The soil moisture decreased linearly upwards from 22 vol. % [> 63 % A. W.] at Ground Water

Table (G. W. T.) at - 73 cm depth to 15 vol. % (< 50 % A.W.) at a depth of - 50 cm ; *i.e.*, 7 vol. % through 25 cm . The E. L. also decreased linearly in the layer (B) . The soil moisture decreased from 19 vol. % (> 50 vol. % A. W.) at a depth of - 50 cm to 6 vol. % (< 25 % A. W.) at a depth of - 30 cm ; *i. e.* , 13 vol. % through 20 cm . Within layer (C) the soil moisture changed more slowly from 8 vol. % (< 25 % A. W.) at a depth of -30 cm to 5 vol. % (< 25 % A. W.) at soil surface ; 3 vol. % over 30 cm . The change was nonuniform and there were few E. L. which were mostly horizontal or oblique . Layer (C) between 0 -20 cm had the lowest water content and had the lowest contribution from upward capillary flow. Also , the evaporation from the soil surface decreased water content . It is evident from Fig. (3) before irrigation that the soil moisture (E. L.) are different and not horizontal through all soil profiles owing to the different soil moisture contents of the same depth at the different measuring locations . Such different moisture contents are attributed to the different G. W. T. contributions for wetting soil layers at different elevations (Fig. 4) , before irrigation . It is also attributed to differences of soil; soil structural unit size distribution and bulk density at each measuring location . It is obvious from Fig. 4, before irrigation , that the soil moisture contents of the layer 0 - 20 cm are higher at lower elevations above the G. W. T. at - 73 cm depth . This coincides with the finding of Schakschouk (1998) , who found that upward capillary flow from a ground water table in sandy soils results in wetting ranges from 5.5 to 7.6 vol. % at an elevation of 75 cm above G.W. T. (higher at lower elevations).Such soils have 31.8 - 39.9 and 0.91 - 1.24 % of the entire mass soil structural unit of sizes < 0.250 and 0.063 mm diameter , respectively and bulk density of 1.608 - 1.723 g / cm^3 (see Table 1) . Fig. (3), after irrigation , reveals that wetting the soil layers occurred upward through capillary rise from the ground water table and downwards through irrigation . The soil moisture E. L. after irrigation changed homogeneously through the layers (A) and (B) . Soil moisture decrease upward in the layer (A) after irrigation was 5 vol. % (< that before irrigation; 7 vol. %) and in the layer (B) 9 vol. % (< that before irrigation; 13 vol. %). The soil moisture decrease at (A) was less than at (B) because (A) is nearer to G. W. T. than (B); *i. e.* receiving more wetting contribution . The soil moisture change within the layer (C) was different . Within the depth 40 - 35 cm across all soil profile changed the soil moisture E. L. homogeneously. The moisture decreased 3 vol. % (14 - 11 vol. %). In the areas 1, 2 and (3 + 4) across the depth of 0 - 40 cm , the soil moisture E. L. changed inhomogeneously. The soil moisture decreased from 14 -, 12 -, and 13 vol. % (> 25 % A. W.) at - 40 cm depth to 10 -, 9 - and 9 vol. % (≥ 25 % A. W.) at the 0 depth (soil surface) at the areas 1, 2 and (3 + 4) respectively. It is obvious from Table (2) that soil moisture within the depth 0 - 40 cm increased to 10.35 -, 8.79 - and 8. 97 vol. % at the areas 1 , 2 , and (3 + 4) , respectively after a mini-sprinkler irrigation of 3.4 mm depth , from 8.01 - , 6.47- and 6.57 vol. % , respectively , before irrigation . Such figures show that the soil moisture increased 2.34 -, 2.32 - and 2.40 vol. % , respectively . This result is discrepant to that Fig. (2) presents. From Fig. (2), it is obvious that the precipitation rate sharply decreases as the distance from the mini-sprinkler increases. Ignoring the abnormal 29 -and 19 mm / hr. at the mini-sprinkler and 50 cm to the left modifies the soil moisture increase at area 1 to 2 .54 vol. %. Also the average precipitation rate at area 2 amounts to 1.52 mm / hr. which wets the 0 -40 cm layer by 0.67 vol. % after 105 minutes. Likewise, 0.02 vol. % was added at area (3 + 4). Checking the soil moisture increase after irrigation (2.34 -, 2.32 - and 2.40 vol. %), the soil moisture as a result of precipitation rate distribution (2.54 -, 0.67 and 0.02 vol. %) and the elevation of the 0 - 40 cm layer above the G. W. T. at - 73 cm, Fig. (4) emphasizes that the upward capillary flow has a role in wetting 0 -40 cm soil layer. The area 1 after irrigation is 1 cm closer to the G. W. T. than that before irrigation. It is concluded that the contribution of the G. W.T to wetting 0 - 40 cm layer at area 1 is negligible and the 3.4mm depth mini-sprinkling during 105 minutes caused the soil moisture increase . Eventhough, the area (3 + 4) the most distant one from the mini-sprinkler and received the least wetting (0.02 vol. % ; about 0) , the soil moisture increased significantly Fig. (4). This is attributed to the contribution of the G. W. T. , where the 0 - 40 cm soil layer at (3 + 4) area after irrigation is lower than that before irrigation . Hence, the soil moisture at the first is more than that at the second . It is also evident from Fig. (4) that soil moisture at the mini-sprinkler after irrigation is more than that before irrigation and resulted from irrigation, measuring before and after irrigation at the mini-sprinkler has same elevation above the G. W. T. and soil characteristics are the same. Both factors gave same contribution from G. W. T. Fig. (4) denotes also that moisture content of the 0 - 20 and 20 - 40 cm layers are more similar than before irrigation . Also soil moisture of 40 -60 cm layer after irrigation is more than before irrigation because the first is nearer than the second to G. W. T. Also soil moisture content of 0 - 40 cm layer at 424 cm from the mini-sprinkler after irrigation is higher than that before irrigation because its elevation above G. W. T. is lower such soil moisture analysis was attained through making use of Supersperg (1966) and Schakschouk (1976 and 1982).

TABLE 1. Soil characteristics:

SOIL LAYER .CM SOIL PARAMETERS	0 – 20	20 -40	40 - 60	60 - 80
Field capacity . vol. %	32.1	34.6	26.1	37.6
Permanent welting point . vol. %	1.1	1.6	2.0	1.8
Available water . vol. %	31.0	33.0	24.1	35.8
Bulk density . g / cm	1.61	1.62	1.68	1.67
Real density . g / cm	2.55	2.56	2.46	2.49
Porosity . %	36.86	36.72	31.71	32.93
Basic infiltration rate . cm /h	32.3	-	-	-
Clay . o < 0.002 mm . w. % Silt . o 0.002 - 0.020 mm .w. % + Sand . o 0.020 – 2.000 mm . w.. %	< 1.88 > 98.12	< 1.38 >98.62	< 1.02 >98.98	< 1.56 > 98.44
Soil texture (I SSS)	sand	sand	sand	sand
105° C dried soil . w. %	99.85	99.95	99.96	99.95
Organic matter content . w. %	1.07	1.33	1.00	0.63
Calcium carbonate content . w. %	11.61	11.22	9.50	12.28
PH	6.90	7.05	7.05	7.10
Salinity . µS / cm	481	397	212	292

+ The figure denote the soil structural unit in size of clay, silt and sand.



Mini-sprinkler
1, 5, 6,..11,..Bodenoberflächenhöhenunterschiede(cm) bei den Bohrlöchern im Vergleich zu der..höhe bei dem 1 5 Mikroregner (0 cm).
soil surface elevation differences (cm) at locations of soil sampling relative to soil surface elevation at 1 5 mini-sprinkler

⊙ Mikroregner.
soil sampling location before irrigation
V Schlagbohrloch vor der Regengabe.
soil sampling location after irrigation
N Schlagbohrloch nach der Regengabe.

(..73 cm) Grundwasserspiegel(cm) im Vergleich zu der Bodenoberfläche (0 cm) bei dem Mikroregner 1 5.
ground water table relative to soil surface elevation at 1 5 mini-sprinkler

ABB. 1 : LAGE DER ENTNAHMESTELLEN DER BODENPROBEN ZUR ERMITTLUNG DER WASSERVERTEILUNG UND DER UNTERIRDISCHEN WASSERTIEFE (-Cm).
FIG. 1 : LOCATIONS OF SOIL SAMPLING TO DETERMINE SOIL MOISTURE DISTRIBUTION AND GROUND WATER TABLE DEPTH (-CM).

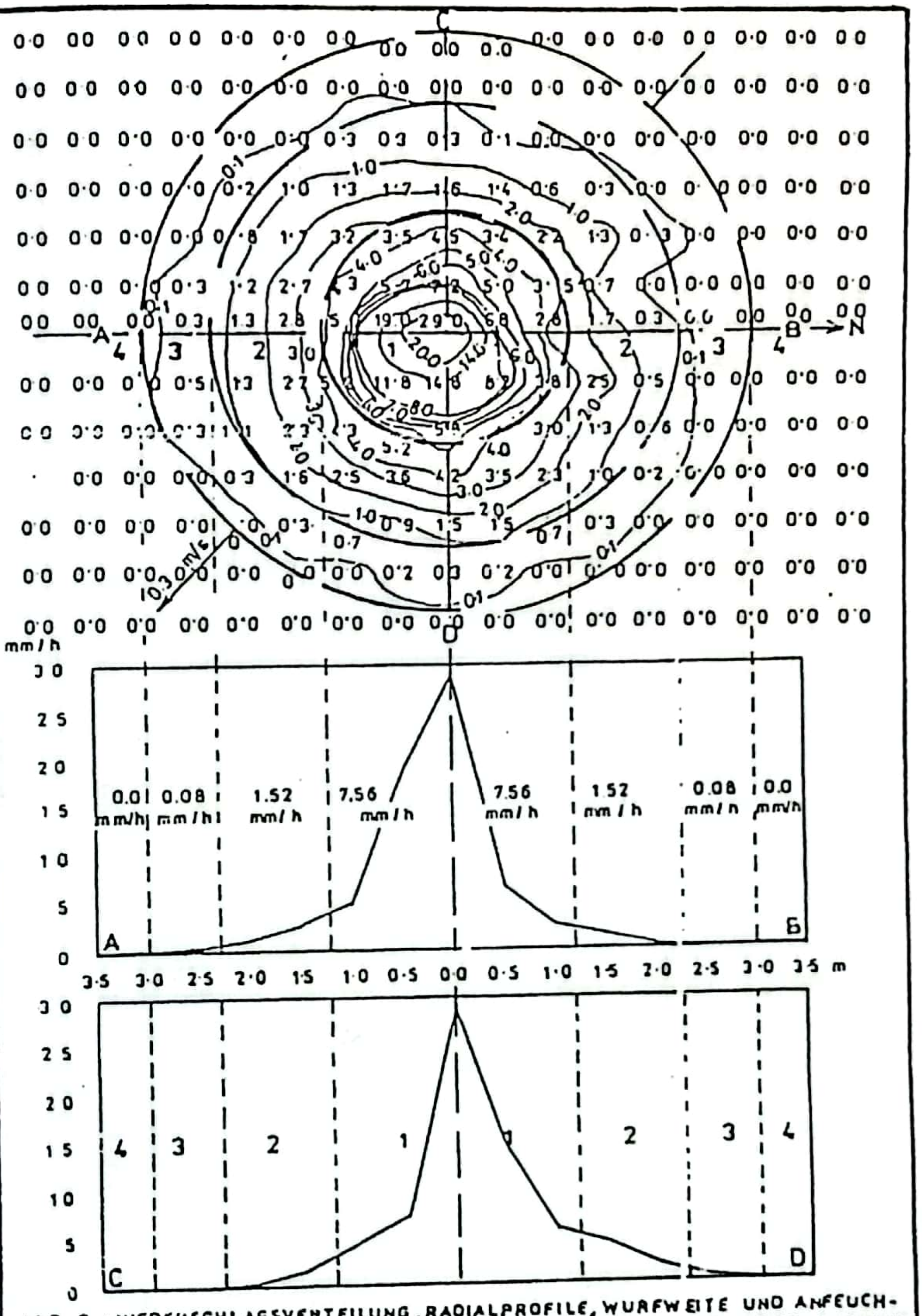


ABB. 2 : NIEDERSCHLAGSVERTEILUNG, RADIALPROFILE, WURFWEITE UND ANFEUCHTUNGSZONEN DES M.REGNERS BEI BETRIEBSDRUCK VON 0.69 BAR UND 0.3M/S WINDGESCHWINDIGKEIT, 22.8 - LUFT - UND 35.7 °C WASSERTEMPERATUR UND 61.8 % REL. LUFTFEUCHTIGKEIT ALS MITTELWERTEN.

FIG 2 : PRECIPITATION RATE DISTRIBUTION, RRADIAL PROFILES, RADIUS OF WETTING AND WETTING ZONES OF A SINGLE MINI-SPRINKLER AT OPERATING RESSURE OF 0.69 BAR AND 0.3 M/S WIND VELOCITY, 22.8 - AIR - AND 35.7 °C WATER TEMPERATURE AND 61.8 % RELATIVE HUNIDITY AS AVERAGES.

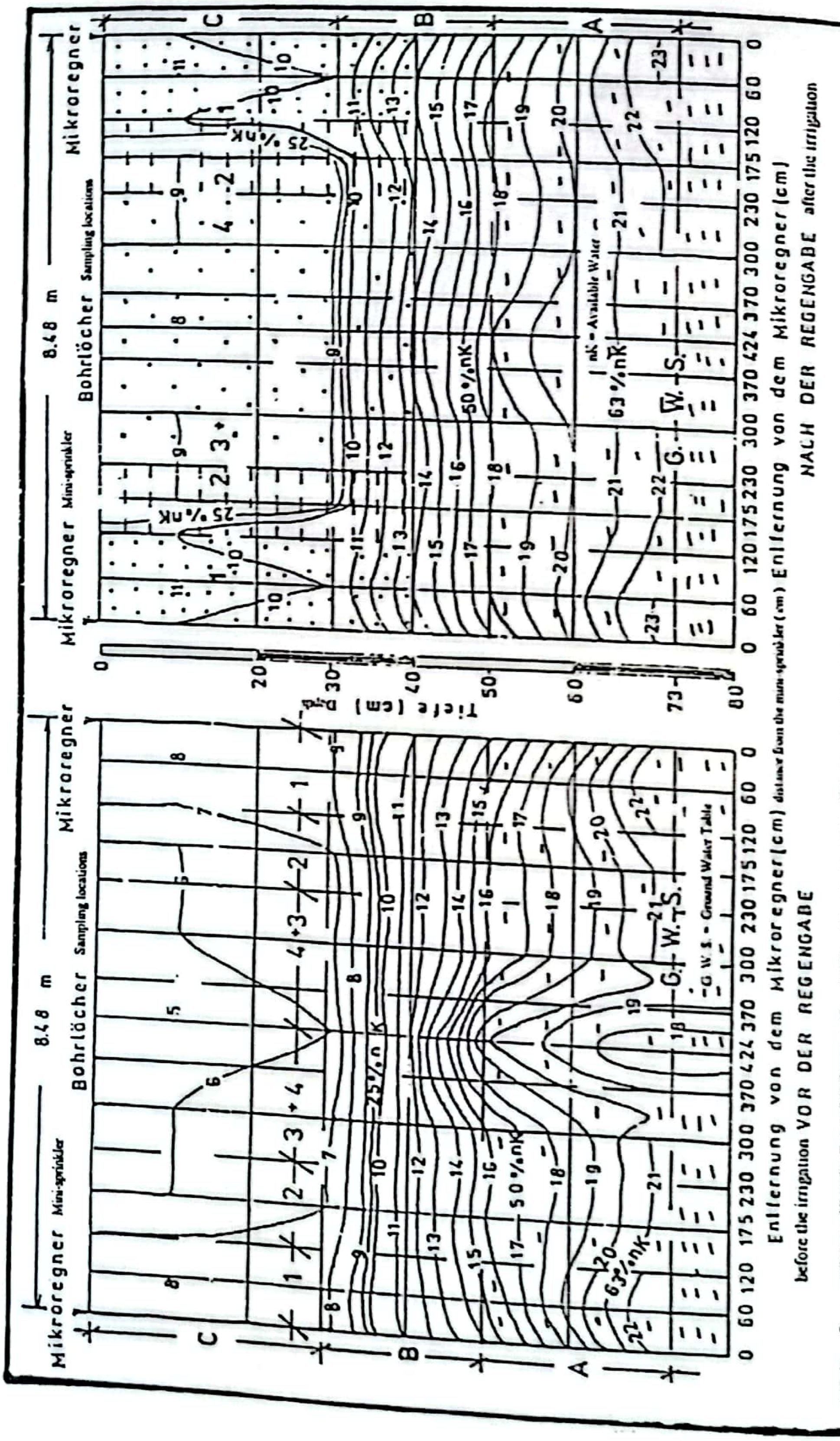
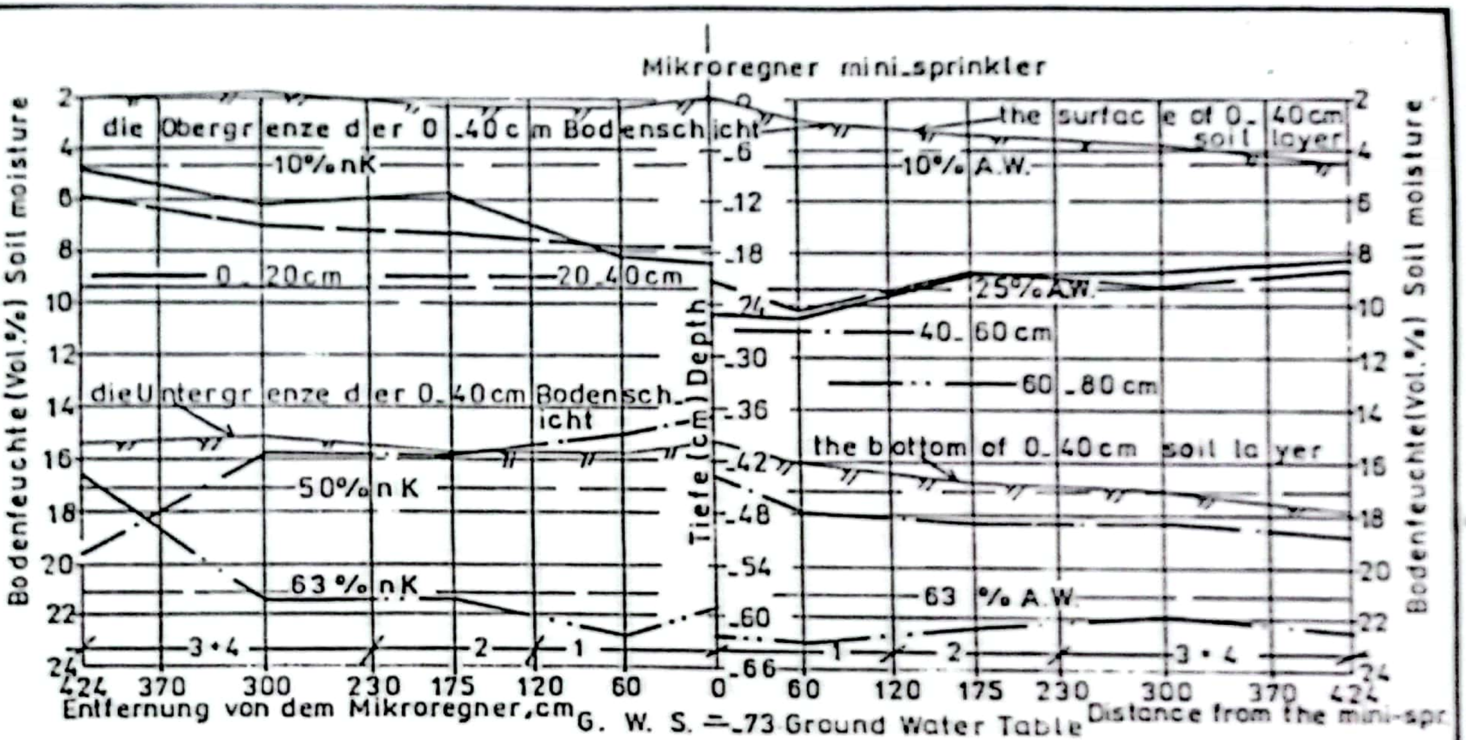


ABB. 3 : ISOPLETHENDARSTELLUNG DER BODENFEUCHTE, MITTELWERTE DER DREI PROFILE 1, 2 UND 3 (JEDER PUNKT JEDER TIEFE IST MITTELWERT DER ZWÖLF STELLENWERTE) VOR UND NACH EINER REGENGABE VON 3.4 MM ALS MITTELWERT.

FIG. 3 : SOIL MOISTURE EQUIPOTENTIAL LINES AS AN AVERAGE OF THE THREE PROFILES 1, 2 AND 3 ; EACH VALUE OF EACH DEPTH IS THE AVERAGE OF TWELVE VALUES BEFORE AND AFTER A MINI-SPRINKLER IRRIGATION OF 3.4 MM ON THE AVERAGE



VOR DER REGENGAB BEFORE THE IRRIGATION NACH DER REGENGABE AFTER THE IRRIGATION

ABB. 4: ÖRTLICHER VERLAUF DER BODENFEUCHTE, MITTELWERTE DER DREI PROFILE 1, 2 UND 3 (JEDER PUNKT JEDER TIEFE IST MITTELWERT DER ZWÖLF STELLENWERTE) VOR UND NACH EINER REGENGABE VON 3.4 MM ALS MITTELWERT, IM VERHALTNIS ZU DER 0-40 CM OBERLIEGENDEN BODENSCHICHTSHÖHE UBER DEM GRUND WASSER SPIEGEL (G.W.S.).

FIG. 4: 0-40 CM SOIL MOISTURE DISTRIBUTION AS AN AVERAGE OF THE THREE PROFILES 1, 2 AND 3. EACH VALUE OF EACH DEPTH IS THE AVERAGE OF TWELVE VALUES BEFORE AND AFTER A MINI-SPRINKLER IRRIGATION OF 3.4 MM ON THE AVERAGE, RELATED TO THE HEIGHT ABOVE GROUND WATER TABLE.

TABLE (2). Ermittleung der Wasserverteilung in Boden (Vol.%) Vor-und nach der Regengabe. Soil moisture distribution befor and after the mini-sprinkler irrigation.

Entfernung von dem. M Regener. Cm distance from the mini sprinkler (cm)		0				60				175				300				424			
Tiefe. Cm / Richtung	Depth / Direction	0-20	20-40	40-60	60-80	0-20	20-40	40-60	60-80	0-20	20-40	40-60	60-80	0-20	20-40	40-60	60-80	0-20	20-40	40-60	60-80
		Vor der Regengabe before the irrigation																			
Quer zu der regenrother; Profil ! perpendicular to the irrigation line	1 5 Rr Mr	10.64	8.26	14.92	23.65	6.87	10.33	15.14	27.24	8.84	8.46	16.98	21.84	6.16	4.69	14.25	20.30				
	2 5	6.48	8.03	9.54	16.96	6.22	7.39	11.54	24.31	2.14	8.83	23.92	17.70	6.16	4.69	14.25	20.30				
	2 4 Rr Mr	8.15	5.63	15.13	19.27	7.71	6.86	14.35	20.75	5.36	5.64	16.40	21.61	7.51	7.16	19.62	22.83				
	1 4	8.28	9.15	18.14	26.48	5.38	9.14	18.61	23.79	4.74	7.97	18.80	23.24	7.51	7.16	19.62	22.83				
	Mittlwert	*8.39*	*7.77*	*14.44*	*21.59*	*6.55*	*8.44*	*14.92*	*24.03*	*4.24*	*7.73*	*19.03*	*21.10*	*6.84*	*5.93*	*16.94*	*21.57*				
Entlang der Regenrohrer profil? Along the irrigation line	1 5 Rr M.r.	10.64	8.26	14.92	23.65	12.54	4.88	13.71	21.10	9.87	5.87	16.87	23.09	5.29	9.07	18.26	21.10				
	2 5	6.48	8.03	9.54	16.96	7.30	7.33	13.29	18.86	6.58	7.68	14.31	21.51	6.95	7.05	12.58	21.66				
	2 4 Rr M.r.	8.15	5.63	15.13	19.27	8.87	5.13	14.70	22.93	6.48	7.94	16.66	22.39	6.95	7.05	12.58	21.66				
	1 4	8.28	9.15	18.14	26.48	8.66	11.22	16.83	25.07	6.25	7.15	12.47	18.30	5.29	9.07	18.26	21.10				
	Mittlwert	8.39	7.77	14.44	21.59	9.35	7.15	14.64	21.99	7.30	7.17	14.83	21.33	6.12	8.06	15.42	21.38				
An der Achse der vier Mikroregner Profil 3 / Axial of the four mini-sprinklers	1 5 Rr Mr.	10.64	8.26	14.92	23.65	9.29	9.77	17.24	20.18	7.00	8.55	16.04	20.78	5.55	6.47	14.68	20.11	4.84	5.89	19.59	16.54
	2 5	6.48	8.03	9.54	16.96	9.03	9.72	10.58	21.79	3.59	5.19	10.75	18.40	6.05	9.59	13.47	16.55	4.84	5.89	19.59	16.54
	3 4 Rr M.r.	8.15	5.63	15.13	19.27	6.46	4.71	15.51	20.90	5.35	5.82	11.86	21.91	5.11	5.98	15.19	21.16	4.84	5.89	19.59	16.54
	2 4	8.28	9.15	18.14	26.48	10.06	7.10	18.21	26.87	6.63	7.18	15.49	24.94	5.54	5.59	17.02	27.47	4.84	5.89	19.59	16.54
	Mittlwert	8.39	7.77	14.44	21 59	8.71	7.83	15.39	22.44	5.65	6.69	13.54	21.51	5.54	6.91	15.10	21.33	4.84	5.89	19.59	16.54
Mittelwert		8.39	7.77	14.44	21.59	8.20	7.81	14.98	22.82	5.74	7.20	15.8	21.31	6.17	6.97	15.82	21.43	4.84	5.89	19.59	16.54
Mittelwert der 0-40 cm obenliegenden Bodenschicht 0-40 cm average						8.01				6.47				6.57							

TABLE 2. Cont.

								Nach Regengabe				after the irrigation									
Quer zu der Regenröhre: Profil 1 perpendicular to the irrigation line	1 5	11.72	8.68	16.40	22.70	11.04	11.03	16.97	22.21	9.11	7.89	18.61	20.10	9.24	8.93	16.97	21.28				
	Rr M.r 2 5	8.62	8.64	12.57	20.81	9.61	9.62	15.05	24.03	7.85	8.52	19.98	24.09	9.82	10.22	17.00	23.24				
	2 4	9.34	8.68	18.41	22.16	9.78	10.40	19.15	24.59	7.80	8.39	18.24	22.14	9.69	9.60	19.76	23.11				
	Rr M.r 1 4	11.36	9.86	18.89	25.46	10.25	11.27	19.61	23.36	8.48	8.10	19.34	21.79	6.75	7.89	18.23	20.98				
	Mittelwert	10.26	8.97	16.57	22.79	10.17	10.59	17.70	23.55	8.32	8.23	19.05	22.03	8.88	9.16	17.99	22.15				
Entlang der Regenröhre: profil 2 Along the irrigation line	1 5	11.72	8.68	16.40	22.70	12.86	10.56	16.65	21.60	9.91	8.67	15.59	19.98	4.72	5.77	13.76	18.22				
	Rr M.r 2 5	8.62	8.64	12.57	20.81	9.24	7.66	15.22	17.92	8.69	8.80	14.77	21.60	9.40	9.59	16.87	24.29				
	2 4	9.34	8.68	18.41	22.16	9.93	9.06	18.36	23.08	9.80	6.94	15.99	20.45	7.80	7.11	19.34	20.65				
	Rr M.r 1 4	11.36	9.86	18.89	25.46	12.11	10.33	19.72	24.74	9.27	8.81	20.26	24.96	8.01	8.31	20.73	22.24				
	Mittelwert	10.26	8.97	16.57	22.79	11.04	9.41	17.49	21.84	9.42	8.31	16.66	21.75	7.48	7.70	17.68	21.35				
An der Achse der vier Mikroegner. Profil 3 axial of the four mini-sprinklers	1 5	11.72	8.68	16.40	22.70	9.77	12.10	17.88	22.24	8.11	9.01	17.77	21.98	6.79	8.94	16.01	20.41	7.21	6.63	15.67	20.68
	Rr. M.r 2 5	8.62	8.64	12.57	20.81	9.67	8.84	15.24	22.96	8.64	10.12	18.55	24.91	10.16	11.87	20.31	23.41	9.04	8.13	19.12	24.36
	2 4	9.34	8.68	18.41	22.16	12.04	11.43	20.18	24.78	10.19	9.93	19.37	24.04	10.66	11.09	19.92	23.09	9.45	11.38	20.55	23.96
	Rr M.r 1 4	11.36	9.86	18.89	25.46	9.64	9.96	20.75	24.04	8.70	9.17	20.60	22.09	11.04	11.72	20.76	21.68	7.24	8.46	19.59	22.08
	Mittelwert	10.26	8.97	16.57	22.79	10.28	10.59	18.52	23.51	8.92	9.56	19.08	23.26	9.67	10.91	19.25	22.15	8.24	8.65	18.73	22.77
Mittelwert average		10.26	8.97	16.57	22.79	10.50	10.20	17.90	22.97	8.89	8.70	18.26	22.35	8.68	9.26	18.31	21.88	8.24	8.65	18.73	22.77
Mittelwert der 0-40 cm oberliegenden Bodenschicht(M) 0-40 cm average						M60=10.35				M175=8.79				M300=8.97							

Conclusion

It is advisable to apply mini-sprinkler irrigation system as supplemental irrigation in Siwa Oases where G. W. T. is high , beside salinity problems Applying a 3.4 mm depth ,on the average , mini-sprinkler irrigation is suitable for salt tolerant cops of 70 cm effective root zone depth . Such crops include palm trees (*Phoenix dactylifera* L.) , olives (*Olea europaea* L.) , water melon (*Cucumis maio* L.) , pomegranate (*Punica granatum* L.) , grapes (*Vitis vinifera* L.) , figs (*Ficus carica* L.) according to Richard (1954) in Achtnich (1980) . Such irrigation increases the soil moisture to more than 25 % A. W. within 0- 40 cm soil layer through an area of 140 cm radius surrounding the mini-sprinkler. G. W. T. at a -73 cm depth increases the soil moisture content to more than 63 - and 25 % A. W. at a depth of more than 60 and 35 cm, respectively. Hence, suitable moisture and aeration conditions would prevail in the effective root zone. Applying more than 3.4 mm irrigation during 105 minutes would cause deeper percolation in such high G. W. T. sandy soils ; losses of good quality irrigation water , more - in vain - irrigation costs and more water logging problems .

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توزيع الرطوبة تحت نظام الرى بالرش الصغير فى أراضى رملية ذات منسوب مياه أرضية مرتفع .

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أجرى البحث فى اراض رملية بواحة سيوة بجمهورية مصر العربية ، بلغ منسوب المياه الأرضية – ٧٣ سم . ويتميز سطح تربة البحث بالتموج . ويعطى الرشاش الصغير (Mikroregner = mini-sprinkler) عند ضغط تشغيل (مقاسا عند الفوهة) ٠,٦٩ بار (psi 10) ، متوسط كثافة إبتلال ٧,٥٦ – ، ١,٥٢ – ، ٠,٨ – ، ٠,٠٠ مم / ساعة على المناطق المحيطة بالرشاش الصغير وهى ١ (صفر ١٢٠ سم) ، ٢ (١٢٠ – ٢٣٠ سم) ، ٣(٢٣٠ – ٣٠٠ سم) ، ٤ (٣٠٠ – ٣٧٠ سم) بما يقابل ٣,٣١ – ، ٠,٦٧ – ، ٠,٠٤ – ، ٠,٠٠ % على أساس الحجم بطبقة التربة العليا صفر – ٤٠ عبر ساعة واحدة و ٤٥ دقيقة . وباستثناء قيمتى القياس الشاذتين ٢٩ – عند الرشاش الصغير و ١٩ مم / ساعة عند ٥٠ سم على يساره ينتج إبتلال قدره ٢,٥٤% على أساس الحجم لطبقة التربة العليا صفر – ٤٠ سم بالمنطقة الأولى (صفر – ١٢٠ سم) المحيطة بالرشاش الصغير. ورغم ذلك أحدثت رية بالرش الصغير بعمق ٣,٤ مم عبر ساعة و ٤٥ دقيقة – كمتوسط لعمق الرية على مساحة ١٤٤ م٢ تخدم بواسطة أربعة رشاشات صغيرة تتباعد عن بعضها بمسافة ستة أمتار – زيادة فى رطوبة التربة بالطبقة العليا (صفر – ٤٠ سم) قدرها ٢,٣٤ – ، ٢,٣٣ – ، ٢,٤% على أساس الحجم مقارنة برطوبة التربة قبل الرى بالمناطق الثلاثة ١ (صفر – ١٢٠ سم) ، ٢ (١٢٠ – ٢٣٠ سم) ، ٣+٤ (٢٣٠ – ٣٧٠ سم) المحيطة بالرشاش على الترتيب . ويرجع ذلك لاختلاف مساهمة منسوب المياه الأرضية فى ابتلال طبقة التربة (صفر – ٤٠ سم) نظرا لاختلاف أرتفاع الطبقة المذكورة فوق منسوب المياه الأرضية عند أماكن القياس المختلفة . ويوصى باستخدام رشاش صغير من نوع أخر يعطى تجانسا أفضل عند مثل ضغط التشغيل المنخفض المذكور .

وينصح باستخدام طريقة الرى بالرش الصغير هذه كرى تكميلى فقط بأراضى واحة سيوه ذات منسوب المياه المرتفع

لرى أنواع الفاكهة التى تجود فى مثل ظروف واحة سيوه . وهـذا يوفر مياه الرى ويخفض تكاليفه ويخفض منسوب المياه الأرضيـة مما يقلل من المشاكل الناجمة عن التغدق . كما يمكن تحميل بعض المحاصيل ذات النمو المفترش مثل الخيار والبطيخ والشمام حتـى لا تعرقل توزيع مياه الرى بالرش على كل المساحة المخدومة .